DIVISION

OF

ELECTRONICS &

COMMUNCIATION ENGINEERING

Code No.	Subject Name	Credit
EC101	Basic Electronics	3:0:0
EC102	Basic Electrical and Electronics Engineering	3:0:0
EC103	Basic Electronics	2:0:0
EC104	Basic Electronics	3:0:0
EC201	Electron Devices	4:0:0
EC202	Electron Devices Laboratory	0:0:2
EC203	Electronic Circuits	3:1:0
EC204	Electronic Circuits Laboratory	0:0:2
EC205	Solid State Circuits-I	4:0:0
EC206	Solid State Circuits-II	4:0:0
EC207	Electronics Lab	0:0:2
EC208	Opto Electronic Devices	4:0:0
EC209	Digital Electronics	3:1:0
EC210	Digital Electronics Lab	0:0:2
EC211	Linear Integrated Circuits and Applications	3:1:0
EC212	Linear Integrated Circuits Lab	0:0:2
EC213	Electronics and Microprocessors	4:0:0
EC214	Electronics and Microprocessor Laboratory	0:0:2
EC215	Microprocessors and Microcontrollers	3:1:0
EC216	Microprocessor Interfacing Techniques	4:0:0
EC217	Microprocessor Lab-I	0:0:2
EC218	Microprocessor Lab-II	0:0:2
EC219	Communication Engineering-I	4:0:0
EC220	Communication Engineering-II	3:1:0
EC221	Communication Engineering-III	3:1:0
EC222	Electronics and Communication Lab	0:0:2
EC223	DSP and Communication Laboratory	0:0:2
EC224	Optical Communication	4:0:0
EC225	Microwave and Optical Communication Lab	0:0:2
EC226	Digital Communication Systems	4:0:0
EC227	Signals and Systems	3:1:0
EC228	Digital Signal Processing	3:1:0
EC229	Digital Image Processing	4:0:0
EC230	VLSI Design	4:0:0
EC231	Linear and Digital IC Lab	0:0:2
EC232	Digital Signal Processing	4:0:0
EC233	Electromagnetic Fields	3:1:0
EC234	Electronics and Microprocessors Laboratory	0:0:1

Code No.	Subject Name	Credit
EC301	Advanced Digital Signal Processing	3:1:0
EC302	Digital System Design and Testing	3:1:0
EC303	Advanced Computer Architecture	4:0:0
EC304	Microcontrollers and its Applications	3:1:0
EC305	Microcontrollers and Digital Signal Processing Lab	0:0:2
EC306	Advanced Topics in VLSI	4:0:0
EC307	Digital Image Processing & MATLAB	0:0:2
EC308	Adaptive Signal Processing	4:0:0
EC309	Artificial Neural Networks	4:0:0
EC310	Advanced Solid State Devices	4:0:0
EC311	VLSI Design Lab	0 :0:2
EC312	Advanced Digital System Design	4:0:0
EC313	Introduction to VLSI Design	4:0:0
EC314	Digital Control Engineering	3:1:0
EC315	Digital Image Processing	3:0:0
EC316	Analysis & Design of Analog Integrated Circuits	4:0:0
EC317	Soft Computing	4:0:0
EC318	Low Power VLSI Design	3:0:0
EC319	Digital Communication	4:0:0
EC320	Medical Systems and Signal Processing	4:0:0
EC321	Satellite and Mobile Communication Systems	4:0:0
EC322	Computer Networking and ATM	3:2:0

EC101 BASIC ELECTRONICS

Credit: 3: 0 : 0
Marks: 40 + 60

Unit I : Introduction to Semiconductor:
Covalent bond – N type & P type semiconductor – conduction in semiconductor – semiconductor devices: diode, transistor, FET, MOSFET, UJT – transistor as an amplifier and a switch – oscillator principles.

Unit II : IC
OP-amp – introduction – parameters – basic op-amp applications – IC fabrication techniques.

Unit III : Digital Systems
Number system – Boolean algebra – logic gates – semiconductor memory – microprocessor – digital computer principles.

Unit IV : Measurement
Error – transducers – signal conditioning unit – telemetry circuits – virtual instrumentation.

Unit V : Communication
Introduction to Noise – modulation & demodulation techniques of AM & FM – antenna principle – radio receiver & transmitter – Principle of TV, Radar – Satellite communication – Fibre optics.

Text books

1. Robert Boylestad, "Electronic Devices & Circuit Theory", Sixth Edition, PHI, 1998.
2. Albert Paul Malvino, Donald P Leach, "Digital Principles and Applications", Tata McGraw Hill, IV Edition, 1991.

Reference Books

1. Roody & Coolen, "Electronic Communication", PHI, 1995
2. W.D. Cooper, A.D. Helfrick, "Electronic Instrumentation and Measurement Techniques", 3rd Edition, PHI, 1989.

EC102 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

Credit: 3:0:0
Marks: 40 + 60

Unit I : DC and AC Circuits
Electrical quantities – Ohm's law – Krichoff's laws – Resistors – Inductors – Capacitors – series and parallel circuits – simple problems.
Sinusoidal functions : Phasor representation – RMS – Effective values – form and peak factors – RLC circuits, power and power factor – simple problems.

Unit II : Electrical Machines
Construction and principle of operation of DC machines – generator / motor action and applications. Construction and principle of operation of AC machines – single phase and three phase transformers – three phase and single phase induction motors – synchronous motors and applications. Domestic wiring – Accessories – Types – staircase wiring – Fluorescent tube circuits – simple layout – earthing.

Unit III : Introduction to Semiconductor
Covalent bond – N type & P type semiconductor – conduction in semiconductor – semiconductor devices : diode, transistor, FET, MOSFET, UJT.

Unit IV
Transistor as an amplifier and a switch – oscillator principles – IC: Op-amp – introduction – parameters – basic op-amp applications – IC fabrication techniques.

Unit V : Communication

Introduction to Noise – modulation & demodulation techniques of AM & FM – antenna principle – radio receiver & transmitter – Principle of TV, Radar – Satellite communication – Fibre optics.

Text Books

1. Robert Boylestad, “Electronic Devices & Circuit Theory”, Sixth Edition, PHI, 1998.
2. Albert Paul Malvino, Donald P leach, “Digital Principles and Applications”, Tata McGraw Hill, IV Edition, 1991.

Reference Books

1. Roody & Coolen, “Electronic Communication”, PHI, 1995
2. W.D. Cooper, A.D. Helfrick, “Electronic Instrumentation and Measurement Techniques”, 3rd Edition, PHI, 1989.

EC103 BASIC ELECTRONICS

Credit: 3:0:0
Marks: 40 + 60

Unit I : Introduction to Semiconductor

Covalent bond – N type & P type semiconductor – conduction in semiconductor – semiconductor devices : diode, transistor, FET, MOSFET, UJT.

Unit II : Integrated Circuits

Transistor as an amplifier and switch – oscillator principles – IC: OP-amp – introduction parameters – basic op-amp applications – IC fabrication techniques.

Unit III : Digital Systems

Number system – Boolean algebra – logic gates – semiconductor memory – microprocessor – digital computer principles.

Unit IV : Modem

Introduction to Noise – modulation and demodulation techniques of AM & FM.

Unit V : Communication

Antenna principle – radio receiver & transmitter – Principle of TV, Radar – Satellite communication – Fibre optics.

Text books

1. Robert Boylestad, “Electronic Devices & Circuit Theory”, Sixth Edition, PHI, 1998.
2. Albert Paul Malvino, Donald P Leach, “Digital Principles and Applications”, Tata McGraw Hill, IV Edition, 1991.

Reference Books

1. Roody & Coolen, “Electronic Communication”, PHI, 1995
2. W.D. Cooper, A.D. Helfrick, “Electronic Instrumentation and Measurement Techniques”, 3rd Edition, PHI, 1989.

EC104 - BASIC ELECTRONICS

Credit : 3:0:0

UNIT-I: Semiconductors

Semiconductor Theory**:** Introduction to semiconductor-energy band description of semiconductor-types of semiconductor (intrinsic and extrinsic)-p-n junction and its properties

Semiconductor Devices**:** Semiconductor diode (p-n junction diode and Zener diode)-Transistor: -different configurations and characteristics-FET-MOSFET and Unijunction transistor:-Basic operation and characteristics.

UNIT-II: Integrated Circuits

Integrated circuits-advantages – classification - Monolithic IC Fabrication Techniques.

Linear IC: Introduction to op-amp (Operational amplifier)-inverting and non-inverting op amp. Applications: Scalar, Adder, Subtractor, Differentiator, and Integrator.

UNIT-III: Digital Systems

Digital Electronics**:** Number System - Boolean Algebra - Logic Gates - Realization – Demorgans Laws.

Basic Principles Of Digital Computer: Introduction to computer-Organization of computer memory-central processing unit-Introduction to microprocessor-architecture of 8085.

UNIT-IV: Communication

Basic block diagram of a communication system-modulation-need for modulation-Types of modulation:-Amplitude and Frequency Modulation (AM & FM)-Demodulation:-Essentials in demodulation-AM diode detector-AM radio receiver-Types of radio receivers:-Straight and Super heterodyne receivers.

UNIT-V: Electronic Instruments And Transducers

Electronic Instruments: Multimeter:-applications of multimeter-sensitivity-merits and demerits-meter protection. Cathode Ray Oscilloscope (CRO):-Deflection sensitivity of Cathode Ray Tube (CRT)-signal pattern on screen and applications.

Transducers: Introduction to Transducers-Capacitive transducers-Inductive transducers and Linear Variable Differential Transformer (LVDT).

Text Books

1. Robert Boylested, “Electronic Devices and Circuit Theory”, Sixth Edition, PHI, 1998.
2. Albert Paul Malvino, Donald P Leach, “Digital Principals And Applications”, Tata McGraw Hill, IV Edition, 1991.

Reference Books

1. Roody and Coolen, “Electronic Communication” PHI, 1995.
2. W.D. Cooper, A.D. Helfrick, “Electronic Instrumentation and Measurement Techniques”, 3rd Edition, PHI, 1989.
3. V.K. Mehta, “Principals Of Electronics Circuits” 8th Edition, S. Chand, 2003.

EC201 ELECTRON DEVICES

Credit: 4: 0 : 0
Marks: 40 + 60

Unit I : Theory Of PN Diodes

Energy band structure of conductors, insulators and semiconductors – Comparison of Germanium, Silicon and gallium arsenide – Electron hole generation and recombination – Intrinsic and extrinsic semiconductors – Conductivity – Temperature dependence – Hall effect – drift and diffusion in semiconductors – Continuity equation – PN junction – Open circuited junction – depletion region – barrier potential – diode equation – Forward and Reverse characteristics – Transition and diffusion capacitance.

Unit II : Theory Of Junction Transistors

Transistor action – Transistor parameters – Transistor current components – emitter injection efficiency – base transport factor – collector efficiency – Large signal current gain – Continuity equation in base region – Eber Moll equation – static characteristics of transistors – Thermal runaway.

Unit III : Transistor Models

Hybrid parameters – T equivalent pi equivalent circuits – Small signal single stage amplifiers – analysis of CE, CB and CC circuits – Voltage gain – Current gain – Input impedance – Output impedance – dependence on source and load impedance.

Unit IV : Theory Of FET, UJT And SCR

Junction FET operation – Static characteristics – FET structure – Enhancement MOSFET, Depletion MOSFET – Comparison of JFET and MOSFET – IGFET – Power MOSFET – Equivalent circuits FET, UJT : Operation, Static characteristics – PUT – SCR: Construction, Static, Characteristics - Light activated SCR.

Unit V : Special Semiconductor Devices (Qualitative Treatment Only)

Zener diodes – Schotky Barrier Diode – Tunnel diodes – DIAC – TRIAC – Photo diodes – Photo transistors – LED – LCD – photocouplers – Gunn diodes – Gallium Arsenic devices – Varacter diode.

Text Books

1. Millman & Halkias,"Electronic Devices & Circuits",Tata McGraw Hill,1995.
2. Malvino A P, “Electronic Principles”, McGraw Hill International, 1998.

Reference Books

1. David.A.Bell, "Electronic Devices & Circuits ", PHI, 1998.
2. Robert Boylestad, "Electronic Devices & Circuit Theory", Sixth Edition, PHI, 1998.
3. Allen Mottershead, "Electronic Devices & Circuits", PHI, 1998.

EC202 ELECTRON DEVICES LABORATORY

Credit : 0 : 0 : 2
Marks: 50 + 50

1. PN Diode Characteristics and Half and Full Wave Rectifiers.
2. Zener Diode Characteristics and Voltage Regulator.
3. Transistor Biasing with and without stabilisation.
4. Transistor (common emitter characteristics) and H parameter evaluation.
5. Transistor as an Amplifier.
6. FET characteristics and Evaluation of its parameters.
7. MOSFET characteristics.
8. FET biasing methods.
9. BJT and FET as a switch.
10. Photo-Transistor-Diode optoisolator.
11. UJT characteristics & relaxation Oscillator.
12. SCR characteristics.

EC203 ELECTRONIC CIRCUITS

Credit: 3 : 1 : 0
Marks: 40 + 60

Unit I : Bias Stability And Device Stabilization
Biasing circuits for BJT, DC, and AC Load linear stability factor analysis, Temperature compensation methods, Biasing circuits of FET's and MOSFET's.

Unit II : Small Signal Low Frequency Analysis And Design
Transistor, FET and MOSFET Amplifiers, Equivalent circuits, input and output characteristics and analysis of mid-band gain, input and output impedances of various amplifiers, cascade amplifiers, Darllington Bootstrapping, Differential amplifier, CMRR measurement of current source in Emitter.

Unit III : Large Signal Amplifiers
Class A, AB, B, C and D type of power amplifiers. Class A amplifier with resistive and transformer coupled load, efficiency of Class B, complementary symmetry amplifiers, MOSFET power amplifiers, heat sinks.

Unit IV : Frequency Response Of Amplifiers & Analysis Using Spice
High frequency equivalent circuit for BJT and FET amplifiers, calculation of lower and higher cutoff frequencies, Bode plot of frequency response, Relations bandwidth and rise time , compensation to improve the low frequency and higher frequency response of

amplifiers, HF amplifiers, Video amplifiers, Optocouplers, BJT modeling, the sinusoidal and pulse Analysis of CE amplifier using SPICE.

Unit V : Rectifiers And Power Supplies
Half and full wave rectifiers, Ripple factor calculation for C, L, L-C and SYMBOL 112f "symbol" filters, switch mode power supplies, linear electronic voltage regulators, power control using SCR.

Textbooks

1. Millman.J and Halkias C. "Integrated Electronics" McGraw Hill.
2. David A.Bell, "Electronic Devices and Circuits" Prentice Hall of India., 3rd Edition, 1998

References

1. Donald L.Schilling Charles Belove, "Electronic Circuits" third edition,1989.

EC204 ELECTRONIC CIRCUITS LABORATORY

Credit: 0 : 0 : 2
Marks: 50 + 50

1. Semiconductor diode and zener diode characteristics
2. Input and output characteristics of a BJT in CE configuration
3. Characteristics of JFET, UJT and SCR
4. Non-linear wave shaping techniques - clipper and clamper
5. Single phase half wave and full wave rectifier with filter
6. Series voltage regulator
7. R-C coupled and Class A transformer coupled power amplifier
8. Complementary symmetry class B power amplifier
9. R-C phase shift oscillator
10. Hartley oscillator

EC205 SOLID STATE CIRCUITS –I

Credit: 4 : 0 : 0
Marks: 40 + 60

Unit I : Rectifiers and Filters
Diode as Rectifiers – Half wave rectifier – Full wave rectifier – ripple factors – DC and AC components in rectifiers – Capacitor and inductor filters – Analysis and design of L section and Pi section filters – Regulators: Voltage and current regulators – Short circuit and over load protection.

Unit II : Transistor And FET Biasing
Transistor Biasing: Location of the Q point – Fixed bias circuit – Collector to base circuit – Self bias circuit – Graphical DC bias analysis – Design of DC bias circuit.
FET biasing : Self biasing – Voltage feedback biasing.

Unit III : Amplifiers
Frequency response – RC coupled and Transformer coupled amplifiers – Single stage – Multistage amplifiers – Wideband amplifiers – Cascode – Video amplifiers – Peaking circuits – Power amplifiers : Class A, AB, B and class D amplifiers – Distortion – Push pull amplifiers – Complimentory symmetry.

Unit IV : Feedback Amplifiers & Dc Amplifiers
Positive and Negative feedback – Current and Voltage feedback – Effect of feedback on gain – Input and Output impedance – Noise and Distortion.
DC amplifiers : Drift in amplifiers – Differential amplifiers – Chopper Stabilization.

Unit V : Oscillators And Tuned Amplifiers
Barkhausen criterion – RC and LC Oscillators – Crystal oscillators – Tuned amplifiers – Single tuned – Double tuned – Stagger tuned.

Text Books

1. Millman .J. & Halkias.C , "Electronic Devices And Circuits", Tata McGraw Hill, 1995.
2. Mathur S.P,m Kulshrestha D.C., Chanda P.R., “Electronic Devices Applications and Integrated Circuits, Umesh Publications, 1988.

Reference Books

1. Malvino A.P., “Electronic Principles”, McGraw Hill International, 1998.
2. Boylestred R and Nashelsky, “Electronic Devices and Circuits Theory”, PHI, 1993.
3. Allen Moltershed, “Electronic Devices and Circuits”, PHI, 1998.

EC206 SOLID STATE CIRCUITS II

Credit: 4 : 0 : 0
Marks: 40 + 60

Unit I : Linear Wave Shaping Circuits
High pass and low pass RC circuits – response for step, pulse, square wave, ramp and exponential signals as input – High pass circuit as a differentiator – low pass circuit as an integrator – attenuators – Non Linear Wave Shaping Circuits: Diode and transistor - clippers – Clamping Circuits – clamping theorem – practical clamping circuits.

Unit II : Bistable And Schmitt Trigger Circuits
Fixed and self bias bistable circuits – Loading – Commutating capacitors – Triggering methods – Design of bistable circuits – Schmitt trigger circuit, critical voltages, Design example – Applications: Comparator, Sine wave to square wave converter.

Unit III : Monostable And Astable Circuits
Collector and emitter coupled monostable circuits – Waveforms – equation for delay – collector coupled, emitter coupled astable circuits – VCO – Design examples for monostable and astable circuits.

Unit IV : Voltage And Current Time Base Generators
General feature of a time base signal – exponential sweep circuit – A transistor constant current sweep – Miller and Bootstrap time base generators – General considerations – Current time base generator: A simple current sweep – A transistor current time base generator – Transistor Television sweep circuit.

Unit V : Blocking Oscillator Circuits And Sampling Gates
Blocking oscillators – Triggering Transistor blocking oscillators – Base and emitter timings – Triggering circuits – Astable blocking oscillators – Sampling gates: Unidirectional and bi-directional sampling gates using diodes and transistors.

Text Books

1. 1.Millman & Taub "Pulse Digital and Switching Waveforms", McGraw Hill, 1965.

Reference Books

1. Ronald Tocci, " Fundamentals of Pulse and Digital Circuits", Merrill Publishing Company, 1965.
2. David A Bell, "Solid State Pulse Circuits", Prentice Hall Inc, 1991

EC 207 ELECTRONICS LAB

Credit: 0 : 0 : 2
Marks: 50 + 50

1. Study of half-wave and full-wave rectifiers with and without filters.
2. Voltage Regulators (Zener Diode, Transistor – Series and Shunt type)
3. Design and Testing of BJT amplifiers.(RC Coupled)
4. Design & testing of FET amplifiers.
5. Design & testing of Feedback amplifiers. (Voltage and Current, Series and Shunt type)
6. Design & Testing of constant-K filters.
7. Design & Testing of m-derived filters.
8. Emitter Follower.
9. Difference Amplifier.
10. Design and testing of single tuned amplifiers.
11. Design and testing of power amplifiers. (Class A, B, AB, C, complementary-symmetry pushpull amplifiers)
12. High frequency oscillator design & Testing.
13. Low frequency oscillator design & Testing.

EC208 OPTO ELECTRONIC DEVICES

Credit: 4: 0: 0
Marks: 40 + 60

Unit I : Elements Of Light And Solid State Physics
Wave nature of light, Polarization, Interference, Diffraction, Light source, Review of quantum Mechanical concept, Review of Solid State physics, Review of semiconductor physics, Semiconductor Junction Device, Review.

Unit II : Display Devices And Lasers
Introduction, Photo Luminescence, Cathode Luminescence, Electro Luminescence, Injection Luminescence, LED, Plasma Displays, Liquid Crystal Displays, Numeric Displays, Laser Emission, Absorption, Radiation, Population Inversion, Optical feedback, Threshold condition, Laser Modes, Classes of Lasers, Mode Locking, Laser applications

Unit III : Optical Detection Devices
Photo detector, Thermal detector, Photon Devices, Photo Conductors, Photo Diodes, Detector Performance

Unit IV : Optical Amplifiers And Network Components
Types –semiconductor laser amplifiers, Erbium – doped fiber amplifiers, Raman fiber amplifiers, Brillouin fiber amplifier, comparison, Applications, Noise in Optical amplifiers, Noise figure of amplifier, wavelength converters, Optical bistable devices.

Unit V : Opto Electronic Integrated Circuits
Introduction, hybrid and Monolithic Integration, Applications of Opto Electronic Integrated Circuits, Integrated transmitters, Guided wave devices.

Text Books

1. J.Willson and J.Haukes, " Opto Electronics – An Introduction", Prentice Hall of India Pvt.Ltd., New Delhi, 1995

Reference Books

1. Bhattacharya, "Semiconductor Opto Electronic Devices", Prentice Hall of India Pvt. Ltd., New Delhi, 1995
2. Jasprit Singh, " Opto Electronics- An Introduction to materials and Devices", McGraw Hill International Edition, 1998
3. J.H. Franz and V.K. Jain, "Optical Communication – Components and Systems", Narosa Publishing House, 2000.

EC209 DIGITAL ELECTRONICS

Credit: 3 : 1 : 0
Marks: 40 + 60

Unit I : Number Systems & Boolean Algebra

Review of binary, octal, & hexadecimal number systems-representation of signed numbers-floating point number representation-BCD-ASCII-EBCDIC-Excess 3 codes-gray code-error detecting & correcting codes.

Boolean Algebra:

Postulates & theorems of Boolean Algebra –canonical forms –simplification of logic functions using karnaugh map Quine Mcclausky method.

Unit II : Combinational Logic Design

Logic gates –implementation of combinational logic functions – encoders & decoders – multiplexers & demultiplexers –code converters – comparator - half adder, full adder – parallel adder – binary adder – parity generator/checker – implementation of logical functions using multiplexers.

Unit III :Counters &Registers

RS, JK, JK Master–slave, D&T flip flops – level triggering and edge triggering – excitation tables –asynchronous & synchronous counters – modulus counters–shift register –Johnson counter- ring counter – timing waveforms-counter applications.

Unit IV :Sequential Logic Design

Basic models of sequential machines – concept of state table – state diagram – state reduction through partitioning & implementation of synchronous sequential circuits – Introduction to asynchronous sequential logic design.

Unit V : Programmable Logic Devices

Semicustom design – Introduction to PLD's – ROM – PAL – PLA – FPGA – Architecture of PLD's : PAL 22V10, PLS 100/101 – Implementation of digital functions.

LOGIC FAMILIES: RTL, DTL, TTL families, schottky – clamped TTL, Emitter Coupled (ECL), Integrated Injection Logic (IIL), MOS inverters, CMOS inverters, comparison of performance of various logic families.

Text Books

1. Morris Mano, "Digital Design", Prentice Hall Of India, 1995.
2. Puri V.K., "Digital Electronics", TMH, 1997.

Reference Books

1. Tocci.R.J, "Digital Systems – Principles & Applications", Prentice Hall Of India, 1997.
2. Fletcher.W.I, "An Engineering Approach To Digital Design", Prentice Hall Of India, 1994.
3. Millman & Halkias ,"Integrated Electronics", TMH, 1995.
4. Floyd, "Digital Fundamentals", PHI, 1997.
5. Mano M.M., "Digital logic and computer design", PHI, 1998.

EC210 DIGITAL ELECTRONICS LAB

Credit : 0 : 0 : 2
Marks: 50 + 50

1. Study of Logic gates. (AND, OR, NOT, NAND, NOR, XOR, EXNOR) Minimisation and realisation of switching functions using NAND, NOR gates.
2. Half adder and Full adder.
3. Code convertors. (BCD to 7 segment, BCD to Excess-3, Gray to binary, Binary to Gray)
4. Encoders and Decoders.
5. Multiplexers and Demultiplexers.
6. Study of Flip flops using
   (a). Universal gates.
   (b). FF ICs.
7. Counters. (MOD N)
8. Shift registers.
9. IC timer.
10. Parity generation and checking.
11. Arithmetic logic unit
12. Analog to Digital Converter.
13. Digital to Analog Converter.
14. Digital Comparator.
15. Random Access Memory.
16. EPROM.

EC211 LINEAR INTEGRATED CIRCUITS AND APPLICATIONS

Credit: 3 : 1 : 0
Marks: 40 + 60

Unit I : Integrated Circuit Technology
Monolithic Integrated Circuit Technology – Planar process – Bipolar Junction Transistor fabrication – Fabrication of FET's – CMOS Technology – Monolithic diodes – Metal – Semiconductor contact – Integrated Circuit Resistors – Integrated Circuit Capacitors – Integrated Circuit Packaging – Characteristics of Integrated Circuit Components – Microelectronic Circuit Layout.

Unit II : OP-AMP Characteristics And Applications
Characteristics of ideal op-amp. Pin configuration of 741 op-amp. Bias, offsets and drift, bandwidth and slew rate. Frequency compensation.
Applications: inverting and non-inverting amplifiers, inverting and non-inverting summers, difference amplifier, differentiator and integrator, Log and antilog amplifiers. Multiplier and divider, analog computers.

Unit III : Comparators And Signal Generators
Comparators, regenerative comparators, input output characteristics, astable multivibrator, Monostable multivibrator, Triangular wave- generators, RC-phaseshift oscillator,Wein's bridge oscillator.
Voltage Regulator
Series op amp regulator, IC voltage regulator,723 general purpose regulator, Switching Regulator.

Unit IV : Active Filters, Timers And Multipliers
Low pass, High pass, Band pass and Band Reject filters, Butterworth, Chebychev filters, first and second order filters-switched capacitor filters.
555 Timer functional diagram, monostable and astable operation, multiplier - application.

Unit V : PLL, ADC And DAC
PLL- basic block diagram and operation, capture range and lock range simple applications of PLL, AM detection, FM detection and FSK demodulation.
Weighted resistor DAC, R-2R and inverted R-2R DAC, monolithic DAC.
Flash ADC, counter type ADC, successive approximation ADC, dual slope ADC, conversion times of typical ADC.

Text Book
1. Roy Choudhury.D., Shail Jain, "Linear Integrated Circuits", 1996.

Reference Books
1. Gayawad.A.R., "Op-Amps & Linear IC's", PHI, 1993
2. Coughlin.Frand.Driscoll.F.F., "Operational Amplifiers & Linear IC's", PHI, 1997.
3. Millman & Halkias., "Integrated Electronics", McGraw Hill, 1991.
4. Franco, "Design With Operational Amplifier And Analog Integrated Circuits", TMH, 1998.

EC212 LINEAR INTEGRATED CIRCUITS LAB

Credit : 0 : 0 : 2
Marks: 50 + 50

1. Measurement of Op-amp Parameters. (Gain, Input offset Voltage, Input offset current, Bias Current, CMRR, Output Voltage, Slew rate)
2. Determination of Frequency response of Op-Amp.
3. Operational Amplifier applications I (Inverter, Non-inverter, summer, Buffer, Subtractor, Integrator, Differentiator)
4. Operational Amplifier applications II (Logarithmic amplifier, Antilog Amplifier, Precision Rectifier)
5. Instrumentation Amplifier.

6. Open Loop operation of Op-amp -Comparators - Zero crossing detector – Schmitt Trigger.
7. Astable Mutivibrator using op-amp - Square, Triangular & rectangular Wave Generators.
8. Sinusoidal Oscillators - RC Phase shift and Wien Bridge.
9. Astable & Monostable Multi vibrators using 555 IC Timer.
10. IC Voltage Regulator.
11. Voltage Controlled Oscillator.
12. Phase Locked Loop.
13. A/D Converters & D/A Converters.
14. ALU
15. Display System
16. Digital Voltmeter

EC213 ELECTRONICS AND MICROPROCESSORS

Credit: 4 : 0 : 0
Marks: 40 + 60

Unit I : Review Of Semiconductor Devices-Electronics Circuits (Qualitative Study Only)

Circuitry and description of half wave and full wave rectifier – Capacitor and inductor filter – zener regulator-I.C. voltage regulators. Transistor Amplifiers: CB, CE, and CC configurations - Biasing Circuits RC coupled amplifier FET amplifiers - power amplifiers – Classification- class A and B Push Pull Configurations. Oscillators. Barkihausen criterion- Colpits-Wien bridge and phase shift oscillators-OP-amp comparators.

Unit II : Transducer And Measuring Instruments

(Qualitative study only)-classification-working principle of potentimetor, strain gauges, piezoelectric crystals, thermistors, photodiodes, phototransistors- microphone and loud speakers. Study of working principle (using block diagram of multimeters, digital voltmeters, signal generators, CRO).

Unit III : Digital Electronics

Comparison between analog and digital systems-Number representation-Binary Octal, Hexadecimal number system –Logic gates-Flip-flops-Registers,Counters, Multiplexers, Decoders, and Encoders-Half and full adders.

UNIT IV : Introduction To Microprocessor

Block diagram of Microcomputer - Architecture of Intel 8085 - Instruction formats, Addressing methods- types of Instruction - Intel 8085 - Instruction set - Development of simple assembly language programs and examples.

Unit V : I/O Devices

Memory and I/O devices and interfacing RAM, ROM, EPROM – Floppy disks-CRT terminals- Printers-I/O ports-Key boards-ADC/DACs-memory interfacing-Asynchronous and synchronous data transfer schemes-interrupt driven data transfer- DMA data transfer-Simple applications of Microprocessors.

Text Books

1. Albert Paul Malvino, " Electronic Principles", Tata McGraw Hill, 6th Edition, 1996.
2. Adithya P. Mathur, " Introduction to Microprocessor", Tata McGraw Hill, 6th Edition, 1997.

Reference Books

1. Gaonkar R. S. , " Digital computer electronics", Willey Eastern,1991.

EC214 ELECTRONICS AND MICROPROCESSOR LABORATORY

Credit: 0 : 0 : 2
Marks: 50 + 50

1. Characteristics of semi conductor diode.
2. Characteristics of zener diode.
3. Study of Half - Wave and Full-Wave rectifier
4. Study of Bridge Rectifiers.
5. Transistors as a Switch and Amplifier
6. Operational amplifier Configurations: Adder, Integrators, and Current to Voltage converters.
7. Verifications of truth tables of logic gates AND, OR, NOT, NAND exclusive OR.
8. Combination logic realisation: Adder, Subtrator.
9. Sequential logic: Counters, Shift Registers with display devices.
10. Study of Microprocessor Kits.
11. Programming Exercise on 8085 and Trainer Kits.
12. Stepper Motor Interface.
13. Display Interface.

EC215 MICROPROCESSORS AND MICRO CONTROLLERS

Credit: 3 : 1 : 0
Marks: 40 + 60

Unit I : 8085 Microprocessor

Organisation of 8085 microprocessor –Instruction set-Addressing modes- Assembly language programming-machine cycles-Read, Write – Interrupt acknowledge – Bus cycles – states – Wait state – HALT and HOLD state – State transition sequence of 8085.

Unit II : 8086 Microprocessor

Organisation of 8086 microprocessor – memory segmentation – Addressing bytes and words – Address formation –Address modes in 8086 – Assembly language programming

– minimum mode and maximum mode – Bus arbitration in minimum mode and maximum mode – multiprocessing.

Unit III : Interfacing of I/O Devices

Interfacing memory and I/O devices with 8085 and 8086 microprocessors – main memory system design – types of main memory – Address decoding techniques – Partial block – PROM, PLA and PAL decoders – Design examples – Wait state generator – Interfacing dynamic RAM – Parallel I/O – Designing a parallel input and output port – Application for the device select pulse – memory mapped I/O – Serial I/O – standard protocols.

Unit IV : Data Transfer Schemes

Data transfer schemes – Programmed data transfer – Synchronous transfer – Asynchronous transfer – Interrupt driven I/O – types of interrupts: 8085 and8086 – direct memory access data transfer – DMA transfer in a 8085 based system – DMA protocols in 8086 in minimum and maximum mode – types of DMA.

Unit V : Microcontrollers

Organisation of 8031 and 8051 microcontrollers – I/O ports-External memory – Counter and Timers – Serial data input and output – Interrupts – Instruction set – Addressing modes – Assembly language programming, simple applications.

Text Books

1. Ramesh.S.Gaonkar "Microprocessor Architecture, Programming & Applications With 8085/8080a" – Penram International – 1997.
2. Kenneth J.Ayala "The 8051 Microcontroller Architecture, Programming & Applications" – Penram International Publishing –1996.

Reference Books

1. D.V.Hall "Microprocessor And Digital System", McGraw Hill Publishing Company, 1990.
2. Ajit Pal "Microprocessor Principles And Applications", Tata McGraw Hill, 1990.
3. Avatar Singh And Walter A.Tribel "16 Bit Microprocessor, Architecture, Software and Interface Techniques", PHI, 1985.
4. Yu.Cheng Liu & Glenn A Gibson," Microcomputer System,8086/8088 Family", 2nd Edition, PHI, 1986.

EC216 MICROPROCESSOR INTERFACING TECHNIQUES

Credit: 4 : 0 : 0
Marks: 40 + 60

Unit I : Micro Computer Communication Techniques

Micro computer communication techniques and Interfacing - Methods of parallel data transfer - Programmable parallel ports-8255 PPI - Serial communication - Asynchronous - synchronous - 8251A Programmable communication interface -DMA -8237 - Programmable DMA Controller.

Unit II : Support Peripherals

8259A Programmable interrupt controller - 8279 Programmable Keyboard/display interface -8253 programmable interval timer - 8295 printer controller chip - 8275 -CRT Controller.

Unit III : Co-processors

Co-processors-8087 NDP - Data types - Processor architecture - Instruction set-8089 - I/O Processor -IOP architecture - communication between CPU and IOP - IOP instruction set - 8288 - Bus controller - 8289 Bus arbiter.

Unit IV : Interface Standards

Interface standards -S-100 Bus -IEEE -488 interface bus -IBM PC Bus - Serial interface - RS 232,RS 422 and RS 423 serial interface -Current loop.

Unit V : I/O Interface

Input/Output Interface -Printer interface using 8295 -CRT interface -Keyboard/display interfacing -A/D and D/A interface -Data acquisition systems -Interfacing high power devices -Microprocessor development system -applications -Temperature controller -Stepper motor controller. Interfacing Techniques (8051) for microcontrollers.

Text Books

1. Hall D.V. "Microprocessor And Interfacing -Programming And Hardware", Tata McGraw Hill, 1991.
2. Liu.Y. And Gibson "Microcomputer System, The 8086/8088 Family Architecture, Programming And Design", PHI, 1986.

Reference Books

1. Rafiquzzaman.M., "Microprocessor Theory And Applications-Intel And Motorola", PHI, 1992.
2. Rafiquzzaman.M., "Microprocessor And Microcomputer Based System Design", CRC Press Inc., Boca Ratan, Florida, 1990.
3. “Peripheral Components”, Intel 1992.
4. Mathur A.P., "Introduction To Microprocessors", TMH, 1995.
5. John Uffenbeck "The 8086 / 8088 Family, Design, Programming And Interfacing" PHI, 1994.

EC217 MICROPROCESSOR LAB-I

(Write programs using assemblers for 8085, 8086 and 8051)

Credit : 0 : 0 : 2

Marks: 50 + 50

8085 Assembly Language program

1. Multibyte Addition and Subtraction Multibyte decimal addition and subtraction.
2. Multiplication and division - repetitive addition and use of a register shifting operation

- Signed and unsigned numbers.

3. Code conversion - BCD to Binary, Binary to BCD, Binary to Gray, Gray to Binary, Binary to Excess code, BCD to seven segment code.
4. Searching, Sorting and data transfer.
5. Square root of a number, Sum of first N-natural Numbers, Average, LCM and BCD, Factorial and delay loops.
6. 8086 Assembly Language Program : Search and Sort, Programs involving string instructions.
7. Simple program using 8051 Assembly Language.
8. Study of programmable I/O ports of 8051 microcontroller.
9. Study of interrupt structure of 8085, 8086, 8031 and 8051.

EC218 MICROPROCESSOR LAB II

Credit : 0 : 0 : 2
Marks: 50 + 50

1. Study of 8255 PPI Square wave generation using mode 0 . Parallel data transfer between two microprocessor kits using mode 1 and mode2.
2. Study of 8253 Timer - Six modes of operation - Measurement of unknown frequency of a square wave Programmable square wave generation.
3. Study of 8259 programmable interrupt controller - Development of interrupt service routine.
4. 8279 Keyboard/display controller - Keyboard scan - blinking and rolling display.
5. Study of 8251 programmable communication interface - Study of RS 232-C serial bus standard - serial communication between two microprocessor kits using RS 232-C interface.
6. Unencoded keyboard interface and multiplexed seven segment display.
7. D/A converter and waveform generation.
8. A/D converter interface - data acquisition - unipolar and bipolar signals - Sample and Hold - Instrumentation amplifier.
9. Stepper motor controller interface.
10. DC motor speed controller interface.
11. Temperature monitoring and control.
12. Study of IBM PC bus - IBM PC compatible cards (I/O card, D/A & A/D card, Timer card)
13. EPROM Programmer.
14. Interfacing High power devices to microcomputer port lines LED, Relays, Solenoids, Solid state relays and LCD display.
15. Study of Microcomputer development system.
16. Microcontroller applications.

EC219 COMMUNICATION ENGINEERING I

Credit: 4 : 0 : 0
Marks: 40 + 60

Unit I : Wave Filters

Theory of T & Pi sections – Filter fundamentals – Constant 'K' low pass and high pass filters – m derived filters – Composite filters – Bandpass and Band elimination filters – Crystal and Lattice filters – Cross over filters – attenuators and equalisers.

TIME VARYING FIELDS AND MAXWELL'S EQUATIONS: Faraday's law and Maxwell's first equation – Gauss law and Maxwell's second equation – Ampere's law and inconsistency in Ampere's law – Maxwell's third and fourth equations.

Unit II : Plane Wave Propagation In A Homogeneous And Isotropic Medium

Plane waves and the wave equation – Solution for free space conditions – Sinusoidal time variations – Intrinsic impedance – The wave equation for a conducting medium – Propagation in good conductors – Skin depth – Polarization, linear, elliptical and circular – Poynting vector – Instantaneous, average and complex Poynting vectors.

Unit III : Reflection And Refraction Of Plane Waves

Reflection and transmission of waves at a boundary for normal incidence – Oblique incidence at a boundary between two dielectrics – Reflection and transmission for polarisation with E in the plane of incidence – Total reflection – Brewster angle.

GUIDED WAVES: Waves between parallel planes – TE, TM, and TEM waves and their characteristics – Attenuation in parallel plane guide for TE, TM and TEM waves – Wave impedances – Phase and group velocities.

Unit IV : Waveguides And Cavity Resonators

Rectangular and circular – TM & TE waves in waveguides – Impossibility of TEM waves – Wave and characteristic impedances – Transmission line analogy for waveguides – Attenuation factor and Q of waveguides. Elemental concepts of cavity resonators – Electric and magnetic fields in rectangular resonator with TE_{101} mode – Energy storage, losses and Q of simple resonator with TE_{101} mode – Circular cylindrical resonators: Field components, Energy storage, power loss and Q for TE_{101} mode-waveguide elements.

Unit V: Electromagnetic Interference & Compatability

EMI environment sources of EMI – definitions and parameters – EMI coupling principles – EMI measurements – Designing for Electromagnetic compatability.

Text Books

1. Edward C. Jordan and Keith G Balmain, "Electromagnetic waves and radiating system", PHI, II edition, 1995.
2. Henry W.Ott, "Noise reduction Techniques in Electronic Systems", John Wiley & Sons, II Edition, 1998.

Reference Books

1. Skitek G.G & Marshall S.V., “Electromagnetic concepts and applications”, Prentice Hall, 1985.
2. Ramo S & Whinnery J R, “Fields and waves in Communication Electronics”, John Wiley, III Edition, 1994.

EC220 COMMUNICATION ENGINEERING II

Credit: 3 : 1 : 0
Marks: 40 + 60

Unit I : Introduction

Need for wireless transmission and modulation – Concept of baseband and bandwidth – Multichannel transmission.

Amplitude Modulation Systems

Waveform representation of AM process, phasor representation – AM spectrum, Bandwidth, Power relations – Need for suppression of carrier – Suppressed carrier systems – Comparison of AM systems – Demodulation of AM signals – Envelope detection, square law & synchronous demodulation methods.

Unit II : Angle Modulation Systems

Concept of instantaneous frequency – Waveform representation of FM process, spectrum of signal, Narrow band FM and wideband FM, phasor representation of NBFM – Armstrong FM system – Reactance tube modulation – Pre emphasis, De-emphasis, capture effect in FM – Demodulation of FM signals – Discriminators, Differentiators, Zero-crossing detectors and PLL method of comparison of AM and FM.

Unit III : Pulse Modulation Systems

Pulse Analog modulation methods – TDM, FDM interchannel cross talk, brief ideas of PCM, DM and DPCM.

TRANSMITTERS: Classification of transmitters – Block diagram of broadcasting transmitters, SSB transmission using pilot and diminished carrier signal techniques – FM transmitter and methods of frequency stabilisation – Armstrong FM transmitter systems – Radio telemetry.

Unit IV : Receivers

Classification of receivers – Block diagram – characteristics and measurement of sensitivity, selectivity and fidelity – Tuned radio frequency receivers – Super heterodyne receivers – Merits and demerits of different receivers.

NOISE IN COMMUNICATION NETWORKS: Noise and interference – Thermal noise and shot noise – signal to noise ratio – Noise figure – Equivalent noise BW – Available noise power density – Noise temperature, Noise in AM, Angle modulation and pulse code modulation.

Unit V : FM Receivers & Radio Telemetry

Block diagram of FM receiver – Automatic frequency control – FM detectors: Radio detector FM discriminators – Limiters – diversity reception techniques – Spurious response in receivers – Multiplexers: TDM and FDM – A typical PCM-FM telemetry system – Self-tuning of transmitters and receivers.

Text Books

1. Lathi B.P., "Introduction to Communication Systems", John Wiley Sons Inc., 19th reprint, 1992.
2. Dennis John, Roddy and Coolen, "Electronic Communications", PHI, 4th Edition, 1995.

Reference Books

1. Taub & Schilling, "Principles of Communication Systems", McGraw Hill International Edition, II Edition, 5th reprint, 1994.
2. Farrel G.Stremler, "Introduction to Communication Systems", John Wiley Inc., II Edition, 1982.
3. Carlson, "Communication Systems: An Introduction to signals and noise in electrical communication", 3rd Edition, McGraw Hill, 1988.
4. Kennedy G., "Electronic Communication Systems", McGraw Hill, 3rd Edition, 8th Reprint, 1995.

EC221 COMMUNICATION ENGINEERING III

Credit: 3: 1: 0
Marks: 40 + 60

Unit I : Radiation Principle And Antenna Terminologies

Principle of Radiation, Isotropic radiator – Antenna terminologies – Reciprocity theorem – Friis formula. ANTENNA FUNDAMENTALS: Radiation from an oscillating dipole – Short linear antennas – Half wave dipole as a basic radiating element – Folded unipole and dipole antennas – Shunt fed dipoles – Slot antennas – Loop antennas – Standing wave radiators.

Unit II : Antenna Arrays & Practice

Pattern multiplication – Arrays of two driven antennas – Broadside arrays – end fire arrays – Collinear arrays – Parasitic Arrays – Antenna for low & medium frequencies – Tower antenna – Effects of ground on antenna performance – Ground systems – Top loading – Excitation methods – Antenna couplers, baluns – Yagi antenna – corner reflector – Biconical antennas – Tumstile antennas – Helical antennas – Parabolic reflectors.

Unit III : Propagation

Propagation in free space – Propagation around the earth – Surface wave and its propagation – Surface of the ionosphere – Propagation of plane waves in an ionised medium – Determination of critical frequencies – Maximum usable frequency – Effect of earth's magnetic field – Ionospheric variations – Fading – Tropospheric propagation – Space wave – Super refraction – frequency – Refractive index of troposphere – Effect of surface irregularities – Scatter propagation.

Unit IV : Microwave Tubes And Solid State Devices
High frequency limitations of conventional tubes – Principle of velocity modulation – Klystron amplifiers – Reflex klystrons – Magnetron oscillators – Travelling wave tubes – Backward oscillators. Microwave transistors – Varactors – Parametric amplifiers – Tunnel diodes – Theory of negative resistive amplifiers – Gunn effect – Gunn diode oscillators – Avalanche effect – IMPATT and TRAPATT diodes –

Unit V : Microwave Communication Systems
Simplified microwave system – block diagram – Repeaters – Need for diversity – Frequency and space diversity – Protection switching arrangements – Microwave radio stations – System gain.

Text Books

1. Prasad K.E., "Antennas and wave propagation", Satya Prakasan, 3rd Edition, 1996.
2. Liao Y.S., "Microwave devices and circuits", PHI, 3rd Edition, 5th Reprint, 1992.

Reference Books

1. Edward C.Jordan and Keith G.Balmain, "Electromagnetic waves and radiating systems", PH, 2nd Edition, 1995.
2. Reich J.H., "Microwave principles", Van Nostrand Reinhold Co., 1st Edition, 1987.
3. Tomasi W, "Advanced Electronic Communication Systems", PHI, 1987.

EC222 ELECTRONICS & COMMUNICATION LAB

Credit : 0 : 0 : 2
Marks: 50 + 50

1. Cascode / wide band amplifiers.
2. Clipping and clamping circuits.
3. Astable, monostable, bistable multivibrators (Transistor version)
4. Voltage and Current sweep generators.
4. Full wave power control circuit using SCR.
5. Amplitude modulation and detection.
6. Frequency modulation and detection.
7. Pre-emphasis, De-emphasis circuits.
8. IF amplifier / mixer circuits.
9. Radio receiver measurements.
10. Attenuators and equalisers.

EC223 DSP AND COMMUNICATION LABORATORY

Credit : 0 : 0 : 2
Marks: 50 + 50

Programs using MATLAB

1. Representation of time series; computation of convolution.
2. Response of a difference equations to initial conditions; stability.
3. DFT computation.
4. Computational experiments with digital filters.
5. DSP processor implementation
6. Sampling & waveform generation.
7. FIR & IIR filters implementation.
8. Fast Fourier Transform.
9. Quantization noise.
10. Adaptive filters.
11. Multirate signal processing.
12. DSP projects.
13. Delta and delta sigma modulation.
14. Digital modulation schemes.
15. Scrambler and unscrambler.
16. Shannon Binary, Shannon Fano Technique.
17. Huffmann, Minimum redundancy Technique.

EC224 OPTICAL COMMUNICATION

Credit: 4 : 0 : 0
Marks: 40 + 60

Unit I : Basic System Concepts
Review of Electrical Communication systems- Need for Optical Communication. Electrical Vs Optical communication- Advantage and applications – EM spectrum - system model description – Selection of system components – Choice of operating wave length – System performance – Future trends.

Unit II : Optical Sources & Receivers
Characteristics and requirements – spontaneous and stimulated emission – Source classifications: Homo and Hetero structures, LASER Diodes and LEDs characteristics, comparison and applications.

Optical Receivers
Requirements – Methods of detection process – Comparison, Basic principles of photo detection – Photo diode – PIN diode – Avalanche photo multiplier – Comparison –S/N consideration – Receiver configurations – Pre amplifier for detectors.

Unit III : Modulation Techniques
Classifications, Direct/Indirect modulation: Analog and digital modulation formats – External modulators: Electro-optic and Acousto-optic modulators –comparison – System configuration.

Unit IV : Transmission Media
Fiber-Optics Vs Coaxial cables- Optical fiber modes and configurations – Light propagation – Fiber transmission properties, Attenuation and pulse dispersion, Choice of wave length for fiber-optic transmission – Cable configurations – Splicers, connectors and couplers.

Unit V : System Configurations
Fiber optic digital trunking systems – Fiber optic link for computers – Multi channel audio/video communication systems – Repeater/Regenerator for fiber-optic systems – System Design: Power budget and Rise-time Budget, WDM.

Text Books

1. Keiser G., “Optical Fiber Communications”, McGraw Hill, 1983.
2. John Gower, “Optical Communication Systems”, PHI, 1984.

Reference Books

1. Ched P.K.,, “Fiber Optics”, Prentice Hall.
2. Okoshi, “Optical Fibers”, Academic Press.
3. Barnoski, “Fundamentals of Optical Fiber Communications”, Academic Press.

EC225 MICROWAVE & OPTICAL COMMUNICATION LAB

Credit : 0 : 0 : 2
Marks: 50 + 50

A. Microwave Experiments

1. Characteristics of Reflex Klystron Oscillator.
2. Characteristics of Gunn Diode Oscillator.
3. Study of Power Distribution in directional coupler, E/H Plane Tee, Magic Tee
4. Frequency measurement.
5. Impedance measurement by Slotted Line Method.

B. Optical Communication Experiments

1. D.C. Characteristics of LED and PIN Photo Diode.
2. Optical transmission using Analog Modulation.
3. System bandwidth Determination by Intensity Modulation.
4. Data transmission through Fiber Optic Link.
5. Time Division Multiplexing.
6. PI Characteristics of LASER diode.

EC226 DIGITAL COMMUNICATION SYSTEMS

Credit: 4 : 0 : 0
Marks: 40 + 60

Unit I : Introduction

Schemes – comparison: Course objective/overview.
SYNCHRONISATION: Need for synchronisation – Synchronisation methods – Bits, word and frame synchronisation – Synchronisation using PN sequences.

Unit II : Baseband Signalling Techniques

Need for lineshaping of signals, Signaling formats – RZ/NRZ, Duobinary, Split phase (Manchester) and high density bipolar coding – Scrambling and unscrambling – channel equalisation, tapped delay line and transversal filters.

Unit III: Quantization And Encoding

Signal sampling, PCM generation and recovery using match filter – Analysis of uniform and non uniform quantizers – Delta modulation – Analysis of delta modulators – Delta sigma and adaptive delta modulators – Linear predictive coding – DPCM – Comparison of PCM and DM on the basis of speech signals.

Unit IV : Digital Data Transmission

Concept of baseband signaling – Detection using matched filters for signals via AWGN channels – Analysis of coherent and non-coherent detection Schemes for ASK, FSK, PSK, DPSK – M-ary signaling – Quadriphase system.

Unit V : Error Control Coding

Parity check codes – Linear block codes – systematic codes – Polynomial representation of code structures – cyclic codes – convolution codes – Decoding algorithms.

Text Books

1. Lathi B.P., “Modern Digital and Communication Systems”, Holt and Reinhart Publishers, 1995.
2. Simon Haykin, “Digital Communications”, John Wiley & Sons, Inc., 1988.

Reference Books

1. Sam Shanmugam K, “Digital and Analog Communication Systems”, John Wiley Inc., 1980.
2. Taub and Schilling D, “Principles of communication systems”, 2nd Edition, McGraw Hill, 1986.

EC227 SIGNALS AND SYSTEMS

Credit: 3 : 1 : 0
Marks: 40 + 60

Unit I : Introduction

Continuous Time (CT) signals – CT signal operations – Discrete Time(DT) signals – Representation of DT signals by impulses – DT signal operations – CT and DT systems – Properties of the systems – Linear Time Invariant(LTI) and Linear Shift Invariant(LSI) systems – Continuous and Discrete Convolutions – CT system representations by differential equations – DT System representations by difference equations.

Unit II : Fourier Analysis of CT Signals And Systems

Fourier series representation of periodic signals – Properties – Harmonic analysis of LTI systems – Convergence of Fourier series – Representation of a periodic signals by Continuous Time Fourier Transform (CTFT) – Properties – Frequency response of systems characterised by Differential Equations – Power and Energy Spectral Density – Parseval's Relation.

Unit III : Discretisation of CT Signals

Representation of CT signals by samples – Sampling Theorem – Sampling Methods – Impulse, Natural and Flat Top Sampling – Reconstruction of CT signal from its samples – Effect of under sampling – Aliasing Error – Discrete Time processing of CT signals.

Unit IV : Fourier Analysis of DT Signals And Systems

Discrete Time Fourier series representation of DT periodic signals – Properties – Representation of DT aperiodic signals by Discrete Time Fourier Transform(DTFT) – Properties – Frequency response of systems characterised by Difference Equations – Power and Energy Spectral Density concepts related to DT signals – Parseval's Relation.

Unit V : Transform Operations of DT Signals and Systems

Z transform and its properties – Inverse Z transform – Solution of Difference equations – Analysis of LSI systems using Z transform.

Text Books

1. Alan V Oppenheim, Alan S Wilsky and Hamid Nawab S, "Signals & Systems", II Edition, PHI, New Delhi, 1997.
2. Simon Haykin and Barry Van Veen, "Signals & Systems", John Wiley and Sons Inc., 1999.

References:

1. Ashok Ambardar, "Introduction to Analog and Digital Signal Processing", PWS Publishing Company, Newyork, 1999.
2. Samir S Solimon and Srinath M.D., "Continuous and Discrete Signals and Systems", II Edition, PHI, 1998.
3. Rodger E Zaimer and William H Tranter, "Signals & Systems – Continuous and Discrete", McMillan Publishing Company, 1990.

EC228 DIGITAL SIGNAL PROCESSING

Credits 3:1:0
Marks 40+60

Unit I : Introduction
Characterization and classification of signals -examples of signals – multi channel -multi-dimensional –continuous versus discrete -analog versus digital- concept of frequency. Concepts of signal processing -typical applications -advantages of digital signal processing compared with analog processing.

Unit II : Discrete Time Systems
Representations - classifications -time domain and frequency domain characterization -transfer functions -Z -transform and applications.

Unit III : Frequency Analysis Of Signals
Analysis of analog and discrete signals-using Fourier series, Fourier transform, Fourier transform of discrete sequence and discrete Fourier transform-properties of transforms -computation of discrete Fourier transforms-Radix 2. FFT algorithms.

Unit IV : Digital Processing Of Continuous Signals
Sampling of continuous signals-analog filter design-anti aliasing filters-sample and hold circuit-reconstructing filters- analog to digital and digital to analog converters.

Unit V :. Digital Filters
Discretization of analog filters-direct discrete design -IIR and FIR structures-window functions-filter realization –introduction to digital signal architecture.

Text Book

1. S.K. Mitra, 'Digital signal processing-A Computer based approach', Tata McGraw-Hill Edition. 1998

Reference

1. Lonnie C. Lumen, 'Fundamentals of Digital Signal Processing', John Wily and Sons, 1987.
2. J.G. Prookis and D.G. Manolakis, 'Introduction to Digital Signal Processing', Macmillan. Publishing company, 1989.
3. Oppenhein and Schafer, 'Discrete Time Signal Processing', Prentice Hall of India, 1992.
4. R.G.Lyons, 'Understanding Digital Signal Processing', Addison Wesley, 1997.

EC229 DIGITAL IMAGE PROCESSING

Credit 4:0:0
Marks 40 +60

Unit-I

Review of image fundamentals – The fast Fourier transform – other separable image transforms. Image Enhancement: Background- Enhancement by point processing – spatial filtering – Enhancement in the frequency Domain – generation of spatial masks from frequency domain specifications – color image processing.

Unit-II

Image Restoration: Degradation model – Diagonalisation of circulant and Block Circulant Matrices – Algebraic approach to Restoration – Inverse filtering Least mean square filter – Constrained Least Squares Restoration – Interactive Restoration – Restoration in the spatial domain – Geometric Transformation.

Unit-III

Image Compression : Fundamentals – Image Compression Models – Elements of Information theory – Error - Free Compression – Lossy Compression – Compression Standards.

Unit-IV

Image Segmentation – Detection of Discontinuities - Edge linking and Boundary Detection – Thresholding – Region Oriented segmentation – The use of motion in segmentation.

Unit-V

Image Representation and Description Representation Schemes – Boundary Descriptors – Regional Descriptors – Morphology – Relational Descriptors. Recognition and Interpretation : Elements of Image Analysis – Patterns and Pattern Classes – Decision – Theoretic Methods – Structural Methods – Interpretation.

Text Book

1. Rafael C., Gonzalez and Richard. E., Woods, "Digital Image Processing", Addison Wesley, 1992.

Reference Book

1. Pratt, " Digital Image Processing", McGraw Hill, 1991.
2. Anil K. Jain, " Fundamentals of Digital Image processing", PHI, 1st Edition – 1998.

EC230 VLSI DESIGN

Credit: 4 : 0 : 0
Marks: 40 + 60

Unit I : Introduction to MOS Technology

MOS technology & VLSI – Basic MOS transistor – depletion & enhancement type – NMOS & CMOS Transistors fabrications – electrical properties of MOS circuits – characteristics – threshold voltage – transconductance – pass transistors – NMOS Inverter – pull-up pull-down ratio for NMOS Inverter driven by NMOS Inverter & through one or more pass transistors – CMOS Inverter – latch-up-sheet-resistance & capacitance calculation – delay calculation – super buffer – HMOS & native transistors.

Unit II : Layout Design

MOS & CMOS Layers – stick diagram – design rules & layout – subsystems design: switch logic – gate logic – other forms of logic – combinational logic design example: passing generator – bus arbitration logic multiplexers – gray to binary code converter – sequential circuit example: two phase clocking – dynamic register element – dynamic shift register – precharged bus concept – scaling circuits.

Unit III : Design of System

PLA – Finite state machine – PLA based finite state machine design – design of 4-bit shifter – design of ALU subsystem: adders – multiplexers – memory: dynamic shift register – dynamic RAM cells – one transistor dynamic memory cell – 4*4 bit register array – RAM array.

Unit IV : Tools for Design

Grounds rules for successful design – design styles & philosophy – CAD tools for design & simulation: textual entry layout language – graphical entry layout – design verification – design rule checkers – simulators – tests & testability.

Unit V : CMOS Design Projects & Fast VLSI Circuits

Incremental/decremental – left/right – serial/parallel shift register – comparator – GaAs device – layout design for GaAs devices.

Text Book

1. Pucknell D.A., & Eshraghian K., "Basic VLSI Design", PHI, 1993.

Reference Books

2. Geiger R.L., Allen P.H., & Starder N.R., "VLSI Design Techniques For Analog & Digital Circuits", McGraw Hill International Edition, 1990.

EC231 LINEAR AND DIGITAL IC LAB

Credits 0:0:2
Marks 50+50

1. Performance characteristics of op-amp IC – input offset voltage, bias current, slew rate, differential gain etc.
2. Instrumentation amplifier, using op-amp ICs.
3. Maximally flat active filter, using op-amp IC.
4. Precision full wave and half wave rectifier, using op-amp IC.
5. Wien's bridge oscillator using op-amp IC.
6. Astable multivibrator and Schmitt trigger, using op-amp IC
7. Frequency multiplier and FM detector, using PLL IC
8. Realization of different flip-flops, using logic gates.
9. Realization of simple switching functions, using NAND or NOR gates.
10. Half adder, Full adder, Half subtracter and Full subtracter using logic gates.
11. Synchronous decade counter
12. Shift register and ring counter
13. Multiplexer and demultiplexer
14. Analog to Digital converter
15. Digital to Analog converter

EC232 DIGITAL SIGNAL PROCESSING

Credit: 4 : 0 : 0
Marks: 40 + 60

Unit I : Discrete Time Signals and Systems
Review of time domain and frequency-domain representation and analysis of linear discrete-time systems, discrete-time signals-review of discrete random signals-averages-autocorrelation and power spectrum computation-periodogram.

Unit II : Design of Finite Impulse Response Filters
Linear phase response and its implications-FIR design using window method-frequency sampling method-design of optimal linear phase FIR filters-realisation structures of FIR Filters-transversal and linear phase structures.

Unit III : Design of Infinite Impulse Response Filters
Calculation of IIR coefficients using pole zero placement method-Review of classical analog filters-Butterworth, Chebyshev and Elliptic filters-Transformation of analog filters into equivalent digital filters using impulse invariant method and Bilinear Z transform method – realization structures of IIR filters - Direct, cascade, parallel forms.

Unit IV : Quantization Effects and Implementation
Representation of numbers in registers-ADC quantization noise-coefficient quantization error – Product quantization error – Limit cycles due to product round-off error, Round off noise reduction scheme – Addition over flow errors – Principle of scaling –

introduction to general and special purpose hardware for DSP – Harvard architecture – pipelining – special instruction – replication – hardware digital filter.

Unit V : Special Types of Signal Processing Techniques
Introduction to multi rate signal processing – decimation – interpolation – multistage approach to sampling rate conversion – Adaptive filtering – basic Wiener filter theory – LMS adaptive algorithm – recursive least square algorithm – concept of spectrum and homomorphic filtering.

**** Prerequisite EC227 Signals & Systems***

Text Books

1. Sajit K. Mitra, 'Digital Signal Processing – A Computer Based Approach', Tata McGraw Hill Publishing Company Ltd., New Delhi, 1998
2. Emmanuel C. Ifeacher and Barrie W. Jervis, 'Digital Signal Processing – A Practical Approach', Addition-Wesley Longman Limited, UK, 1993
3. John G. Proakis and Dimitris G. Manolakis, 'Digital Signal Processing, Algorithms and Applications'. PHI, New Delhi, 1995

Reference Books

1. Alan V. Oppenheim, Ronald W. Scafer and John R. Buck, 'Discrete – Time Signal Processing'. PHI, 2nd Edition, 1999
2. Richard G. Lyons, 'Understanding Digital Signal Processing', Addition Wesley Longman, Delhi, 1997
3. David J. Defatta, Joseph G. Lucas and William S. Hodgkiss, 'Digital Signal Processing – a System Design Approach', John Wisely & Sons, Singapore, 1998
4. V.K. Khanna, 'DSP Telecommunications and Multi Media Technology', Wheeler Publications, 1999.

EC233 ELECTROMAGNETIC FIELDS

Credit: 3 : 1 : 0
Marks: 40 + 60

UNIT – I : Static Electromagnetic Fields
Introduction to co-ordinate system, Gradient, Divergence, Curl, Divergence Theorem, Stoke's Theorem, Coulomb's Law, Electric field Intensity, Principle of superposition, Electric Scalar potential, Line charge distribution by Moment method, Electric flux Density, Gauss Law and its applications, Field Computations and Problems.

UNIT – II: Static Magnetic Field
Magnetic field of a current carrying element, Ampere's Force law, The Biot-Savart Law, Magnetic Flux density, Gauss law for magnetic fields, Torque on a loop, Magnetic moment, Ampere's Law and Magenetic field intensity, Magnetomotive force, Field cells and permeability, Vector potential, Field computation and problems.

UNIT – III: Electric Field In Dielectrics

Permitivity, Polarization, Boundary relation, Capacitance, Dielectric strength, Energy and energy density, Poisson's and Laplace equations and applications, Electric Current, Current Density, Ohms law at a point, Resistance and Conductance, Continuity relations for current problems.

UNIT – IV: Magnetic Field In Ferromagnetic Materials

Magnetic materials, Magnetic dipoles, Loops and Solenoids, Magnetization, Inductance, Energy in an Inductor and Energy Density, Boundary relations, Ferro magnetism, Hysteresis, Reluctance and Permeance, Problems.

UNIT – V: Time Varying Electric And Magnetic Fields

Faraday's Law, Transformer and Motional Induction, Maxwell's equation from Faraday's Law, Self and Mutual Inductance, Displacement current, Maxwell's equation from Ampere's Law and its in-consistency, Boundary relation, Poynting Vector, Comparision of field and circuit theory, Circuit Application of Poynting Vector.

Text Books

1. John D. Kraus, "Electromagnetics", McGraw Hill, 1992.
2. David K. Chang, " Field and Wave Electromagnetics ", Second edition, Addison Wesley, New Delhi, 1999.

Reference Books

1. Hayt W.H., "Engineering Electromagnetics", McGraw Hill, 1995.
2. Narayana Rao N., " Basic Electromagnetics with applications ", Prentice Hall of India, 1988.
3. Harrington R.F., " Field computation by moment methods ", Macmillan, 1988.
4. Stanley V. Marshall, Richard DuBroff, Gabriel G.Skitek, " Electromagnetic Concepts and Applications", Fourth Edition, Prentice Hall International Inc., New Jersy, 1996.

EC234 – ELECTRONICS AND MICROPROCESSORS LABORATORY

Credit: 0:0:1 **Marks: 40+60**

1. Characteristics of Semiconductor Diode.
2. Characteristics of Zener Diode.
3. Study of Half-wave and Full-wave Rectifier.
4. Study of Bridge Rectifiers.
5. Transistor as a Switch and Amplifier.
6. Operational Amplifier Configurations: Adder, Integrators, Current to Voltage Converters.
7. Verifications of truth tables of logic Gates AND, OR, NOT, NAND, exclusive OR.
8. Combination logic realization: Adder, Substrator.
9. Sequential Logic: Counters, Shift Registers with display devices.

10. Study of Microprocessor Kits.
11. Programming Exercise on 8085 and Trainer Kits.
12. Stepper Motor Interface.

EC301 ADVANCED DIGITAL SIGNAL PROCESSING

Credit: 3 : 1 : 0
Marks: 40 + 60

UNIT I : Introduction To Digital Signal Processing

Digital Signal Processing and its benefits – Digital filtering – Discrete transformation – Modulation – Typical real-time DSP systems – Analog to Digital conversion process – Digital to Analog conversion process (signal recovery) – Digital Signal Processors – Constraints of real-time signal processing with Analog input/output signals.

Convolution : Properties of Convolution – Circular Convolution – Linear Convolution – Sectioned Convolution.

Correlation : cross and auto-correlation – Applications of correlation – relationship between convolution and correlation.

Unit II : Discrete Transforms

Z-transform and its properties – Inverse Z-transform – Discrete Fourier Transform and its properties – Radix-2 Fast Fourier Transform – Computational advantages of FFT over DFT – Decimation-in-time FFT algorithm – Decimation-in-frequency FFT algorithm – Inverse FFT by direct DFT – Discrete Cosine transform – Walsh transform – Hadamard transform.

Unit III : Digital Filter Design

Introduction to Digital Filters – Types of digital filters: FIR and IIR filters – Characteristic features of FIR filters – Linear phase response of FIR filters – FIR filter design – FIR filter specifications – FIR filter coefficient calculation methods – FIR design techniques : Window method – Frequency Sampling method – Optimal method.Basic features of IIR filters – Design stages for digital IIR filters – converting analog filters into equivalent digital filters – Impulse invariant method – Bilinear Transformation method – Comparison of IIR and FIR filters.

UNIT IV : Multirate Signal Processing And Adaptive Digital Filters

Concepts of Multirate Signal Processing – Sampling rate decrease (Decimation) by integer factors – Sampling rate increase (Interpolation) by integer factors – Sampling rate conversion by non-integer factors – multistage approach to sampling rate conversion – Design of practical sampling rate converters – Digital filter banks. Concepts of Adaptive filtering – Basic components of the adaptive filters – Adaptive algorithms - Basic Least Mean Square Adaptive algorithm – Recursive Least Squares algorithm – Adaptive filter as a noise canceller.

UNIT V : DSP Processors And DSP Applications

General purpose Digital Signal Processors: Texas Instruments TMS320 family – Motorola DSP 56333 family – Analog devices ADSP 2100 family – Instruction set of

TMS320C50 – simple programs. Detection of foetal heart beats during labour – FFT Spectrum Analyser – Musical Sound Processing.

Text Book

1. Emmanuel C.Ifeachor, Barrie W.Jervis, "Digital Signal Processing – A Practical Approach", Addison Wesley, 1993.

Reference Books

1. Sanjit k.Mitra, "Digital Signal Processing – A Computer based approach", Tata McGraw Hill, 1999.
2. Defatta D.J., Lucas and Hodgkias, "Digital Signal Processing", John Wiley and sons, 1995.
3. Texas Instruments, "Users Guide TMS320C50".

EC302 DIGITAL SYSTEM DESIGN AND TESTING

Credit: 3 : 0 : 0
Marks: 40 + 60

Unit I : Programmable Logic Devices

Basic concepts – Programming technologies - Programmable Logic Element(PLE) – Programmable Logic Array(PLA) – Programmable Array Logic(PAL) – Structure of standard PLD's – Complex PLD's(CPLD) – Altera Max 7000 series – AMD Mach 4 Structure.

Unit II : System Design using PLD's

Design of combinational and sequential circuits using PLD's – Programming PAL devices using PALASM – Design of state machines using Algorithimic State Machines (ASM) chart as a design tool.

Unit III : Introduction to Field Programmable Gate Arrays

Types of FPGA – Xilinx XC3000 series – Logic Cell Array (LCA) – Configurable Logic Blocks(CLB) – Input/Output Blocks(I/OB) – Programmable Interconnection Points(PIP) – Introduction to ACT 2 family and Xilinx XC4000 families – Design examples.

Unit IV : Introduction to VHDL

Design process flow – Software tools – Hardware Description Languages – VHDL : Data Objects – Data types – Operators – Entities and Architectures – Component declaration – Component instantiation – Concurrent signal assignment – Conditional signal assignment – Selected signal assignment – Concurrent statements – Sequential statements – Behavioural, Data flow and Structural modelling.

Unit V : Fault Testing in Digital circuits

Detection and location of faults in combinational logic circuits - Path Sensitising method - Boolean Difference method - Fault detection and location in synchronous sequential circuits - Design for testability – Built-in-self test.

Fault Tolerant systems: Fault Avoidance and Fault Tolerance - Techniques of Fault Tolerance - Hardware Fault tolerance: Static, Dynamic and Hybrid Redundancy - Fault Tolerance in members.
Software Fault Tolerance: Design of Fault Tolerant software - N-version programming - Recovery block - Reliability models for fault tolerant software - Validation of fault tolerant software.

Text Books

1. Palmer,J.E., Perlman, D.E., “Introduction to Digital Systems”, McGraw Hill Book Company, International Student Edition, 1993.
2. Nelson, V.P., Nagale H.T., Carroll, B.D., and Irwin J.D., “Digital Logic Circuit Analysis and Design”, Prentice Hall International, Inc., New Jersey, 1995.

References

1. John V. Oldfield and Richard C.Dorf, “Field Programmable Gate Arrays: Reconfigurable Logic for Rapid Prototyping and Implementation of Digital Systems”, John Wiley, 1995.
2. D.K.Pradhan, "Fault - Tolerant computing - theory and Techniques" vol.I & II, Prentice hall 1986
3. "Programmable logic devices databook and design guide" National semiconductors, 1989
4. Navabi, Z., “VHDL : Analysis and Modelling of Digital Systems”, Prentice Hall Inc., 1989.
5. David Pellerin, Douglas Taylor"VHDL Made Easy" Prentice Hall Inc., 1997.

EC303 ADVANCED COMPUTER ARCHITECTURE

Credit: 4 : 0 : 0
Marks: 40 + 60

Unit I : Register Transfer and Micro Operations

Register transfer language - Inter register transfer- Arithmetic micro operations - Logic micro operations - Shift micro opertions - Control Functions.
Arithmetic and Logic Unit: Binary arithmetic unit - BCD arithmetic unit - Floating point arithmetic unit.
Memory Unit: Memory hierarchy - Solid state memeories - RAMs, ROMs, EPORMs - Backup storge units - Virtual memeory systems - Cache memory - Associative memory - Multiple module memories – Interleaved memory - Memory management hardware.

Unit II : Control Unit

Processor bus configuration - Data transfer and manipulation - Hardwired and microprogrammed control.
Input-Output Unit: Characteristics of I/O Subsystem - I/O procesors - I/O channels - I/O interface - Asynchronous data transfer - Direct memory access - Interrupt handling.

Unit III : Parallel Processing
Basic Uniprocessor Architecture - Parallel processing Mechanisms - Balancing of subsystem Bandwidth - Parallel computer structures - Architectural classifications - Parallel processing Applications.

Unit IV : Pipelining and Vector Processing
Linear Pipelining - Pipeline processors - Instruction and Arithmetic Pipelines - Instruction prefetch and Branch handling - Data buffering and busing structures - Hazard Detection and Resolution - Job sequencing and collision prevention – Vector Processing - Requirements, Characteristics.

Unit V : Array Processing
SIMD Array processors - Parallel Algorithms for Array processors – Associative Array Processing.
Multiprocessor Architecture: Functional structures - Multiprocessor scheduling strategies - Parallel Algorithms for Multiprocessors.

Text Book

1. Mano, M M., "Computer system Architecture", Prentice Hall of India, 3rd Edition, 1993.

References

1. Kai Hwang and Faye A Briggs., "Computer Architecture and Parallel Processing". McGraw Hill Book Company, 1989.
2. Chandra & Rafiquzzaman., "Modern Computer Architecture", West Publishing Company, 1989.
3. Gayakwad, A.R., "Op-Amps and Linear Integrated Circuits Technology", Prentice Hall of India, 3rd Edition, 1993.
4. Mohd. Ismail, Terri Fiez, "Analog VLSI – Signal and Information Processing", McGraw Hill International Edition, 1994.
5. Malcolm R Haskard, Ian C.May, "Analog VLSI Design", Prentice Hall Inc., 1988.

EC304 MICROCONTROLLERS AND APPLICATIONS

Credit: 3 : 1 : 0
Marks: 40 + 60

Unit I : Intel 8051
Architecture of 8051 - Memory Organisation – Register Banks – Bit addressable area – SFR area – Addressing modes – Instruction set – Programming examples.

Unit : II
8051 Interrupt structure – Timer modules - Serial features – Port structure - Power saving modes –MCS51 Family features: 8031/8051/8751.

Unit III : Motorola 68HC11
68HC11 features – Different modes of operation and memory map - Functions of I/O ports in single chip and expanded multiplexed mode – Timer system of 68HC11- Input capture, output compare and pulsed accumulator features of 68HC11.

Unit : IV
Serial peripheral and serial communication interface – Analog to digital conversion features – Watchdog feature.

Unit V : 8096 Controller
Architecture of 8096 - Modes – Block diagrams of Interrrupt structure - Timers - High speed Input and Outputs – PWM output – Analog interface – Serial ports.
Typical Applications: Stepper Motor Control - DC Motor Control – AC Power Control – Introduction to micro controller development tools.

Text Books

1. "8-bit Embedded Controllers", Intel corporation, 1990.

References

1. "16 bit Embedded Controller Handbook", Intel corporation, 1989.
2. John B Peatman, " Design with Microcontrollers", McGraw Hill, Singapore 1988.

EC305 MICROCONTROLLER & DSP LAB

Credit: 0 : 0 : 2
Marks: 50 + 50

1. Speed control of DC motor using microcontrollers.
2. Speed control of stepper motor using micro controllers
3. Determination of pulse width using timer of 8031
4. Waveform generation using 8031.
5. Arranging numbers in an array.
6. FFT implementation in TMS processor. (TMS320XX)
7. FIR filter design in TMS processor. (TMS320XX)
8. Convolution algorithms implementation in TMS processor.
9. Counting number of pulses using timer of 8031.
10. Traffic light interface using 8031.

EC306 ADVANCED TOPICS IN VLSI

Credit: 4 : 0 : 0
Marks: 40 + 60

Unit I : Testing and Testable Design of Digital Systems
Need for testing – Fault Models – Fault detection and Redundancy – Combinational circuits – Sequential circuits – Fault equivalence – Fault dominance – Fault simulation techniques – Serial, parallel, deductive.

Unit II : Testing For Single-Stuck-At Faults
Test generation algorithms for combinational circuits – Fault oriented ATG – D-algorithm – PODEM – Fault independent ATG – Random test generation – ATG for SSF's in sequential circuits – TG using iterative array models – TG using RTL models – Random Test generation.

Unit III : Design of Testability
Adhoc design for testability techniques – Controllability and observability by means of scan registers – Storage cells for scan designs – Level – Sensitive scan design – LSSD – Partial scan – Boundary scan.

Unit IV : Logic Synthesis And Optimization
Overview of Boolean and switching algebra – Minimization techniques – Cubical representation and manipulation of switching functions – Cofactor and shannon expansion – Merging – Unate function – The choice of the splitting variable.

Unit V : Two Level Combinational Logic Minimization
Exact logic minimization – Heuristic logic minimization – Expand, Reduce, Reshape, Irredundant algorithms – Testability properties – The Espresso minimizer – Symbolic minimization and encoding problems – Basics of multiple – Level combinational logic optimization.

Text Books

1. Abramovici,M., Brever,A., and Friedman,D., "Digital Systems Testing and Testable Design", Jaico Publishing House, 1997.
2. Giovanni De Micheli, "Synthesis and Optimization of Digital Circuits", McGraw Hill International Edition, 1994.

References

1. Weste, N.,and Eshranghian,K., "Principles of CMOS VLSI Design: A Systems Perspective", Addition-Wesley, 1993.
2. Brayton, K.Etal., "Logic Minimization Algorithms for VLSI Synthesis", Kluwer Academic Publishers, Fifth printing, 1989.
3. Fredrick J.Hill and Gerald R.Peterson, "Computer Aided Logical Design with Emphasis on VLSI", John Wiley Inc., Fourth Edition, 1993.

EC307 DIGITAL IMAGE PROCESSING & MAT LAB

Credit: 0 : 0 : 2
Marks: 50 + 50

1. Calculating the FFT of a given sequence using DIT and DIF algorithms.
2. a) Finding convolution between two sequences by circular and linear convolution.
   b) Proving convolution in time domain is equal to multiplication in frequency domain.

3. FIR filter design using windowing methods.
4. IIR filter design using bilinear transformation and impulse invariant methods.
5. Calculating FFT of an image and displaying its spectrum.
6. Demonstrating low pass and high pass filtering of images.
7. For the given image, add impulse, noise and filter the noise
8. Find the histogram for the given image
9. Detect the edges using sobel operator for the given image

EC308 ADAPTIVE SIGNAL PROCESSING

Credit: 4 : 0 : 0
Marks: 40 + 60

Unit I : Introduction
Need for adaptation – Areas of application – Open and closed loop adaptation – An adaptive linear combiner, Input signals – weight vectors – desired response and error – performance function gradient and minimum mean squared error – Decorrelation of error and input with optimum weights.

Unit II : Adaptation Theory (Stationary Signals)
Input correlation matrix, eigen values and eigen vectors and their geometric significance – Methods of searching the performance surface – Gradient search methods – stability – rate of convergence – the learning curve.

Unit : III
Newton's method (Multi dimensional space) and method of steepset descent for gradient search – Comparison of learning curves – Gradient estimation from measurement derivatives – performance – penalty with multiple weights – variance of gradient estimate and its effect on weight vector solution – time constants and misadjustment – Comparision of Newton's method and method of steepest descent.

Unit IV : Adaptive Algorithms And Structures
The least mean square (LMS) algorithm – convergence of weight vector – learning curve – noise in weight vector solution – misadjustment – performance – Expressing performance function in terms of transfer function H(z) of the adaptive system and the signal – power spectra – The ideal LMS / Newton algorithm and its properties - The sequential regression algorithm – Advantages and disadvantages of adaptive recursive filters – LMS algorithm for recursive filters – Random search algorithms – Lattice predictor – Adaptive filters with orthogonal signals.

Unit V : Applications Of Adaptive Signal Processing
Adaptive modelling of multipath communication channels – Adaptive equalisation of telephone channels – Adaptive interference cancellation – 50Hz interference in ECG – maternal ECG in Foetal Electrocardiography – noise in speech signals, echoes in long distance telephone circuits – Adaptive arrays and adaptive beam forming – side lobe cancellation.

Text Book

1. Bernard Widrow & Samuel D.Streams, “Adaptive Signal Processing”, Prentice Hall, 1985.

Reference Book

1. Simon Haykin, “Adaptive Filter Theory”, Prentice Hall, 1986.

EC309 ARTIFICIAL NEURAL NETWORKS

Credit: 4 : 0 : 0
Marks: 40 + 60

Unit I : Basic Concepts

Biological neurons – their artificial models – Neural Processing – Learning and Adaptation – Neural Network learning rules – HEBBIAN rule – Perception rule – Delta Learning rule – Widrow – Hoff rule – Winner – Takes – All rule – Outstar rule.

Unit II : Perceptions

Classification – Features – Decision Region – Discriminant function – Linear Classifier – Minimum distance classification – Training and classification using Discrete perceptron – Single Layer continuous perceptron – Single layer multicategory perceptron – Multi layer Feedforward Network – Linearity non seperable classification – feed forward recall and error back propagation training – Learning factors – Network Architecture – Necessary number of hidden nodes – Application to Character recognition.

Unit III : Feedback Networks

Dynamical Systems – Discrete time Hopfield Networks – Gradient Type Hopfield Network – Solution of optimisation problems Associative Memory – Linear associator – recurrent auto associative memory – bidirectional associative memory – Associative memory of spatio – temporal patterns.

Unit IV : Self Organising Networks

Unsupervised Learning of Clusters – Hamming net & MAX NET winner – take-All – Learning – Counter propagation network – Feature mapping – self organising feature maps – ART network Cognitron & Neo-Cognitron.

Unit V : Ann Implementation

Neuro computing Hardware Requirements – IC Synaptic connections – analog storage of adjustable weights – Digitally Programmable weights.

CIRCUITS FOR NEURAL NETWORKS: Invertor Based Neuron – Scalar product & averaging circuits – Template matching circuit – Analog multipliers with weight storage – associative memory implementations.

Text Book

1. Wasserman P.D., “Neural Computing Theory & Practice”, Van Nortrand Reinhold, 1989.

Reference Books

1. J.A.Freeman and D.M.Skapura, “Neural Algorithm Applications & Programming Techniques”.
2. Jacek M. Zurada, “Introduction to Artificial Neural Systems”, Jaico Publication House, 1995.

EC310 ADVANCED SOLID STATE DEVICES

Credit: 4 : 0 : 0
Marks: 40 + 60

Unit I: Diodes
PN diode, Heterojunction diode, Tunnel diode, PIN diode, MS diode, MIS diode, Varacter diode, CCD.

Unit II : Transistors Construction and Characteristics
BJT, JFET, MOSFET, NMOS, CMOS, MESFET, HFET, Amorphous silicon devices.

Unit III : Power Electronic Devices Construction and Characteristics
PNPN diodes, SCR, DIAC, TRAIC.

Unit IV : Microwave Devices Construction and Characteristics
READ diode, IMPATT, TRAPATT, GUNN diode.

Unit V : Photonic Devices
LED, Injection laser, Photodiode, Phototransistor, Photoconductors, Solar cells.

Text Books

1. S.M.Sze, "Physics of semiconductor devices”, Wiley Eastern, 2nd edition, 1991.
2. A.G.Milnes, "Semiconductor devices and Integrated electronics”,Van Nostrand Reinhold co., 1980.

Reference Books

1. Michael Shur, "Physics of Semiconductor Devices”, Prentice Hall of India, 1995.
2. Giuseppe Massobrio & Paolo Antognethi,”Semiconductor Device Modeling with SPICE”, Mc Graw Hill, Inc.2nd edition , 1993.

EC311 VLSI DESIGN LAB

Credit: 0:0:2
Marks: 50 + 50

1. Design and testing of Flip-Flops
2. Design and testing of Registers
3. Design and testing of memory units
4. Design and testing of circuits for combinational logic circuits
5. Design and testing of programmable logic arrays

6. Design and testing of 8 bit ALU
7. Design and testing of Adders and Multipliers
8. Design and testing of parity generator
9. Design and testing of counters
10. Design and testing of A/D and D/A converters

EC312 – ADVANCED DIGITAL SYSTEM DESIGN

Credit: 4 : 0 : 0
Marks: 40 + 60

UNIT – I: Advanced Topics In Boolean Algebra
Shannon's expansion theorem, Conseusus theorem, Octal Designation, Run measure, INHIBIT / INCLUSION / AOI / Driver / Buffer Gates, Gate Expander, Reed Muller Expansion, Synthesis of multiple output combinational logic circuits by product map method, Design of static hazard free and dynamic hazard free logic circuits.

UNIT – II: Threshold Logic
Linear seperability, Unateness, Physical implementation, Dual comparability, Reduced functions, Various theorems in threshold logic, Synthesis of single gate and multigate threshold Network.

UNIT – III: Symmetric Functions
Elementary symmetric functions, Partially symmetric and totally symmetric functions, Mc Cluskey decomposition method, Unity ratio symmetric ratio functions, Synthesis of symmetric function by contact networks.

UNIT – IV: Sequential Logic Circuits
Mealy machine, Moore machine, Trivial / Reversible / Isomorphic sequential machines, State diagrams, State table minimization, Incompletely specified sequential machines, State assignments, Design of synchronous and asynchronous sequential logic circuits working in the fundamental mode and pulse mode, Essential hazards Unger's theorem.

UNIT – V: Programmable Logic Devices
Basic concepts, Programming technologies, Programmable Logic Element (PLE), Programmable Logic Array (PLA), Programmable Array Logic (PAL), Structure of standard PLD's, Complex PLD's (CPLD). Design of combinational and sequential circuits using PLD's.
Type of FPGA – Xilinx XC3000 series – Logic Cell Array (LCA) – Configurable Logic Blocks (CLB) Input/Output Blocks (I/OB) – Programmable Interconnection Points (PIP) – Introduction to ACT 2 family and Xilinx XC4000 families – Design examples.

References
1. William I. Fletcher, "An Engineering Approach to Digital Design", Prentice Hall of India, 1996.

2. James E. Palmer, David E. Perlman, “Introduction to Digital Systems”, Tata McGraw Hill, 1996.
3. N.N. Biswas, “Logic Design Theory”, Prentice Hall of India, 1993.
4. S. Devadas A. Ghosh and K. Keutzer, “Logic Synthesis”, McGraw Hill, 1994.

EC313 – INTRODUCTION TO VLSI DESIGN

Credit: 4 : 0 : 0
Marks: 40 + 60

UNIT – I: MOS Technology And Circuits
MOS Technology and VLSI - Process parameters and considerations for BJT, MOS and CMOS- Electrical properties of MOS circuits and Device modeling.

UNIT – II: MOS Circuit Design Process
MOS Layers- Stick diagram- Layout diagram- Propagation delays- Examples of combinational logic design - Sealing of MOS circuits.

UNIT – III: Digital Circuits And Systems
Programmable Logic Array (PLA) and Finite State Machines-Design of ALU - Memories and Registers.

UNIT – IV: Analog VLSI and High Speed VLSI
Introduction to Analog VLSI- Realization of Neural Networks and Switched Capacitor filters- Sub-micron Technology and GaAs VLSI Technology.

UNIT – V: Hardware Description Languages
VHDL background and basic concepts- Structural specifications of hardware design organization and parameterization.

References
1. Douglas A. Pucknell and Kamran Eshraghian, Basic VLSI Design Systems and Circuits, Prentice Hall of India Pvt. Ltd., 1993.
2. Wayne Wolf, Modern VLSI Design, 2nd Ed., Prentice Hall, 1998.
3. Amar Mukherjee, Introduction to NMOS and CMOS VLSI System Design, Prentice Hall, 1986.
4. Randall L. Geiger and P.E. Allen, VLSI Design Techniques for Analog and Digital Circuits, McGraw Hill International Company, 1990.
5. Fabricious. E, Introduction to VLSI Design, McGraw Hill, 1990.
6. Navabi. Z, VHDL Analysis and Modeling of Digital Systems, McGraw Hill, 1993.
7. Mohmmed Ismail and Terri Fiez, Analog VLSI Signal and Information Processing, McGraw Hill, 1994.
8. Peter J. Ashenden, The Designer’s Guide to VHDL, Harcourt Asia Private Limited & Morgan Kaufman, 1996.

EC314 – DIGITAL CONTROL ENGINEERING

Credit: 3 : 1 : 0
Marks: 40 + 60

UNIT – I: Principles Of Controllers

Review of frequency and time response analysis and specifications of control systems- need for controllers- continuous time compensations- continuous time PI, PD, PID controllers- digital PID controllers.

UNIT – II: Signal Procesing In Digital Control

Sampling- time and frequency domain description- aliasing- hold operation- mathematical model of sample and hold- zero and first order hold-factors limiting the choice of sampling rate- reconstruction.

UNIT – III: Modeling and Analysis Of Sampled Data Control Systems

Difference equation description- Z-transform method of description- pulse transfer function- time and frequency response of discrete time control systems- stability of digital control systems- Jury's stability test- state variable concepts- first companion, second companion- Jordan canonical models- discrete state variable models- elementary principles.

UNIT – IV: Design Of Digital Control Algorithms

Review of principle of compensator design- Z-plane specifications- digital compensator design using frequency response plots- discrete integrator- discrete differentiator- development of digital PID controller- transfer function- design in the Z-plane.

UNIT – V: Practical Aspects Of Digital Control Algorithms

Algorithm development of PID control algorithms- software implementation- implementation using microprocessors and Microcontrollers- finite word length effects- choice of data acquisition systems- Microcontrollers and Microcontroller based temperature control systems- Microcontroller based motor speed control systems.

Text Books

1. M. Gopal, "Digital Control and Static Variable Methods", Tata McGraw Hill, New Delhi, 1997.

Reference Books

1. John J. D'Azzo, Constantine Houpios, Linear Control System Analysis and Design, McGraw Hill, 1995.
2. Kenneth J. Ayala, The 8051 Microcontrollers – Architecture, Programming and Applications, Penram International, 2nd Edition, 1996.

EC315 – DIGITAL IMAGE PROCESSING

Credit: 3 : 0 : 0
Marks: 40 + 60

UNIT – I: Continuous and Discrete Images and Systems
Light, Luminance, Brightness and Contrast, Eye, The Monochrome Vision Model, Image Processing Problems and Applications, Vision Camera, Digital Processing System, 2-D Sampling Theory, Aliasing, Image Quantization, Lloyd Max Quantizer, Dither, Color Images, Linear Systems and Shift Invariance, Fourier Transform, Z-Transform, Matrix Theory Results, Block Matrices and Kronecker Products.

UNIT – II: Image Transforms
2-D orthogonal and Unitary transforms, 1-D and 2-D DFT, Cosine, Sine, Walsh, Hadamard, Haar, Slant, Karhunen-loeve, Singular value Decomposition transforms.

UNIT – III: Image Enhancement
Point operations – contrast stretching, clipping and thresholding density slicing, Histogram equalization, modification and specification, spatial operations – spatial averaging, low pass, high pass, band pass filtering, direction smoothing, medium filtering, generalized spectrum and homomorphic filtering, edge enhancement using 2-D IIR and FIR filters, color image enhancement.

UNIT – IV: Image Restoration
Image observation models, sources of degradation, inverse and Wiener filtering, geometric mean filter, non linear filters, smoothing filters and interpolation, constrained least squares restoration.

UNIT – V: Image Data Compression And Image Reconstruction From Projections
Image data rates, pixel coding, predictive techniques transform coding and vector DPCM, Block truncation coding, wavelet transform coding of images, color image coding. Random transform, back projection operator, inverse random transform, back projection algorithm, fan beam and algebraic restoration techniques.

Reference Books

1. Anil K. Jain, "Fundamentals of Digital Image Processing", PHI 1995.
2. M.A. Said Ahmed, "Image Processing", McGraw Hill, Inc., 1995.
3. R. Gonzalaz and P. Wintz, "Digital Image Processing", Addition Wesley 2nd Ed., 1987.
4. William K. Pratt, "Digital Image Processing", Willey Interscience, 2nd Ed., 1991.

EC316 – ANALYSIS AND DESIGN OF ANALOG INTEGRATED CIRCUITS

Credit: 4 : 0 : 0
Marks: 40 + 60

Unit – I: Circuit Configuration For Linear IC
Current sources, analysis of difference amplifiers with active load, supply and temperature independent biasing techniques, voltage references.

Unit – II: Operational Amplifiers
Analysis of Operational amplifier circuits, slew rate model and high frequency analysis, operational amplifier noise analysis and low noise operational amplifiers.

Unit – III: Analog Multiplier And PLL
Analysis of four quadrant and variable transconductance multiplier, voltage controlled oscillator, closed loop analysis of PLL.

Unit – IV: MOS Analog ICs
Design of MOS Operational Amplifier, CMOS voltage references, MOS Power amplifier and analog switches.

Unit – V: MOS Switched Capacitor Filters
Design techniques for switched capacitor filter, CMOS switched capacitor filters, MOS integrated active RC Filters.

Reference Books

1. Gray and Meyer, "Analysis and Design of Analog ICs", Wiley International, 1996.
2. Gray, Wooley and Brodersen, "Analog MOS Integrated Circuits", IEEE Press, 1989.
3. Kenneth R. Laker, Willey M.C. Sansen and William M.C. Sansen, "Design of Analog Integrated Circuits and Systems", McGraw Hill, 1994.
4. Behzad Razavi, "Principles of Data Conversion System Design", S. Chand & Company Ltd., 2000.

EC317 – SOFT COMPUTING

Credit: 4 : 0 : 0
Marks: 40 + 60

Unit – I: Artificial Neural Networks
Basic concepts – Single layer perception – Multilayer Perception – Supervised and Unsupervised learning – Back propagation networks – Kohonen's self organizing networks – Hopfield network.

Unit – II: Fuzzy Systems
Fuzzy sets and Fuzzy reasoning – Fuzzy matrices – Fuzzy functions – Decomposition - Fuzzy automata and languages – Fuzzy control methods – Fuzzy decision making.

Unit – III : Neuro – Fuzzy Modeling

Adaptive networks based Fuzzy interface systems – Classification and Regression Trees – Data clustering algorithms – Rule based structure identification – Neuro–Fuzzy Controls – Simulated Annealing – Evolutionary Computation.

Unit – IV: Genetic Algorithms

Survival of the Fittest – Fitness Computations – Cross over – Mutation – Reproduction – Rank method – Rank space method.

Unit – V: Softcomputing And Conventional AI

AI search algorithm – Predicate calculus – Rules of interference – Semantic networks – Frames – Objects – Hybrid models – Applications.

Reference Books

1. Jang J.S.R, Sun C.T and Mizutani. E, "Neuro-Fuzzy and Soft Computing", Prentice hall 1998.
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill 1997.
3. Laurene Fausett, "Fundamentals of Neural Networks", Prentice Hall, 1994.
4. George. J Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic", Prentice Hall, USA 1995.
5. Nih J. Nelson, "Artificial Intelligence – A New Synthesis", Harcourt Asia Ltd., 1998.
6. D.E. Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley. N.J, 1989.

EC318 - LOW POWER VLSI DESIGN

Credit: 3 : 0 : 0
Marks: 40 + 60

UNIT-I

Introduction - Simulation - Power Analysis-Probabilistic Power Analysis.

UNIT-II

Circuit -Logic - Special Techniques - Architecture and Systems.

UNIT-III

Advanced Techniques - Low Power CMOS VLSI Design - Physics of Power Dissipation in CMOS FET Devices.

UNIT-IV

Power Estimation - Synthesis for Low Power - Design and Test of Low Voltages - CMOS Circuits.

UNIT-V

Low Power Static RAM Architectures -Low Energy Computing Using Energy Recovery Techniques –Software Design for Low Power.

Text Books

1. Gary Yeap "Practical Low Power Digital VLSI Design", 1997.
2. Kaushik Roy, Sharat Prasad, "Low Power CMOS VLSI Circuit Design", 2000.

EC319 – DIGITAL COMMUNICATION

Credit: 4 : 0 : 0
Marks: 40 + 60

Unit – I: Random Process And Noise

Random variable – Random Process – Stationarity – Ergodicity – Mean, Correlation and Convariance Function – Power Spectral Density – Transmission of the Random Process through a Linear Filter; Noise in Communication Systems.

Unit – II: Waveform Quantization & Coding

Sampling – Band Pass Sampling – PCM – Quantization noise – Logarithmic Companding – Differential Pulse Code Modulation (DPCM) – Delta Modulation (DM) – ADPCM & ADM.

Unit – III: Information Theory & Coding

Entropy – Mutual Information Channel Capacity – Hartley – Shannon Law – Source Coding – Channel coding – Block codes – Cyclic codes – Convolutional codes, Coded modulation techniques.

Unit – IV: Digital Signaling Schemes

Base-band Signaling – ISI Channel Equalization – Duobinary Signaling – Mary System – Band Pass Signaling – Correlation & Matched Filter – Coherent binary ASK, PSK & FSK – QPSK & MSK.

Unit – V: System Design Issues

Synchronization Technique: Bit synchronization – Scramblers – PN Sequence Generators – Frame Synchronization.

MA Techniques: Introduction – Capacity of Multiple Access methods - Code division multiple access – Random access methods.

Reference Books

1. Haykin. S, "Communication System", Third Edition, John Wiley & Sons, 1995.
2. Sklar. B, "Digital Communication Fundamentals and Applications", Prentice Hall, II Edn, 2001.
3. Proakis J.G., "Digital Communication", 4th Edn., McGraw Hill Higher Education, 2000.
4. L.W. Couch, "Digital and Analog Communication Systems", Prentice Hall, V Edn., 1996.

5. Benede Ho. S., Biglieri E., “Principles of Digital Transmission: With Wireless Applications”, Planum Series in Telecommunication, 1999.
6. Bruce Carlson. A, “Communication Systems”, 3rd Edn., Tata McGraw ill, 1986.

EC320 - MEDICAL SYSTEMS AND SIGNAL PROCESSING

Credit: 4 : 0 : 0
Marks: 40 + 60

Unit – I: Electro Physiology
Medical terminology – Electrical activity of nerve and muscle cells-ion pumps – membrane potential – An electrical model for the source of internal cell potential Resting – Resting and action potentials – propagation of Action potentials – The bioelectric potentials.

Unit – II: Cardio Pulmonary Physiology
Electrical basis of cardiac activities – Cardiac muscle and conduction system – Electrical potential on surfaces – projections of cardiac vector – Frontal plane projections – Unipolar chest leads – Electrical axis of the hear – Vector cardiography – ECG waveform and related heart action.

Unit – III: Neurophysiology
The anatomy of nervous system – The Neuron – Neuronal communication – ionic environment of neuron – Neuronal Receptors – Central and peripheral nervous system – EEG – Evoked potential – Electrical activity in muscular system – EMG.

Unit – IV: Signal Classification And Recognition
Statistical Signal Classification - Linear Discriminated Function – Direct Feature Selection and Ordering.

Unit – V: Adaptive Filtering, Wavelet Detection & Applications
Least Mean Square Adaptive Filtering – Adaptive Noise canceling – Contour Limiting Matched Filtering – Adaptive Wavelet detector – applications.

References
1. Cromwell. L, “Biomedical Instrumentation and Measurements”, Prentice Hall of India, 1995.
2. Jacabson. B, Webster J.G., “Medicine and Clinical Engineering”, Prentice hall of India, 1979.
3. Khandpur R.S., “Handbook of Biomedical Instrumentation”, Tata McGraw Hill, 1999.
4. Cohen A., “Bio-Medical Signal Processing”, Vol. I and II, CRC Press Inc., Florida, 1988.
5. Windrow B. and Steam S.D., “Adaptive Signal Processing”, Prentice Hall, 1985.

EC321 - SATELLITE AND MOBILE COMMUNICATION SYSTEMS

Credit: 4 : 0 : 0
Marks: 40 + 60

Unit – I: Elements of Satellite Communication
Satellite systems, Orbital description and Orbital mechanics of LEO, MEO and GSO, Placement of a satellite in a GSO, Satellite – description of different Communicaion Subsystems, Bandwidth allocation.

Unit – II: Transmission, Multiplexing, Modulation, Multiple Access And Coding
Different modulation and multiplexing schemes, Multiple Access Techniques – FDMA, TDMA, CDMA and DAMA, coding Schemes.

Unit – III: Satellite Link Design
Basic link analysis, Interference analysis, Rain induced attenuation and interference, Ionospheric characteristics, Link Design with and without frequency reuse.

Unit – IV: Mobile Communication Systems
Cellular engineering concepts, Mobile radio environment – propagation losses and multipath fading, Frequency Management and Channel Assignment, Co-channel Interference and Handoff.

Unit – V: Case Studies
GPS Satellite Scheme, Mobile Communication Standards – GSM, WCDMA and PCS.

References

1. Wilbur L. Pritchard and Joseph A. Sciulli, “Satellite Communication Systems engineering”, Prentice Hall, New Jersey, 1986.
2. Timothy Pratt and Charles W. Bostian, “Satellite Communications”, John Wiley and Sons, 1986.
3. Tri T Ha, “Digital Satellite Communication”, Macmillan Publishing Company, 1986.
4. William C.Y. Lee, “Mobile Cellular Telecommunications, Analog and Digital Systems” , 2nd Ed., McGraw Hill Book Co., Singapore, 1995.
5. Michel Mouly and Marie Bernadette Pautet, “The GSM System for Mobile Communications, Cell and Systems”, France 1992.
6. Scott D. Elliot and Daniel J., Dailey, “Wireless Communicationss for Intelligent Transportation Systems”, Artech House Inc. 1995.
7. Gunther C.G., “Mobile Communications: Advanced Systems and Components Springer – Verlag, 1994.

EC322 - COMPUTER NETWORKING AND ATM

Credit: 3 : 2 : 0
Marks: 40 + 60

Unit – I: Introduction
Protocol Architecture – Protocols-OSI/TCP/IP. LAN Architecture – Topologies – MAC – Ethernet, Fast Ethernet, Token ring, FDDI, Wireless LANs – Bridges.

Unit – II: Network Layer
Switching concepts – Circuit switching networks – Packet switching – Routing – Congestion Control - X.25 – Internetworking concepts & Architectural model – IP – unreliable connectionless delivery – Datagrams – Routing IP datagrams – IPv4, IPv6, ARP, RARP, ICMP.

Unit – III: Transport Services And Applications
Reliable delivery service – Congestion control – connection establishment – Flow control - Transmission Control Protocol (TCP) – User Datagram Protocol (UDP) – Sessions & presentation aspects – DNS, Telnet, Rlogin, FTP, SMTP – WWW – Security – SNMP.

Unit – IV : Integrated Services Digital Network (ISDN)
Services- History of ISDN- Subscriber access to the ISDN: B channel, D channel, H channel, user interface –ISDN Layers – Broad band ISDN.

Unit –V: ATM Networks
Introduction – Protocol Architecture – Logical connections – Cells – Transmission of ATM cells – SONET – Connection setup – Routing, Switching, Signaling, ATM service categories – QOS parameters – Traffic and Congestion Control.

References

1. Stallings. W, “High Speed Networks TCP/IP and ATM Design Principles”, Prentice Hall of India, 1998.
2. Tanenbaum. A.S, “Computer Networks”, Prentice hall of India, III Edn., 1996.
3. Keiser, “Local Area Network”, Tata McGraw Hill, 1997.
4. Keshav. S, “An Engineering Approach to Computer Networking”, Addition-Wesley, 1999.
5. Stevens. R.W, “TCP/IP Illustrated Volume I – The Protocols”, Addison-Wesley, 1999.
6. Comer D.E., “Internetworking with TCP/IP volume I, Principles, Protocols and Architecture”, III Edn., Prentice Hall of India, 1999.
7. Uyless Black, “ATM: Vol 1 and 2” Prentice Hall PTR, 1999.
8. Behrouz A. Forouzan,” DataCommunication and Networking” 2nd Edn., Tata McGraw Hill, 2000.

DEPARTMENT

OF

ELECTRICAL SCIENCES

ADDITIONAL SUBJECTS

Code No	Subjects	Credits
EC235	Electron Devices and Circuits Lab	0:0:2
EC236	Measurements and Instrumentation	4:0:0
EC237	Measurements and Instrumentation Lab	0:0:2
EC238	Microprocessors and Applications	4:0:0
EC239	Microcontrollers and Applications	4:0:0
EC240	Microprocessors Lab	0:0:2
EC241	Microcontrollers Lab	0:0:2
EC242	Communication Theory and Systems	4:0:0
EC243	Transmission Lines and Antenna Systems	4:0:0
EC244	Microwave and Optical Communication Engineering	4:0:0
EC245	Digital Signal Processing	3:1:0
EC246	Digital Signal Processing Lab	0:0:2
EC247	Advanced Communication Lab	0:0:2
EC248	Embedded systems	4:0:0
EC249	Digital Communication	4:0:0
EC250	Digital System Design using VHDL	4:0:0
EC251	Satellite Communication	4:0:0
EC252	Digital Image Processing	4:0:0
EC254	Digital Design using VHDL Lab	0:0:2
EC255	VLSI Design	4:0:0
EC256	Neural Networks and Fuzzy Systems	4:0:0
EC257	Computer Communication	4:0:0
EC323	Advanced Digital System Design & Testing	4:0:0
EC324	Advanced VLSI Design	4:0:0
EC325	Analysis & Design of Analog Integrated Circuits	4:0:0
EC326	Embedded System Design	4:0:0
EC327	ASIC Design	4:0:0
EC328	Medical Electronics	4:0:0
EC329	Embedded System Lab	0:0:2
EC330	Statistical Digital Signal Processing	3:1:0
EC331	Digital System Design	3:1:0
EC332	CMOS VLSI Design	4:0:0
EC333	Advanced Computer Architecture	3:0:0
EC334	Analog VLSI Design	4:0:0
EC335	HDL Laboratory	0:0:2
EC336	Analysis & Design of Analog Integrated Circuits	4:0:0
EC337	VLSI Signal Processing	3:1:0
EC338	Low Power VLSI Design	3:0:0
EC339	Computer Aided VLSI Design	4:0:0
EC340	Simulation Laboratory	0:0:2
EC341	Advanced Communication Engineering	4:0:0

EC235 ELECTRON DEVICES AND CIRCUITS LAB

Credits: 0:0:2 **Marks: 50+50**

12 experiments will be notified by HOD from time to time

EC236 MEASUREMENTS AND INSTRUMENTATION

Credits 4:0:0 **Marks 40+60**

UNIT I : Transducers `

Measurements, Instrumentation, Errors in measurements, Calibration and standard, Classification and characteristics of Transducers, Digital, Electrical, Electronic Weighing System, AC / DC Bridge measurement and their applications

UNIT II : Signal Generator and Signal Analyzers `

A.F. Generator, Pulse Generator, AM/FM Signal generator, Function generator, Sweep frequency generator, wave analyzers, Spectrum Analyzers, Logic Analyzers, Distortion Analyzers.

UNIT III : Digital Instruments

Digital Voltmeters and Multimeters, Automation in Voltmeters, Accuracy of DVM, Guarding Techniques, frequency, period, time interval and pulsewidth measurements, automatic vector voltmeter**.**

UNIT IV : Data Display and Recording System

CRO, single beam, dual trace, double beam CRO, Digital storage and Analog storage Oscilloscope, sampling Oscilloscope, Power scope, Curve Tracer, Analog, Digital Recorders and Printers.

UNIT V : Computer Controlled Test System

Testing and Audio amplifier, Testing a Radio Receiver, Instrument used in Computer Controlled Instrumentation, Digital Control Description, Microprocessor based measurements, Case studies in Instrumentation.

Text Books

1. Rangan C.S., "Instrumentation Devices and Systems", Tata McGraw Hill, Second Edition, 1998.
2. W.D. Cooper, "Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, Third Edition, 1988.

References

1. Bouwels A.J., " Digital Instrumentation ", McGraw Hill, First Edition, 2002
2. Barney C., "Intelligent Instrumentation", Prentice Hall of India, First Edition 2002
3. Oliver and Cage, "Electronic Measurements and Instrumentation", McGraw Hill, Third Edition, 1999
4. Deobelin, "Measurements Systems Application and Design", McGraw Hill, Fifth Edition, 2004

EC237 MEASUREMENTS AND INSTRUMENTATION LAB

Credits: 0:0:2 **Marks 50+50**

12 Experiments will be notified by HOD from time to time

EC238 MICROPROCESSORS AND APPLICATIONS

Credit: 4:0:0 **Marks: 40+60**

UNIT I : 8085 Microprocessor
Organisation of 8085 microprocessor –Instruction set-Addressing modes- Assembly language programming-machine cycles-Read, Write – Interrupt acknowledge – Bus cycles – states – Wait state – HALT and HOLD state

UNIT II: 8086 Microprocessor
Organisation of 8086 microprocessor – memory segmentation – Addressing bytes and words – Address formation –Address modes in 8086 – Assembly language programming – minimum mode and maximum mode – Bus arbitration in minimum mode and maximum mode .

UNIT III: Microprocessor Interfacing Techniques
Microcomputer communication techniques and Interfacing - Methods of parallel data transfer - Programmable parallel ports-8255 PPI - Serial communication – Asynchronous Synchronous - 8251A Programmable communication interface -DMA -8237 -Programmable DMA Controller**.**

UNIT IV: Programmable Peripheral Devices
8259A Programmable interrupt controller - 8279 Programmable Keyboard/display interface - 8253 programmable interval timer - 8295 Printer Controller – 8275 CRT Controller

UNIT V : Interfacing Memory and I/O Devices and Microprocessor Applications
Memory interface - Input/Output Interface - -Keyboard/display interfacing -A/D and D/A interface - -Interfacing high power devices -applications -Temperature controller -Stepper motor controller – DC Motor Controller – Traffic light controller.

Text Books

1. Ramesh.S.Goankar “Microprocessor Architecture, Programming & Applications with 8085/8080a” – Penram International, Fifth Edition, 1999
2. D.V. Hall “Microprocessor and Interfacing Programming and Hardware”, McGraw Hill Publishing Company, 2nd Edition, 1990.

References

1. Yu.Cheng Liu & Glenn A Gibson, “Microcomputer System,8086/8088 Family” 2nd Edition, PHI, 2003

2. Ajit Pal “Microprocessor Principles And Applications”, Tata McGraw Hill, 1st Reprint, 2003
3. Avatar Singh And Walter A.Tribel “The 8088 and 8086 Microprocessor, Architecture, Software and Interface Techniques”, PHI, 1985.
4. Rafiquzzaman M., "Microprocessor Theory And Applications-Intel And Motorola", PHI, 2002

EC239 MICROCONTROLLERS AND APPLICATIONS

Credits 4:0:0 **Marks 40+60**

UNIT I: Intel 8051
Architecture of 8051 - Memory Organization – Register Banks-Bit addressable area – SFR area - Addressing Modes – Instruction Set - Programming examples.

UNIT II: MCS51 Family Features
8051 Interrupt Structure – Timer modules – Serial Features – Port Structure – Power Saving Modes - Comparison of 8031, 8051 and 8751.

UNIT III: Motorola 68HC11
68HC11 features – Different modes of operation and memory map – Functions of I/O ports in single chip and expanded multiplexed mode – Timer system of 68HC11 – Input capture, output compare and pulsed accumulator features of 68HC11.

UNIT IV: Interface Techniques
Serial peripheral and serial communication interface - Analog to digital conversion features – Watchdog timer feature.

UNIT V: PIC Microcontroller
CPU architecture – Timer – Interrupts – I/O port expansion – I^2C bus – A/D converter – Instruction set.
Typical applications: Stepper motor control – DC motor control – AC power control using any microcontroller mentioned above.

Text Books
1. “8- bit Embedded controllers”, Intel corporation,1990.
2. John B Peatman “Design with PIC Microcontrollers”, Pearson Education Asia, Singapore, 8th Edition, 2004
3. Kenneth J. Ayala, “The 8051 Microcontroller Architecture Programming and Applications”, Penram International, 2nd Edition, 2004

References
1. “16 – bit Embedded Controller Handbook”, Intel corporation,1989.
2. John B Peatman “ Design with Microcontrollers”, McGraw Hill, Singapore, 1st Edition, 1988.

EC240 MICROPROCESSORS LAB

Credits: 0:0:2 **Marks: 50+50**

12 Experiments will be notified by HOD from time to time

EC241 MICROCONTROLLERS LAB

Credits: 0:0:2 **Marks: 50+50**

12 Experiments will be notified by HOD from time to time

EC242 COMMUNICATION THEORY AND SYSTEMS

Credits: 4:0:0 **Marks: 40+60**

UNIT I: Base Band Signals and Systems
Introduction, Definition of communication, Communication system block diagram – Need for wireless communication – Need for modulation – General definition of modulation – Types of modulation. General concepts about base band signal and bandwidth of signals.

UNIT II: Analog Modulation Techniques
Amplitude Modulation: Introduction – Theory of Amplitude Modulation – AM power calculations – AM with a complex wave – Need for suppression of carriers – Suppressed carrier systems (DSB SC, SSB & VSB systems).
Angle Modulation: Theory of Frequency modulation, Mathematical analysis of FM and representation of FM – Spectra of FM signals – Narrow band FM and wide band FM.
Theory of PM, PM obtained from FM – Comparison of AM & FM, Comparison of PM & FM.

UNIT III: Modulation and Demodulation Techniques
Amplitude Modulation: Introduction – generation of AM signal – low level and high level modulation – square law diode modulation – AM in amplifier circuits – suppressed carrier AM generation (Balanced Modulator, Ring Modulator, Product Modulator)
AM Demodulation: Square law detector, envelope (or) diode detector – distortion in diode detectors – synchronous demodulation.
Frequency Modulation: Generation FM signal by Direct method (Varactor diode modulator) – Indirect generation of FM (Armstrong method, RC phase shift method).
FM Demodulation: Direct methods frequency demodulation (Travis detector, Balanced slope detector, Foster seeley discriminator, ratio detector, limiters), Indirect methods (Detection using PLL, zero crossing detector)

UNIT IV: AM & FM Transmitters and Receivers

AM Transmitter and Receiver: Allocation of frequency for various services- AM transmitters-block schematic- high level and low level transmitters- class C- R.F tuned amplifiers- frequency multiplier- SSB transmitters- ISB transmitters.

Tuned radio frequency receivers – Super heterodyne receiver- Basic elements of AM super heterodyne receiver: - RF amplifier, Classes of operation of RF amplifier, Image frequency rejection – frequency conversion – IF amplifier – tracking and alignment – merits and demerits of different receivers. Characteristics of Receivers.

FM Transmitter and Receivers: Block diagram of FM transmitter and methods of frequency stabilization – Armstrong FM transmitter system – Pre-emphasis.

Block diagram of FM receiver – De-emphasis – RF amplifier – AFC – Diversity reception techniques – Spurious response in receivers.

UNIT V : Noise

Noise and Interference-Thermal and Shot noise-Signal to Noise ratio - Noise figure - Noise temperature.

Noise in AM and FM: SSB-SC - calculation of output signal to noise ratio. DSBSC-calculation of output signal to noise ratio-figure of merit-frequency modulation-calculation of output signal to noise ratio-comparison of SNR with respect to AM and FM.

Text Books

1. Anokh Singh, “Principles of Communication Engineering” S.Chand Co., 2001
2. Roody & Coolen, “Electronic Communication”, PHI, 4^{th} Edition, 2003

References

1. Taub and Schilling – “Principles of Communication Systems”, Mc Graw Hill, 2^{nd} Edition, 25^{th} Reprint, 2003
2. G.Kennedy, “Electronic Communication Systems”, Mc Graw Hill, 4^{th} Edition, 8^{th} Reprint, 2003
3. Sam Shanmugam.K. "Digital and Analog Communication Systems", John Wiley & Sons, 1^{st} Edition, 1985
4. Carlson, “Communication Systems: An Introduction to Signals Noise in Electrical Communication”, Mc Graw Hill, 3^{rd} Edition, 1988

EC243 TRANSMISSION LINES AND ANTENNA SYSTEMS

Credits: 4:0:0 **Marks: 40+60**

UNIT-I: Transmission Line Theory & Parameters

Introduction to different types of transmission lines - Definition of line parameters, the transmission line - General Solution - Physical Significance of the equations - the infinite line - input impedance - loading of transmission line - waveform distortion - Distortion less transmission line - input and transfer impedance - Reflection phenomena - Line losses - Return loss - reflection loss - insertion loss.

UNIT-II: Transmission Line at Radio and Power Frequencies
Parameters of open wire line and Coaxial line at high frequencies; Line constants for dissipation less line - voltages and currents on dissipation less line - standing waves and standing wave ratio - input impedance of open and short circuited lines - power and impedance measurement on lines. Reflection losses on unmatched line - single and double stub matching - smith chart - problem solving using smith chart.

UNIT-III: Guided Waves and Wave Guides:
Waves between parallel planes, Characteristics of TE, TM and TEM waves, Attenuation in parallel plane guides, Rectangular & Circular wave guide - Excitation of modes.

UNIT-IV: Antenna Terminologies, Antenna Arrays and Propagation
Isotropic Radiator-Radiation pattern-Directivity-Gain-Radiation resistance - Effective aperture - Terminal impedance - Reciprocity theorem-Frii's formula.
Arrays of point sources (driven elements): - Array factor, directivity and beam width -Pattern Multiplication – Broad side array - End fire array.
Propagation: Sky wave and space wave and its characteristics.

UNIT-V: Types of Antenna
VLF and LF Transmitting Antennas: Grounded antennas - Beverage antenna. Medium Rrequency Antennas: Tower radiator. High Frequency Antennas: Half wave dipole - dipole antennas - long wire antennas - V and inverted V antennas – rhombic antenna - rhombic arrays - traveling wave antennas. Special Purpose Antennas: Yagi-Uda antenna - corner reflector - horn antenna-Helical antenna - slot antenna - discone antenna - log periodic antenna -parabolic reflector -Cassegrain feed - cheese feed - lens antennas - feed for lens antennas.

Text Books

1. John D.Ryder, "Networks, Lines and Fields", Prentice Hall of India, 2nd Edition, 2003
2. Prasad.K.D. "Antennas and Wave Propagation" Satya Prakasan, 3rd Edition, 1996.

References

1. Edward.C.Jordan And Keith.G.Balmain "Electromagnetic Waves And Radiating Systems' PHI, II Edition 1995
2. Terman F.E., "Electronic And Radio Engineering", Mcgraw Hill, 4th Edition, 1988
3. Kennedy.G. "Electronic Communication Systems". Mc Graw Hill, 3rd Edition, 1995.
4. Umesh Sinha, "Transmission Lines And Networks" Sathya Prakashan Publishers, 7th Edition, 2001
5. J.D. Kraus, 'Antennas', Mc Graw Hill Publication, 2nd Edition, Reprint, 2001

EC244 MICROWAVE AND OPTICAL COMMUNICATION ENGINEERING

Credit : 4 : 0 : 0 **Marks: 40 + 60**

UNIT I: Microwave Passive Devices
Review of electromagnetic theory on Transverse magnetic and electric waves in rectangular and circular wave-guides.
Passive microwave devices: Coaxial Connectors and Adapters, Wave guide Choke Flanges, Matched Terminations, Short Circuit Plunger, Rectangular to circular wave guide transition, Tuning screws, Wave guide Corners, Bends and Twists, Windows, Coaxial line to Wave guide Adapters, Coupling Loops and Coupling Aperture, Attenuators, Phase shifters, Wave guide Tees - E plane Tee, H plane Tee, Magic Tee and their applications, Isolators, Circulators, Directional couplers. Scattering matrix derivation for all components.

UNIT II: Microwave Vaccum Tube Devices
Introduction, Two cavity Klystron Amplifier – Mechanism and mode of Operation, Power output and Efficiency, Reflex Klystron Oscillator – Mechanism and mode of Operation, Modulation of Reflex Klystron; Applications, TWT amplifier, Principle of Operation gain and applications; Magnetron Oscillator – Hull cut-off voltage, Mechanism of Operation, Mode separation.

UNIT III : Microwave Solid State Devices and Measurement
Microwave diodes – Crystal diode, Schottky diode, Harmonic Mixer; PIN diode – Gunn diode – Mode of operation, Oscillator Circuit, TRAPAT, IMPATT and BARITT diodes, – Mechanism of Operation, Application as Oscillator and Amplifiers, Microwave transistors – Unipolar and Bipolar, Applications.
Power measurements – Low and High power measurement, Insertion loss and Attenuation measurement, VSWR measurement – Low and High VSWR, Impedance measurement. Frequency measurement.

UNIT IV : Optical Communication
Overview of optical communication - Need for optical communication – Comparison with the electrical communication - Optical Fiber light guides theory: Ray theory – Mode theory. Snell's law – Critical angle – Acceptance angle – Numerical Aperture. Types of fibers: Step and Graded index fibers. Wave propagation in multi mode and single mode optical fibers – Attenuation – dispersion – Polarization**.**

UNIT V : Optical Transmitters and Receivers
Optical sources and Transmitters: Review of Physical Electronics - Physics of light emission and amplification in semiconductors - LEDs - types of LEDs – principle of operation - Laser Diodes – working principle -Power launching and coupling - Numerical Aperture.
Optical Detectors and Receivers: Photo detectors - photodiodes - *pin* and Avalanche photo detectors - Photo detector requirements for optical communications - Mechanisms of photon detection – Quantum Efficiency - Detector responsively –Phototransistors.

Text Books

1. Samuel.Y.Liao, “Microwave Devices and Circuits”, Prentice Hall of India Pvt Ltd., 3rd Edition, 5th Reprinting, 2000
2. Keiser.G. "Optical Fiber Communications”, McGraw Hill, 3rd edition, 2000

References

1. Collin. R.E, “Foundation of Microwave Engineering”, McGraw-Hill, II Edition, 1992.
2. Annapurna Das, Sisir K. Das, “Microwave Engineering”, Tata McGraw-Hill Co., Ltd., 1st Edition, 1999. Reprint 2001.
3. Gower.J "Optical Communication Systems”, Prentice Hall, 2nd edition, 5th Reprint, 2001. John Senior “optical communications” Prentice Hall India.

EC245 DIGITAL SIGNAL PROCESSING

Credits: 3:1:0 **Marks: 40+60**

UNIT I: Introduction to DSP and Fourier Transform

Review of Discrete Time LTI Systems – Linear, circular and sectioned convolutions - DFS, DTFT, DFT – FFT computations using DIT and DIF algorithms - Time response and frequency response analysis of discrete time systems to standard input signals.

UNIT II: Finite Impulse Response Digital Filters

Symmetric and Antisymmetric FIR filters – Linear phase response and its implication – FIR filter design using window method – frequency sampling method – design of optimal linear phase FIR filters – realization structures of FIR filters – transversal and linear phase structures.

UNIT III: Infinite Impulse Response Digital Filters

Calculation of IIR coefficients using pole –zero placement method-Review of classical analog filters-Butterworth,Chebyshev and Elliptic filters–Transformation of analog filters into equivalent digital filters using impulse invariant method and Bilinear Z transform method-Realization stuctures of IIR filters-Direct,cascade,parallel forms

UNIT IV: Finite Word Length Effects

Representation of numbers in registers-ADC quantization noise-coefficient quantization error-Product quantization error –Limit cycles due to product round-off error, Round –off Noise reduction scheme-Addition over flow errors-Principle of scaling.

UNIT V: Special Topics in DSP And DSP Processors

Adaptive filtering – basic wiener filter theory – LMS adaptive algorithm – recursive least square algorithm. Introduction to general and special purpose hard ware for DSP – Harvard architecture –pipelining-Special instruction-Replication-Hardware digital filter - Texas Instruments TMS320C5416 – Instruction set of TMS320C5416 – Simple programs.

Text Books

1. John G. Proakis and Dimitris G.Manolakis, 'Digital Signal Processing, Algorithms and Applications', PHI of India Ltd., New Delhi, 3rd Edition, 2000.
2. Dinniz, 'Digital Signal Processing – A Computer based Approach', Cambridge Publications

References

1. Opeenheim and Schafer, 'Digital Time Signal Processing', Prentice Hall of India, Reprint, 2002
2. Emmanuel C. Ifeacher and Barrie W. Jervis, 'Digital Signal Processing – A Practical Approach', Addition – Wesley Longman Ltd., UK, 2nd 2004 Low Price Edition
3. Sanjit K.Mitra, 'Digital Signal Processing - A Computer Based Approach', Tata McGraw-Hill, New Delhi, 2nd Edition, 2001
4. Texas Instruments Manuel for TMS320C5416 Processor.

EC246 DIGITAL SIGNAL PROCESSING LABORATORY

Credits: 0:0:2 **Marks: 50+50**

12 experiments will be notified by HOD from time to time

EC247 ADVANCED COMMUNICATION LABORATORY

Credits: 0:0:2 **Marks: 50+50**

12 experiments will be notified by HOD from time to time

EC248 EMBEDDED SYSTEM

Credits: 4: 0: 0 **Marks: 40 +60**

UNIT I: Introduction to Embedded Systems

An Embedded System – Processor in the System – Other hardware units – Software embedded into a System – Exemplary Embedded Systems - Embedded System On Chip and in VLSI circuit

UNIT II : Real Time Systems

Introduction – Issues in Real time Computing – Structure of a Real Time System – Architecture of Real Time Systems – Performance measures for Real Time Systems – Properties of Performance Measures – Traditional Performance Measures - Performability – Cost Functions and Hard Deadlines – Estimating Program Runtimes

UNIT III : Real Time Operating Systems
Task and Task States, tasks and data, semaphores and shared Data Operating system Services- Application of Semaphores -Message queues-Timer Function-Events – Memory management – Real time and Embedded System Operating Systems - Interrupt Routines in RTOS Environment

UNIT IV : Programming Languages and Tools
Language features-Programming environments-Introduction to-assembler-compiler-cross compilers and Integrated Development Environment (IDE). Debugging strategies, Simulators, Emulators- RTOS Programming Tools : Micro C/ OS-II and VxWorks

UNIT V : Programming Concepts and Embedded Programming in C and C++
Software programming in Assembly Language and in High level language – C Program Elements – Queues – Stacks – lists and ordered lists – Embedded programming in C++

Text Books

1. W. Valvano ,Thomson Brroks,"Embedded Microcomputer Systems", Jonathan, 1st Edtion, 2002
2. Jane W.S. Liu, "Real Time Systems", Pearson International Edition, 1st Indian Reprint, 2001

References

1. C.M. Krishna, Kang G. Shin, "Real Time systems", McGraw Hill, 1st Edition, 1997.
2. Raj Kammaal, "Embedded System" McGraw Hill, 1st Edition, 2003.

EC249 DIGITAL COMMUNICATION

Credits: 4:0:0 **Marks: 40+60**

UNIT I : Sampling And Bandlimited Signalling
Review of Sampling Theorem, PAM and TDMA Principles, Quantization, PCM, DPCM and Delta Modulation – International standard (CCCIT, CEPT) Power Spectra of PAM signals - Inter symbol Interference - Ideal Nyquist channel - Raised cosine channels - Correlative coding and precoding.

UNIT II : Digital Modulation
Introduction - Binary phase shift keying - differential phase shift keying - differentially encoded PSK - Quadrature phase shift keying – M-ary PSK – quadrature amplitude shift keying - Binary frequency shift keying – similarity of BFSK and BPSK – M-ary FSK – Minimum shift keying – Duo binary encoding.

UNIT III : Data Transmission – Detection and Estimation
Base band signal receiver – Probability of error – Optimum filter – White noise: Matched filter – Probability of error of the matched filter – Coherent reception: Correlation – Phase-

shift Keying – Non-coherent detection of FSK – Differential PSK – Four phase PSK (QPSK)
.

UNIT IV : Information Theory and Coding

Discrete messages-amount of information-average information-entropy information rate-Shannon's theorem-capacity of gaussian channel-bandwidth-S/N trade off-coding-parity check bit coding-block codes coding and decoding probability of error with coding- - Convolution codes – Cyclic codes.

UNIT V : Spread Spectrum Systems

Psuedo Noise sequences, generation and correlation properties - direct sequence spread spectrum systems - Frequency Hop systems - processing gain - antijam and multipath performance.

Text Books

1. Taub and Schilling – "Principles of Communication Systems", Mc Graw Hill, 2nd Edition, 25th Reprint, 2003
2. Simon Haykins, "Digital Communications", John Wiley, 1st edition, Reprinted, 2004.

References

1. Harold kolimbinis "Digital Communication Systems" Prentice Hall India, Indian print, 2001
2. John.G.Proakis, 'Digital Communication', McGraw-Hill Inc., 4th edition, Malaysia, 2000
3. M.K.Simen, 'Digital Communication Techniques, Signal Design & Detection', Prentice Hall of India, Reprint, 2003
4. Leon.W.Couch II "Digital and Analog Communication", Pearson Education Asia, Indian print 2001.

EC250 DIGITAL SYSTEM DESIGN USING VHDL

Credit: 4 : 0 : 0 **Marks: 40 + 60**

UNIT I : Programmabl e Logic Devices

Introduction - Programming Technologies - Programmable Read only Memory (PROM or PLE) - Programmable Logic Array (PLA) - Programmable Array Logic (PAL).

System Design using PLD's: Design of Combinational and Sequential circuits using PLD's - Design of state machines using ASM chart - Minimal logic realization of ASM chart.

UNIT II : Programmed Logic

Introduction – Register transfer language (RTL) – RTL notations – Microprogrammed Controller – Designing of micro programmed controller – Preparing a Micro instruction – ROM simulation – Emulation – Bit sliced computers – Advanced Boolean expression language.

UNIT III : FPGA And CPLD

Semi custom and full custom IC design- Xilinx XC3000 series, Xilinx XC4000 series -Logic cell Array (LCA)-Configurable Logic block (CLB) - Input and output block (IOB) – Programmable Interconnection Point (PIP) – structure of PLD and Complex PLD – Altera 7000 series – Introduction to ACT2 family.

UNIT IV : Introduction to VHDL

Design flow process – Software tools – Data objects – Data types – Data operators – Entities and Architectures – Component declaration and instantiation.

UNIT V : Data Flow, Behavioral and Structural Modeling

Concurrent signal assignment – conditional signal assignment – selected signal assignment – concurrent and sequential statements – Data flow, Behavioral and Structural Modeling - Test bench - Examples – CPU – Traffic light controller.

Text Books

1. Palmer. J.E, Perlman. D.E, “Introduction to Digital Systems”, McGraw Hill Book Co., International Student Edn., 2001
2. Nelson. V.P, Nagale. N.T, Carroll. B.D and Irwin. J.D, “Digital Logic Circuit Analysis and Design”, Prentice Hall International Inc., New Jersy, 1995.

References

1. John V. Oldfield and Richard C. Dorf, “Field Programmable Gate Arrays: Reconfigurable Logic for Rapid Prototyping and Implementation of Digital Systems”, John Wiley, 1995.
2. Navabi. Z, “VHDL: Analysis and Modeling of Digital Systems”, Prentice Hall Inc., 2nd Edition, 1998
3. David Pellerin and Douglas Taylor, “VHDL Made Easy”, Prentice Hall Inc., 1997.
4. Bhutgani, “Digital Logic Design”, Prentice Hall International, Simon & Schuster (Asia) Pte., Ltd, 1996.

EC251 SATELLITE COMMUNICATION

Credits: 4:0:0 **Marks: 40+60**

UNIT I: Communication Satellite - Orbit and Description

Kepler’s laws- Orbital period and velocity – Azimuth and elevation - orbital patterns– Placement of satellite in a geo-stationary orbit – satellite description – transponder subsystem – Telemetry, Command and ranging subsystem – Attitude control and electrical power

UNIT II : Earth Station

Earth Station Transmitters, Receivers-antenna types – Gain and radiated power – Poynting loss – Noise temperature – G/T ratio – High power amplifiers – Redundancy configurations – Carrier & power combining – Low noise amplifiers – Redundancy configuration and non-linearity – Up converter & down converter – Conversion process – Monitoring& control

UNIT III : Satellite Link Analysis and Design

Basic link analysis – Interference analysis – Carrier to noise plus interference ratio – Terrestrial interference – Cross polarization interference – Adjacent channel and inter symbol interference – Rain Induced attenuation – Path diversity – Up link power control – Rain induced cross polarization interference – Satellite link design – Link without frequency reuse – Link design with frequency reuse.

UNIT IV : Multiple Access Techniques

Frequency Division multiple access (FDMA) – Time division multiple access (TDMA) and code division multiple access (CDMA) – SPADE – Performance comparison of various multiple access schemes**.**

UNIT V : Applications and Services

Very small aperture terminal (VSAT) networks – Technologies & configurations – Mobile satellite (MSAT) networks – Low orbital satellites – Domestic satellite systems-the INSAT System-International systems-INTELSAT / INMARSAT

Text Books

1. Tri. T. Ha, "Digital Satellite Communications", second edition, McGraw-Hill Publishing Co., 1990.
2. Wilbur L.Pritchard & Joseph A.Sciulli, "Satellite Communication Systems Engineering", Prentice Hall Inc, 2nd Edition, 1st Indian print, 2003

References

1. Timothy Pratt and Charles W. Bostian, "Satellite Communication", John Wiley and Sons, 1st edition, 1994
2. B.N. Agarwal, "Design of Geosynchronous Spacecraft", prentice Hall
3. D.Rody, "Satellite Communication", McGraw Hill, 1991.

EC252 DIGITAL IMAGE PROCESSING

Credits: 4:0:0 **Marks: 40+60**

UNIT I : Digital Image Fundamentals

Elements of a Digital Image Processing system – Structure of Human eye – Image formation and contrast sensitivity Sampling and Quantization – Neighbours of a pixel – Distance measures – Photographic film structure and exposure – Film characteristics – Linear scanner – Video camera – Image processing applications.

Image Transforms: Introduction to Fourier transform – DFT – Properties of two dimensional FT – Separability, Translation – Periodicity, Rotation, Average value – FFT algorithm – Walsh transform – Hadamard transform – Discrete Cosine transform.

UNIT II: Image Enhancement
Definition – Spatial domain methods – Frequency domain methods – Histogram modification technique – Neighbourhood averaging Media filtering – Lowpass filtering – Averaging of multiple images – Image sharpening by differentiation and high pass filtering.

UNIT III : Image Restoration
Definition – Degradation model –Discrete formulation – Circulant matrices – Block circulant matrices – Effect of diagonalization of circulant and block matrices – Unconstrained and constrained restorations – Inverse filtering – Wiener filter – Restoration in spatial domain.

UNIT IV: Image Encoding
Objective and subjective fidelity criteria – Basic encoding process – The mapping – The quantizer – The coder Differential encoding – Contour encoding – Run length encoding – Image encoding relative to fidelity criterion – Differential pulse code modulation.

UNIT V: Image Analysis and Computer Vision
Typical computer vision system – Image analysis techniques – Spatial feature extraction – Amplitude and Histogram features – Transform features – Edge detection – Gradient operators – Boundary extraction – Edge linking – Boundary representation – Boundary matching – Shape representation.

Text Books

1. Rafae,C.Gonzalez and Paul, Wintz., “Digital Image Processing”, Addison-Wesley Publishing Company, 5th edition, 2000
2. William, K.Pratt., “Digital Image Processing”, John Wiley and Sons, 3rd edition, 2002

References

1. Rosenfeld and Kak A.C., “Digital Image Processing”, Academic Press, 1979.
2. Anil K.Jain, “Fundamentals of Digital Image Processing”, Prentice Hall of India, 9th edition, Indian Reprint, 2002

EC254 DIGITAL DESIGN USING VHDL LAB

Credit: 0:0:2 **Marks: 50+50**

12 experiments will be notified by HOD from time to time

EC255 VLSI DESIGN

Credits: 4 : 0 : 0 **Marks: 40 + 60**

UNIT I : Overview of VLSI Design Methodology
VLSI Design Process – Arcitectural Design – Logical Design – Physical Design – Layout Styles – Full Custom Semi Custom Approaches – Overview of wafer fabrication – Wafer

processing – Silicon gate NMOS process – CMOS process – N well – P well – Twin Tub – Silicon On Insulator

UNIT II : Basic Electrical Properties of MOS And CMOS Circuits
NMOS and PMOS enhancement transistors – Threshold voltage – MOS device equations – Basic DC equations – Second order effect – Small signal AC characteristics – NMOS and CMOS inverter – Inverter delay – Pass Transistor – Transmission gate

UNIT III : Layout Design Rules
Need for design rules – Mead Conway design rules for the Silicon gate NMOS process-CMOS N well / P well design rules – Sheet resistance – Area Capacitance – Wiring Capacitance

UNIT IV : Logic Design
Switch logic- Gate Logic – Inverter – Two input NAND and NOR gate- Other forms of CMOS logic – Dynamic CMOS logic – Clocked CMOS logic – Prechared domino CMOS logic – Structure Design – Simple combinational logic design examples – Parity generator – Multiplexer – Clocked sequential circuits – 2 Phase clocking – Charge storage – Dynamic Register Element – NMOS and CMOS dynamic shift register

UNIT V : Sub System Design Process
Design of a 4 bit shifter – 4 bit arithmetic processor – ALU Subsystem – Implementing ALU functions with an Adder – Carry look ahead adders – Multipliers – Serial/ Parallel Multipliers – Pipelined multiplier array – Modified booths algorithm – high density memory – FSM – PLA Control Implementation

Text Books

1. Dougulas A Pucknell and Kamran Eshranghian, "Basic VLSI Design", PHI, 3rd Edition, 2004
2. Neil H E West and Kamran Eshranghian, "Principles of CMOS VLSI Design : A System Perspective", Addison Wesley, 2nd edition, 2002
3. Wayne Wolf, "Modern VLSI Design" – Pearson Education Inc., 1997

References

1. Amar Mukerjee, "Introduction to NMOS and CMOS VLSI System Design" PHI 1986
2. Caver Mead and Lynn Conway, "Introduction to VLSI Systems", Addison Wesley 1980

EC256 NEURAL NETWORKS AND FUZZY SYSTEMS

Credit: 4 : 0 : 0 **Marks: 40 + 60**

UNIT I : Fundamentals of Artificial Neural Network
Artificial neuron, Biological Neural networks, Applications, Typical architectures, Training, Common activation functions, Single layer net, Back Propogation neural net.

UNIT II: Neural Nets for Pattern Classification & Pattern Association
Hebb Net, Perceptron Adaline, Madaline , Hetroassociative Memory Neural Network, Autoassociative Net, Iterative Autoassociative Net, Bidirectional Associative Memory (BAM)-Architecture, Algorithm and Applications.

UNIT III: Neural Nets for Clustering
Fixed Weight Competitive Nets : Maxnet-Mexican Hat-Hamming Net, Kohonen Self organising Maps, Counter propogation, Adaptive Resonance Theory-Architecture, algorithm and application.

UNIT IV: Fundamentals of Fuzzy Logic
Fuzzy sets, Fuzzy Relations, Fuzzy Equivalence Relations, Membership functions, Defuzzification methods, Extension principle, Approximate Reasoning, Rule based systems, Fuzzy Associative Memories(FAMs)

UNIT V: Fuzzy Logic Applications
Fuzzy classification, Fuzzy Pattern Recognition, Fuzzy Control systems, Fuzzy image processing, Fuzzy optimization**.**

Text Books

1. Laurence Fausett, "Fundamentals of Neural Networks, Architecture, Algorithm and Applications", Prentice-Hall, Inc, 1994.
2. Timothy J.Ross, "Fuzzy Logic with Engineering Applications", Mc.Graw Hill International Editions, 1995**.**

References

1. Phillip D. Wasserman, "Neural Computing" theory and practice, Van Nostrand Reinhold, New York, 1989.
2. Kosko.B, "Neural Networks and Fuzzy Sytems" A Dynamic systems Approach to Machine Intelligence, Engle wood Cliffs, N.J.Prentice Hall, First Edition, 1992.
3. Jacek M. Zurada, "Introduction to Artificial Neural Networks", Jaico Publishing House, 1997.
4. George J. Klir and Bo Yuan, 'Fuzzy Sets and Fuzzy Logic – Theory and Applications', Printice Hall of India, 2002.
5. Limin Fu, 'Neural Networks in Computer Intelligence', McGraw Hill, 1994.

EC257 COMPUTER COMMUNICATION

Credits: 4:0:0 **Marks: 40+60**

UNIT I: Introduction
Computer Networks – A perspective – Goals – Applications – Switching techniques – Circuit switching –Message switching – Packet switching – Network components existing network – ARPANET – Concepts of network protocol – OSI reference model – Basics of Queuing theory – Queuing models – Poisson Statistics – M/M/1 queue.

UNIT II: Local Area Networks

Topologies – Star – Ring, Bus – Ethernet – Transmission media – LAN Access Techniques – Polling Contention – ALOHA – CSMA – CSMA/CD - Token Bus and Token Ring protocols – Delay throughput Characteristics – Token Ring and CSMA/CD Bus – performance.

UNIT III: Data Communication Techniques

Asynchronous and synchronous communication – BISYNC , SDLC , HDLC – x 2.5 protocols – Error control coding.

UNIT IV : Inter – Networking

Routing Algorithms – Congestion Control Algorithms – Internetworking – TCP/IP - IP Protocol – IP Address.

UNIT V: Broadband Networks

ISDN – User Access – Transmission structure - ISDN Protocol – Limitations – B – ISDN – ATM concepts and principles – Introduction to VSAT networks.

Text Books

1. Tannenbaum., "Computer Networks", Prentice Hall India, 4th Edition, 2003
2. Forouzan, "Introduction to Data Communication and Networking", TMH, 1998

References

1. William, Stallings, "Data and Computer Communication", Prentice Hall India, 7th edition, 2003
2. Keiser, G.E., "Local Area Networks", Galgotia Publications, 2nd edition, 2002
3. Basandra S.K. "Local Area Networks", Galgotia Publications, 5th edition, 2000
4. Vijay, Ahuja, "Design and Analysis of Computer Communication Networks", McGraw Hill, 3rd edition
5. Uyless, Black., "Computer Networks, Protocols, Standards and Interfaces", Prentice Hall, International Edition, 2nd edition, 2002

EC323 ADVANCED DIGITAL SYSTEM DESIGN AND TESTING

Credits: 4:0:0 **Marks: 40+60**

UNIT I: Programmable Logic Devices

Basic concepts, Programming techniques, Programmable Logic Element (PLE), Programmable Logic Array (PLA), Programmable Array Logic (PAL), Structure of Standard PLD's, Complex PLD's (CPLD), Altera Max-7000 Series. Design of combination and sequential circuits using PLD's.

Type of FPGA – Xilinx XC3000 Series – Logic Cell Array (LCA) – Configurable Logic Blocks (CLB) Input/Output Blocks (I/OB) – Programmable Interconnection Points (PIP) – Xilinx XC4000 families – Design examples.

UNIT II: Sequential Logic Circuits
Mealy machine, Moore machine, State diagrams, State table minimization, Incompletely speficied sequencial machines, State assignments, Design of synchronous and asynchronous sequencial logic circuits working in the fundamental mode and pulse mode.

UNIT III: Symmetric Functions
Elementory symmetric functions, Partially symmetric and totally symmetric functions, Mc Cluskey de-composition method, Synthesis of symmetric function by contact networks**.**

UNIT IV: Fault Testing in Digital Circuits
Detection and location of faults in combinational logic circuits – Path sensitizing method – Boolean difference method – Fault detection and location in synchronous sequential circuits – Fault equivalence – Fault dominance - Design for testability – Built-in-self-test.

UNIT V: Developing Test Pattern and Fault Simulation Techniques
Introduction – Test generation algorithms for combinational logic circuits – Fault table, D-algorithm, Sequential circuits – Random test vectors.
Series, Single-fault propagation, Deductive, Parallel and concurrent simulation**.**

Text Books

1. James E. Palmer & David E. Perlman, “Introduction to Digital Systems”, Tata McGraw Hill, 1996.
2. Bhutgani, “Digital Logic Design”, Prentice Hall International, Simon & Schuster (Asia) Ptd., Ltd, 1996.

References

1. Robert J. Feugate, Jr. Steven M.Mc/n tyre, “Introduction to VLSI Testing”, Prentice Hall, Englewood Cliffs, 1998.
2. M. Abramovici, M.A, Breuer and A.D. Friedman, “Digital Systems Testing and Testable Design”, Computer Sciences Press, 2nd Edition, 2002

EC324 ADVANCED VLSI DESIGN

Credits: 4 : 0 : 0 **Marks: 40 +60**

UNIT I: MOS Transistor Theory
MOS Transistors – MOS Transistor switches – CMOS Logic – Introduction – MOS Device Design equations – The Complementary CMOS Inverter – Pseudo NMOS Inverter – Differential Inverter – Transmission Gate – Tristate Inverter

UNIT II: CMOS Circuit and Logic Design and Design Methods
Layout design rules – Basic physical design of Simple Logic Gates – CMOS Logic Structures – Clocking Strategies – CMOS Design Strategies – Design methods – Design capture tools – Design verification tools

UNIT III: CMOS Testing
Need for testing – Manufacturing test principles – Design Strategies for test – chip level test techniques - System level test techniques.

UNIT IV: CMOS Subsystem Design
Subsystem design principles – Combinational shifters – Adders – Multipliers – High Density memory – Finite state machines – PLA Control Implementation – ROM Control Implementation

UNIT V: CMOS System Design Examples
A Core risk microcontroller – instruction set – pipeline architecture – major logic blocks – TV echo cancellor – system architecture – sub modules – 6 bit flash A/D converts.

Text Books
1. Neil.H.E.Weste, Kamran Eshraghian "Principles of CMOS VLSI Design" Pearson Education, Second Edition, 2002
2. Wayne Wolf, "Modern VLSI Design" Second Edition PHI, 1998

References
1. Douglas.A.Pucknell and Kamran Eshraghian "Basic VLSI Design Systems and Circuits" PHI, 3rd Edition, 2004
2. Jan M. Rabey"Digital Integrated Circuits: A Design Perspective", PHI, 1996

EC325 ANALYSIS & DESIGN OF ANALOG INTEGRATED CIRCUITS

Credit: 3 : 0 : 0 **Marks: 40 + 60**

UNIT I: Basic Building Blocks of Linear ICs
Types of current mirrors: Simple, Beta helper, Degeneration, Cascode, Wilson Active Loads: complementary, depletion, diode connected
Voltage References: Bipolar widlar, peaking, MOS widlar & peaking
Supply Insensitive Biasing: Widlar and other voltage standards.

UNIT II: Bipolar Operational Amplifiers
Analysis and design of OP. AMP: DC Analysis, small-signal analysis, offsets, CMRR
Analysis of Slew Rate: Limitations, methods, improvement in Bipolar and MOS
Frequency Response Models: Compensation techniques and Root Locus methods.

UNIT III: Analog Multipliers
Types of Analog Multipliers: Limitations, squared, logarithmic, PH/PW & Tran-conductance
Analysis and Design of Monolithic Multiplier Circuits: EC coupled pair, DC analysis of Gilbert Multiplier cell, complete analog multiplier.

UNIT IV: MOS Operational Amplifier
Analysis and design of OP. AMP: Resistances, voltage gain, CMRR, PSRR
MOS Power Amplifier: Class AB output stage, CD, CS and CD-CS Amplifier.

UNIT V: Phase Locked Loop
Basic principles and orders of PLL: Basic concepts and first and second orders
Analysis and Design of Monolithic PLLs: IC PLL, analysis of Monolithic PLL

Text Book

1. Gray and Meyer, "Analysis and Design of Analog ICs", Wiley International, 1996, First India Edition 2004.

Reference Books

2. Gray, Wooley and Brodersen, "Analog MOS Integrated Circuits", IEEE Press, 1st Edition, 2000
3. Kenneth R. Laker, Willey M.C. Sansen and William M.C. Sansen, "Design of Analog Integrated Circuits and Systems", McGraw Hill, 1st Edition, 1994.
4. Behzad Razavi, "Principles of Data Conversion System Design", S. Chand & Company Ltd., 2000.

EC326 EMBEDDED SYSTEM DESIGN

Credit: 4 : 0 : 0 **Marks: 40 + 60**

UNIT I: Introduction
An Embedded system, processors and other hardware units, software embedded in the system, Exemplary embedded systems, SOC and VLSI concepts

UNIT II: Embedded Organisation and Architecture
Processor and Memory Organization, Devices and Buses for device networks, Device drivers and Interrupts servicing Mechanisms.

UNIT III: Embedded Software Development Process
Modeling Processes for software Analysis, Response time constrained RT programs, Software Algorithms complexity, Software Analysis, Software Design, Software Testing, validating and Debugging, Software Project Management

UNIT IV: Real Time Operating Systems
I/O Subsystems, Network Operating systems, Interrupt Routines in RTOS Environment, Performance Metrics in Scheduling Models, IEEE Standards, Preemptive Scheduler, Embedded Internals, OS Security

UNIT V: Case Studies and Hardware-Software Co-Design
Case Studies in FOUR diverse applications, Embedded system design and co-design , Design cycle, ICE, Scopes and Logic Analysers, General issues in ES Design

Text Book

1. Raj Kamal, 'Embedded Systems, Architecture, Programming and Design', Tata McGraw-Hill, 2003

References

1. David.E.Simon, 'An Embedded Software Primer', Addison Wesley Longman 1999.
2. Arnold.S.Berger, 'Embedded Systems Design—An Introduction to Processes, Tools and Techniques', CMP Books 2001.
3. Frank Vahid and Tony Givaris, 'Embedded System—A Unified Hardware / Software Introduction', John Wiley and Sons, 2001.
4. John.B. Peatman, 'Design with PIC Micro Controllers', Pearson Education Asia, 2001.
5. Phillip.A. Lapalnte, 'Real Time Systems Design and Analysis - An Engineer's Handbook', Prentice Hall of India, 2000.
6. Jane W.S. Liu, 'Real Time Systems', Pearson Education (Indian Reprint 2001).

EC327 ASIC DESIGN

Credit: 4 : 0 : 0 **Marks: 40 + 60**

Unit I : Introduction to ASICS,CMOS Logic and ASIC Library Design

Types of ASICs – Design flow – CMOS Transistors - CMOS Design rules – Combinational Logic Cell – Sequential logic cell – Data path logic cell – Transistors as Resistors – Transistor Parasitic Capacitance – Logical effort.

Unit II : Programmable ASICS, Programmable Asic Logic Cells And Programmable ASIC I/O Cells

Anti fuse – static RAM – EPROM technology – Actel ACT – Xilinx LCA – Altera FLEX – Altera MAX-Xilinx I/Oblocks

Unit III : Programmble ASIC Interconnect, Programmable ASIC Design Sofware and Low Level Design Entry

Actel ACT – Xilinx LCA – Xilinx EPLD – Altera MAX 5000 and 7000 – Altera MAX 9000 – Altera FLEX – Design systems – Logic synthesis – Half gate ASIC – Schematic entry - Low level design language – PLA tools – EDIF – CFI design representation.

Unit IV : Simulation and Testing

Types of simulation – boundary scan test – fault simulation – automatic test pattern generation.

Unit V : ASIC Construction, Floorplanning, Placement and Routing

Partitioning methods – floor planning – placement – global routing –detailed routing- circuit extraction –DRC.

Text Book

1. M.J.S.Smith, "Application – Specific Integrated Circuits", Addison, Wesly Longman Inc., 1997.

References

1. Andrew Brown, "VLSI Circuits and Systems in Silicon", Mc Graw Hill, 1991.
2. S.D. Brown R.J. Francis, J.Rox, Z.G. Urumesic, "Field Programmable Gate Arrays", Kluver Academic Publishers, 1992.
3. Mohammed Ismail and Terri Fiez, "Analog VLSI Signal and Information Processing", Mc Graw Hill, 1994.
4. S.Y, Kung, H.J. Whilo House, T. Kailath, "VLSI and Modren Signal Processing", Prentice Hall, 1983.
5. Jose E. France, Yannis Tsividis, "Design of Analog – Digital VLSI Circuits for Telecommunication and Signal Processing", Prentice Hall, 1994.

EC328 MEDICAL ELECTRONICS

Credit: 4 : 0 : 0 **Marks: 40 + 60**

UNIT I: Physiology and Bio-Electric Concepts

Cell and its structure –Resting Potential - Action Potential – Bioelectric Potentials – Electrode Theory – Equivalent Circuit – Types – Design of Low Noise Medical Pre-amplifier – Isolation Amplifier – Chopper Amplifier – Electrical safety in Hospitals.

UNIT II : Body Potential Measurement

Electro Physiology of Heart – ECG – Physiology of Central Nerves System – EEG – Evoked Potential – Physiology of Eye – ERG – EMG.

UNIT III: Prosthesis

Heart Lung Machine – Kidney Machine – Nerve Stimulators – Centralized and Bedside Monitoring – Microprocessor based Ventilator.

UNIT IV: Blood Parameter Measurement

Measurement of Blood flow – Lung Volume – Cardiac output – Oxygen Saturation of Blood – Blood Cell Counters – Flame photometer.

UNIT V: Medical Imaging

Computer Tomography – NMR, Magnetic Resonance Imaging – Ultrasonic Imaging – Positron Emission Tomography – Computers in Medicine.

Text Book

1. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", Pearson Education Inc., 2001, Low Price Edition.

Reference Books

1. John G. Webstar, Medical Instrumentation Application and Design, John Wiley & Sons, Inc. 1999, ISBN 997151270-X.
2. Khandpur R.S., "Hand book of Biomedical Instrumentation", Tata McGraw Hill, 2000 ISBN 0074517252

EC329 EMBEDDED SYSTEM LABORATORY

Credit: 0:0:2 **Marks: 50+50**

12 experiments will be notified by HOD from time to time

EC330 STATISTICAL DIGITAL SIGNAL PROCESSING

Credits: 3:1:0 **Marks: 40+60**

UNIT – I : Discrete Random Signal Processing
Discrete Random Processes - Expectations – Variance - Co-Variance - Scalar Product - Energy of Discrete Signals - Parseval’s Theorem - Wiener Khintchine Relation-Power Spectral Density - Periodogram - Sample Autocorrelation - Sum Decomposition Theorem - Spectral Factorization Theorem - Discrete Random Signal Processing by Linear Systems-Simulation of White Noise -Low pass Filtering of White Noise.

UNIT – II: Spectrum Estimation
Non-Parametric Methods-Correlation Method-Co-Variance Estimator-Performance Analysis of Estimators - Unbiased - Consistent Estimators - Periodogram Estimators - Barlett Spectrum Estimation - Welch Estimation - Model based Approach - AR - MA - ARMA Signal Modeling-Parameter Estimation using Yule - Walker Method.

UNIT – III: Linear Estimation And Prediction
Maximum likelihood criterion - Efficiency of estimator - Least mean squared error criterion-Wiener filter - Discrete Wiener Hoff equations - Recursive estimators - Kalman filter - Linear Prediction - Prediction Error - Whitening filter - Inverse filter - Levinson recursion - Lattice realization and Levinson Recursion algorithm for solving Toeplitz System of equations.

UNIT – IV: Adaptive Filters
FIR adaptive filters - Newton’s steepest descent method - Adaptive filter based on steepest descent method - Windrow Hoff LMS adaptive algorithm - Adaptive channel equalization - Adaptive echo chancellor - Adaptive noise cancellation - RLS adaptive filters - Exponentially Weighted RLS - Sliding window RLS - Simplified IIR LMS Adaptive filter.

UNIT – V: Multirate Digital Signal Processing
Mathematical description of change of sampling rate-Interpolation and Decimation-continuous time model - Direct digital domain approach - Decimation by an integer factor - Interpolation by an integer factor - Single and multistage realization - Poly phase realization - Application to sub band coding - Wavelet transform and filter bank implementation of wavelet expansion of signals.

Text Books

1. Monson H.Hayes, “Statistical Digital Signal Processing and Modeling”, John Wiley and Sons Inc., New York, 1996.

References

1. John G.Proakis, Dimitris G.Manolakis, “Digital Signal Processing”, Prentice Hall of India, 1995.

EC331 DIGITAL SYSTEM DESIGN

Credits: 3:1:0 **Marks: 40+60**

UNIT – I: PROGRAMMABLE LOGIC DEVICES & FPGA

Basic concepts - Programming techniques - Programmable Logic Element (PLE) - Programmable Logic Array (PLA) - Programmable Array Logic (PAL) - Structure of Standard PLD’s - Design of combination and sequential circuits using PLD’s.

Type of FPGA – Xilinx XC3000 Series – Logic Cell Array (LCA) – Configurable Logic Blocks (CLB) Input/Output Blocks (I/OB) – Programmable Interconnects - CPLD-Altera Max 7000 Series – Introduction to Actel Act-1 Logic Module – Xilinx XC4000 Series.

UNIT – II: SEQUENTIAL LOGIC CIRCUITS

Mealy machine - Moore machine - State diagrams - State table minimization - Incompletely specified sequential machines - State assignments - Design of synchronous and asynchronous sequential logic circuits working in the fundamental mode and pulse mode.

UNIT – III: SYMMETRIC FUNCTIONS

Elementary symmetric functions - Partially symmetric and totally symmetric functions - Mc Cluskey de-composition method - Synthesis of symmetric function by contact networks.

UNIT – IV: INTRODUCTION TO VHDL

Entity - Architecture - Data Types Variables – Signals – Constants – Arrays – Operators – Functions – Procedures – Packages – Libraries – Attributes – Operator Overloading – Generics – Modeling Delays - Modeling Synchronous Logic And State Machine Modeling.

UNIT – V: Introduction to VERILOG

Design methodology – Modules – Ports – Basic concepts – Operators – Nos. specification – Data types – Arrays – Parameters – Gate delays – Operator types – Conditional statements – Multiway branches - Loops - Switch – Modeling elements.

Text Books

1. Charles H. Roth, Jr., “Digital System Design using VHDL”, PWS Publishing Co., 2001.

References

1. A.P. Godse, D.A. Godse, “Digital Systems”, Technical Publications, Pune, 2003.
2. Samir Palnitkar, “Verilog HDL”, Pearson Publication, II Edn., 2003.
3. J. Bhaskar, “A VHDL Synthesis Primer”, BS Publications, III Edn., 2004.

EC332 CMOS VLSI DESIGN

Credits: 4:0:0 **Marks: 40+60**

UNIT – I: Introduction to CMOS Circuits
MOS Transistors - MOS Transistor Switches - CMOS Logic - Circuit and System Representations - MOS Transistor Theory - Introduction MOS Device Design Equations - The Complementary CMOS inverter - DC Characteristics - Static Load Inverters - The Differential Inverter - The Transmission Gate - The Tri state Inverter - Bipolar Devices.

UNIT – II: Circuit Characterization and Performance Estimation
Introduction Resistance Estimation Capacitance Estimation - Inductance - Switching characteristics CMOS - Gate Transistor sizing - power Dissipation - Sizing Routing Conductors - Charge Sharing - Design Margining - Reliability.

UNIT – III: CMOS Circuit and Logic Design
CMOS Logic Design - Basic Physical Design of Simple Gate - CMOS Logic Structures Clocking Strategies - I/0 Structures - Low Power design.

UNIT – IV: Systems Design and Design Method
Design Strategies CMOS Chip Design Options - Design Methods - Design Capture Tools - Design Verification Tools - Design Economics - Data Sheet - CMOS Testing-Manufacturing Test Principles - Design Strategies for Test - Chip Level Test Techniques - System Level Test Techniques - Layout Design for Improved Testability.

UNIT – V: CMOS Sub System Design
Data Path Operations-Addition/Subraction - Parity Generators - Comparators - Zero/One Detectors - Binary Counters - ALUs - Multiplication - Shifters - Memory Elements - Control- FSM - Control Logic Implementation.

Text Books

1. Nell H.E. Weste and Kamran Eshraghian, “Principles of CMOS VLSI Design”, Pearson Education India, 5th Indian Reprint 2001.

References

1. Wayne Wolf, “Modern VLSI Design System – On-chip Design”, Pearson Education First Indian Reprint 2002.

EC333 ADVANCED COMPUTER ARCHITECTURE

Credits: 3:0:0 **Marks: 40+60**

Unit – I: Parallel Computer Models
Evolution of computer architecture – system attributes to performance – Multiprocessors and Multi computers – Multivector and SIMD computers _ PRAM and VLSI models –

Parallelism in programming – conditions for parallelism – Program Portioning and Scheduling – Program Flow mechanisms.
Performance metrics and measures – Speedup performance laws – Memory bounded speedup model – Scalability metric and goals.

Unit – II: Memory Systems
Memory hierarchy – virtual storage systems – Bus - Cache and shared memory concepts – Back plane bus system – Cache coherence and synchronization – shared memory organizations.

Unit – III : Advanced Processors
Instruction set architectures – CISC scalar processor – RISC scalar processors – Super scalar Processors – VLIW architecture – Multi-vector and SIMD computers – Vector processing principles – Memory access schemes – Cray Y – MP 816 system – SIMD computer – Models – Inter processor communication.

Unit – IV: Multiprocessors And Multicomputers
Multiprocessor system interconnects – Hotspot problem – Cache coherence and synchronization mechanisms – Message passing mechanisms.
Pipelined processors – Linear Pipeline – Non-linear pipeline - Instruction Pipeline Design – Arithmetic pipeline design architectures.

Unit – V: Multithreaded and Dataflow Computers
Principles of multithreading – Issues – Multiple context processors – Multidimensional architectures – Data flow architectures – Scalable and multithreaded systems.

Text Books
1. K. Hwang and F.A. Briggs, 'Computer Architecture and Parallel Processors', McGraw Hill, N.Y, 1999.

References
1. William Stallings, "Computer Organization and Architecture", Pearson Education India, 6th Edn., 2002.
2. KAI. Hwang, ' Advanced Computer Architecture Parallelism, Scalability, Programmability', McGraw Hill, New York, 1993.

EC334 ANALOG VLSI DESIGN

Credits: 4:0:0 **Marks: 40+60**

UNIT – I: VLSI Technology
Introduction – IC production process – Semiconductor processes – Design rules and process parameters – Layout techniques and practical considerations.

UNIT – II: Device Modeling & Circuit Simulation
Modeling – MOS models – Diode models – Bipolar models – Passive component models – Circuit simulation using SPICE – MOSFET model – Diode model – BJT model.

UNIT – III: Analog Systems
Analog signal processing – Digital–to–analog–converters – Analog-to-digital-converters – Continuous Time filters – Switched capacitor filters – Analog signal processing Circuits.

UNIT – IV: Design Automation and Verification
Integrated Circuit layout – Symbolic circuit representation – Computer check plots – Design rule checks – Circuit extraction – Digital circuit simulation – Logic and switch simulation – Timing analysis – Register-transfer-level simulation.

UNIT – V: Statistical Modeling and Simulation, Analog Computer Aided Design and Analog and Mixed Analog Digital Layout
Review of Statistical Concepts – Statistical Device Modeling – Statistical Circuit Simulation – Automation Analog Circuit Design – Automatic Analog Layout – CMOS Transistor Layout – Resistor Layout - Capacitor Layout - Analog Cell Layout – Mixed Analog – Digital Layout.

Text Books

1. Philip E. Allen, Douglas R. Halberg, "CMOS Analog Circuit Design", Oxford University Press, II Edn. 2003.

References

1. Randall L. Geiger, Philip E. Allen, Noel K. Strader, "VLSI Design Techniques for Analog and Digital Circuits", McGraw Hill International Co., 1990.
2. Mohammed Ismail, Terri Fiew, "Analog VLSI Signal and Information Processing", McGraw Hill International Edn, 1994.
3. Malcom R. Haskard, Lan C. May, "Analog VLSI Design, NMOS and CMOS", Prentice Hall, 1998.
4. Jose E. France, Yannis Tsividis, "Design of Analog Digital VLSI Circuits for Telecommunication and Signal Processing", Prentice Hall - 1994.

EC335 HDL LABORATORY

Credit: 0:0:2 **Marks: 50+50**

12 experiments will be notified by HOD from time to time

EC336 ANALYSIS & DESIGN OF ANALOG INTEGRATED CIRCUITS

Credit: 4:0:0 **Marks: 40+60**

UNIT – I: Basic Building Blocks of Linear ICs
Types of current mirrors - Active loads - Voltage references - Supply and temperature insensitive biasing techniques.

UNIT – II: Bipolar Operational Amplifiers
Analysis and design of OP. AMP (Bipolar treatment) - Analysis of slew rate and frequency response models – Noise analysis.

UNIT – III: Analog Multipliers and PLL
Types of analog multipliers – Analysis and design of monolithic multiplier circuits – Basic principles and orders of PLL – Analysis and design of monolithic PLLs.

UNIT – IV: MOS Operational Amplifier
Analysis and design of OP. AMP. (MOS treatment) - MOS power amplifier and Analog switches.

UNIT – V: MOS Switched Capacitor Filters
Design techniques for switched capacitor filter - CMOS switched capacitor filters - MOS integrated active RC Filters.

Text Books

1. Gray and Meyer, "Analysis and Design of Analog ICs", Willey International, First Indian Reprint, 2004.

References

1. Behzad Razavi, "Principles of Data Conversion System Design", S. Chand & Company Ltd., 2000.
2. Kenneth R. Laker, Willey M.C. Sansen and William M.C. Sansen, "Design of Analog Integrated Circuits and Systems", McGraw Hill, 1st Edn., 1994.

EC337 VLSI SIGNAL PROCESSING

Credit: 3:1:0 **Marks: 40+60**

UNIT – I
Introduction to DSP systems-Iteration Bound - Pipelined and parallel processing.

UNIT – II
Retiming – Unfolding - Algorithmic strength reduction in filters and transforms.

UNIT – III
Systolic architecture design - Fast convolution - Pipelined and parallel recursive and adaptive filters.

UNIT – IV
Scaling and round off noise - Digital lattice filter structures - Bit level arithmetic architecture-Redundant arithmetic.

UNIT – V
Numerical strength reduction - Synchronous wave and asynchronous pope lines - Low power design - Programmable digital signal processors.

Text Books

1. Keshab K.Parthi, "VLSI Digital Signal Processing Systems, Design and implementation", Wiley, Inter Science, 1999.

References

1. Mohammed Isamail and Terri Fiez, "Analog VLSI Signal and Information Processing", McGraw Hill, 1994.
2. Jose E. France, Yannis Tsividis, "Design of Analog-Digital VLSI Circuits for Telecommunication and Signal Processing", Prentice Hall, 1994.

EC338 LOW POWER VLSI DESIGN

Credits: 3:0:0 **Marks: 40+60**

UNIT – I: Simulation Power Analysis
Need for low power VLSI chips – Short circuit current – Leakage current – Static current – Basic principles of low power design – Simulation power analysis at all levels – Data correlation in DSP system – Monte Carlo simulation.

UNIT – II: Circuit Logic Level Estimation
Circuits – Transistor and gate sizing – Pin ordering – Network restructuring and reorganization – Special latches and flip-flops.
Logic-Gate reorganization – Signal gating – Logic encoding – State machine ending – Precomputation logic – Power reduction in clock networks – Low power bus – Delay balancing.

UNIT – III: Architecture and System Level Estimation
Architecture and system – Power and performance management – Switching activity reduction – Parallel architecture – Flow graph transformation.

UNIT – IV: Circuit Design Techniques And SRAM Architecture
Circuit design – Leakage current in deep submicrometer transistor – Design issues – Low voltage circuit design – Multiple supply voltages.
MOS static RAM cell – Banked SRAM – Reducing voltage swing – Reducing power in write drives and sense amplifier.

UNIT – V: Energy Recovery And Software Design For Low Power

Energy recovery circuit design – Design with partially reversible logic – Source of software power dissipation – Software power estimation – Software power optimization – Codesign for low power.

Text Books

1. Gary Yeap, 'Practical Low Power Digital VLSI Design', Klwrver Academic Publishers, 2001.

References

1. Koushik Roy & Sharat Prasad, 'Low Power CMOS VLSI Circuit Design', John Wiley & Sons Inc. 2000.
2. Anantha Chandrakasan, Robert Broderson, 'Low Power CMOS Design', Standard Publishers Distributors, 2000.

EC339 COMPUTER AIDED VLSI DESIGN

Credits: 4:0:0 **Marks: 40+60**

UNIT – I: Introduction to VLSI Design

Introduction to VLSI Methodologies – VLSI Physical Design Automation – Design and Fabrication of VLSI Devices – Fabrication process and its impact on Physical Design.

UNIT – II: Automation Tools and Algorithms

A quick tour of VLSI Design Automation Tools – Data structures and Basic Algorithms – Algorithmic graph theory and computational complexity – Traceable and Intractable problems.

UNIT – III: Combinational Optimization

General purpose methods for combinational optimization – Partitioning – Floor planning and pin assignment – placement – routing.

UNIT – IV: Simulation and Synthesis

Simulation – Logic synthesis – Verification – High level synthesis – Compaction.

UNIT – V: Design Automation

Physical Design Automation of FPGAs – MCMS – VHDL – Verilog – Implementation of Simple circuits using VHDL and Verilog.

Text Books

1. N.A. Sherwari, "Algorithms for VLSI Physical Design Automation", John Wiley, 1999.

References

1. S.H. Gorez, "Algorithms for VLSI Design Automation", John Wiley, 1998.

2. Mark Bimbaum, “Essential EDA”, Prentice Hall, 2003.

EC340 SIMULATION LABORATORY

Credit: 0:0:2 **Marks: 50+50**

12 experiments will be notified by HOD from time to time

EC341 ADVANCED COMMUNICATION ENGINEERING

Credits: 4 : 0 : 0 **Marks: (40 + 60)**

Unit I: Digital and Data communications

Digital communications-Introduction, Digital communication, Shannon limit for information capacity, Digital radio, Digital amplitude modulation, Frequency shift keying, Phase shift keying, Quadrature amplitude modulation, Bandwidth efficiency, Carrier recovery, differential phase shift keying, Clock recovery, Probability of error and bit error rate - History of data communication standards organizations for data communication, Data communication circuits, Data communication codes, Error control, Synchronization, Data communication hardware, Serial interfaces, Parallel interfaces, The telephone network, The telephone circuit, Data modems

Unit II: Data Communication protocols and network configurations

Open systems interconnection, Data transmission modes, Asynchronous protocols, Synchronous protocols, Public data network, CCITT X.25 user-to-network interface protocol, Integrated services digital network, Local area networks, Token passing ring, Ethernet, Fiber distributed data interface.

Unit III: Digital Transmission and Multiplexing:

Pulse modulation, Pulse code modulation, Delta modulation PCM, Adaptive Delta modulation PCM, Differential pulse code modulation, Pulse transmission, Signal power in binary digital signals, Time-division multiplexing, T1 digital carrier system, CCITT time division multiplexed carrier system, Codecs, Combo chips, North American digital hierarchy line encoding, T carriers, Frame synchronization, Bit Interleaving versus word interleaving, Statistical time-division multiplexing, Frequency division multiplexing, AT&T’s FDM hierarchy, Composit base band signal, Formation of a master group, hybrid data.

Unit IV: Microwave Radio Communications & system gain, Optical fiber Communications

Frequency Vs Amplitude modulation, Simplified FM microwave radio system, FM microwave radio repeaters, Diversity, Protec
tion switching, FM microwave radio stations, Path characteristics, System gain, History of fiber optics, Optical fibers Vs metallic cable facilities, Electromagnetic spectrum, Optical fiber communications system, Light propagation, Propagation of light through an optical

fiber, Optical fiber configurations, Acceptance angle and acceptance cone, Losses in optical fiber cables, Light sources, Light detectors, Lasers.

Unit V: Satellite Communication

History of satellites, Orbital satellites, Geostationary satellites, Orbital patterns, Look angles, Orbital classification, Spacing & frequency allocation, Radiation patterns: Footprints, Satellite system parameters, Satellite system link equations, Link budget, FDM/FM Satellite systems, Multiple accessing, Channel capacity, Satellite radio navigation.

Text book

1. Wayne Tomasi, *"Advanced Electronic Communications Systems"*, Prentice-Hall International Inc., 1998, ISBN: 0-13-649278-9.

DEPARTMENT
OF
ELECTRICAL SCIENCES

ADDITIONAL SUBJECTS

Code No.	Subject	Credits
EC258	Digital system Design Using VHDL	2:0:0
EC259	Matlab & VHDL Lab	0:0:2
EC342	Testing and Testability of Electronics Systems	4:0:0
EC343	High Speed VLSI Design	4:0:0
EC344	Mixed Signal Processing	4:0:0
EC345	Designing with Gate Array and ASIC	4:0:0
EC346	Cellular Mobile Communication	4:0:0
EC347	Multimedia Compression Techniques	4:0:0

EC258 DIGITAL SYSTEM DESIGN USING VHDL

Credit : 2:0:0 **Marks: 40+60**

Unit: I Programmable Logic Devices
Introduction – Programming Technologies- Programmable Read only Memory (PROM or PLE)- Programmable Logic Array (PLA) – programmable Array Logic (PAL.)

Unit II : FPGA and CPLD
Semi custom and full custom IC design –Xilinx XC3000 series, Xilinx XC4000 series – Logic cell Array (LCA)-Configurable Logic block (CLB) – Input and output block (IOB) –Programmable Interconnection Point (PIP)- structure of PLD and Complex PLD- Altera 7000 series.

Unit III : Introduction to VHDL
Design flow process –Software tools – Data objects - Data types – Data operators – Entities and Architectures – Component declaration and instantiation.

Unit IV : Data Flow, Behavioural Modeling
Concurrent signal assignment – conditional signal assignment - selected signal assignment - concurrent and sequential statements – Data flow, Behavioral Modeling.

Unit V: Structural Modeling
Structural Modeling – Test bench – Examples – CPU- Traffic light controller

Text Books

1. Navabi . Z,"VHDL: Analysis and Modeling of Digital System", Prentice Hall Inc., 2nd Edition, 1998
2. Palmer. J.E, Perlman. D.E, "Introduction to Digital Systems', MCGraw Hill Book Co., International Student Edu.,2001'

Reference

1. John V. Oldfield and Richard C. Dorf, “Field Programmable Gate Arrays: Reconfigurable Logic for Rapid Protoyping and Implementation of Digital Systems”, John Wiley, 1995.
2. Peter J. Ashen den, “The designer’s guide to VHDL”, Morgan Kaufman Publishers, San Fransico, 1995
3. Stephen Brown, Zvonko Vranesic, “Fundemental of Digital Logic with VHDL Design” Tata McGraw Hill, edition – 2002.

EC259 MATLAB & VHDL LAB

Credits: 0:0:2 **Marks: 50+50**

12 Experiments will be notified by HOD from time to time

EC342 TESTING AND TESTABILITY OF ELECTRONICS SYSTEMS

Credits: 4:0:0 **Marks: 40+60**

Unit I : Introduction
Motivation for testing and design for testability – Fault models – Functional tests – Example of a functional test program.

Unit II : Test Generation Algorithms for Combinational Logic Circuits
Introduction - Fault - Table, Boolean difference – Path sensitization, D algorithm – Sequential circuits – Random test vectors.

Unit III : Fault Simulation Techniques
Serial, Single-fault propagation, Deductive, Parallel and Concurrent Simulation.

Unit IV : Special Testing Problems:
Problems in Memory ROM – RAM – Bump and Bounce Testing – Problems in Micro controllers – Operation code and address mode testing – Interrupts – Input/output ports- testing analog components.

Unit V: Design for Testability
Key testability concepts – Scan-in Scan-out design – Signature analysis – Built-in self-test - Testability features for board test.

References

1. Robert J.Feuguate, Jr. Steven M.Mcintyre, “Introduction to VLSI testing’, Prentice Hall, Englewood Cliffs, 1998.
2. M. Abramovici M.A, Breuer and A.d Friedman, “Digital Systems Testing and Testable Design”, Computer Sciences Press, 1990.

EC343 HIGH SPEED VLSI DESIGN

Credits:4:0:0 **Marks: 40+60**

Unit I

Clocked Logic Styles, Single-Rail Domino Logic Styles, Dual-Rail Domino Structures, Latched Domino Structures, Clocked pass Gate Logic

Non Clocked Logic Styles, Static CMOS, DCVS Logic, Non-Clocked pass Gate Families.

Unit II

Circuit Design Margining, Design Induced Variations, Process Induced Variations, Application Induced Variations, Noise.

Unit III

Latching Strategies, Basic Latch Design, Latching Differential Logic, Race Free Latches for Pre-charged Logic, Asynchronous Latch Techniques.

Unit IV

Signaling Standards, Chip-to-Chip Communication Networks, ESD Protection, Skew Tolerant Design

Unit V

Clocking Styles, Clock Jitter, Clock Skew, Clock Generation, Clock Distribution, Asynchronous Clocking Techniques.

References

1. Kerry Bernstein & et.al., High Speed CMOS Design Styles, Kluwer,1999.
2. Evan Sutherland, Bob Stroll, David Harris, Logical Efforts, Designing Fast CMOS Circuits, Kluwer,1999
3. David Harris, Skew Tolerant Domino Design.

EC344 MIXED SIGNAL PROCESSING

Credits 4:0:0 **Marks: 40+60**

Unit I : Introduction

Introduction – Modeling Basic analog concepts – Analog circuit analysis – network independent – dependent data sampled analog systems, loading effects.

Unit II: Analog and Mixed Signal Extensions To VHDL

Introduction– Language design objectives – Theory of differential algebraic equation – the 1076.1 Language – Tolerance groups – Conservative systems – Time and the simulation cycle – A/D and D/A Interaction – Question Point – Frequency domain modeling and examples.

Unit III : Analog Extensions to Verilog:
Introduction – Equation construction – solution – waveform Filter functions – simulator – Control Analysis – Multi – disciplinary model.

Unit IV: Behavioural Generic Model of Operational Amplifiers
Introduction – Description of Generic Opamp Model – structure – configuration – Functional specification – Auxillary block – conflict Resolution – Application Examples.

Unit V: Non-Linear State Space Averaged Modeling of 3-State Digital Phase – Frequency Detector:
Introduction – Model – Resetable Integrator – AC Analysis – sample Application

Reference:

1. ALAIN Vachoux Jean – Michel Borage Oz Levia, "Analog and Mixed signal Hardware Description Language (Current Issues in Electronic Modelling, V.10) Kluwer Academic publishers 1997.
2. Philip E-Allen, Dougles R. Holberg, "CMOS Analog Circuit Design", Second Edition, Oxford University Press, 2003
3. Behzad Razavi, "Design of Analog CMOS Integrated Circuits", Tata McGraw Hill, edition - 2003.

EC345 DESIGNING WITH GATE ARRAYS AND ASICS

Credits: 4:0:0 **Marks: 40+60**

Unit I : Hardware and Mixed Logic Convention:
Gate Hardware – mixed logic as a design tools and descriptive conventions – Uses of mixed logic in trouble shooting

MSI & LSI Elements
Multiplexes – Decoders and demultiplexers – ROM

Unit II : Timing Diagram
Introduction – micro timing diagrams – Hazards – macro timing diagrams- timing simulations - Feedback in combinational circuits
Combination of Flip Flops
Registers – Parallel Serial Conversion – Ripple Counters - Rate Multipliers - RAM

Unit III : Application Specific Devices

Programming technologies – PROMs & EPROMs – PLA – PAL Gate arrays – Programmable gate arrays and applications – Antifuse FPGA – Synthesis methods for FPGA- Full Custom design

Unit IV : Design of Simple State Machines
Traditional state machine design with D-flip-flops – Design with JK flip flops –Design for PLD – ASM chart – Design from an ASM chart : Boolean implementation for minimal number of flip flops, one-hot controller implementation – clock skew in state machines-implementation and lockout in state machines

Unit V : Electronically Programmable Functions
Introduction basic components – Arithmetic logic units- Programmable Registers – problem in electronically Programmable Circuits.

Textbook

1. James E. Palmer, David E perlman, " Introduction to digital systems", Tata Mcgraw Hill

References

1. Michael John Sebastian Smith, "Application Specific Integrated circuits", Pearson Education.
2. Bhutiyani, "Digital System Design", Tata McGraw Hill.

EC346 CELLULAR MOBILE COMMUNICATION

Credits: 4:0:0 **Marks: 40+60**

Unit I : Introduction to Wireless Mobile Communications
History and evolution of mobile radio systems.Types of mobile wireless services/systems-Cellular,WLL,Paging,Satelite systems,Standards,Future trends in personal wireless systems

Unit II : Cellular Concept and System Design Fundamentals
Cellular concept and frequency reuse,Multiple Access Schemes,channel assignment and handoff,Interference and system capacity,Trunking and Erlang capacity calculations

Unit III : Mobile Radio Propagation
Radio wave propagation issues in personal wireless systems, Propagation models, Multipath fading and Base band impulse response models, parameters of mobile multipath channels, Antenna systems in mobile radio

Unit IV: Modulation and Signal Processing
Analog and digital modulation techniques,Performance of various modulation techniques-Spectralefficiency,Error-rate,Power Amplification, Equalizing Rake reciever concepts,Diversity and space-time processing,Speech coding and channel coding

Unit V : System Examples and Design Issues
Multiple Access Techniques-FDMA,TDMA and CDMA systems,operational systems,Wireless networking,design issues in personal wireless systems

References

1. K.Feher,Wireless digital communications,PHI,New Delhi,1995
2. T.S.Rappaport,Wireless digital communications;Principles and practice,Prentice Hall,NJ,1996.
3. W.C.Y.Lee,Mobile communications Engineering:Theory And Applications,Second Edition,McGraw Hill,New York.19908.
4. Schiller,Mobile Communications;Pearson Education Asia Ltd.,2000

EC347 MULTIMEDIA COMPRESSION TECHNIQUES

Credits: 4:0:0 **Marks: 40+60**

Unit I: Introduction
Brief history of data compression applications,Overview of information theory redundancy. Overview of Human audio, Visual systems, Taxonomy of compression techniques.Overview of source coding,,source models,scalar quantisation theory,rate distribution theory,vector quantisation,structure quanitizers. Evaluation techniques-error analysis and methodologies

Unit II : Text Compression
Compact techniques-Huffmann coding-arithmetic coding-Shannon-Fano coding and dictionary techniques-LZW family algorithms. Entropy measures of performance-Quality measures.

Unit III :Audio Compression
Audio compression techniques-frequency domain and filtering-basic subband coding-application to speech coding-G.722-application to audio coding-MPEG audio,progressive encoding for audio--silence compression,speech compression techniques-Vocoders

Unit IV : Image Compression
Predictive techniques-PCM,DPCM,DM.Contour based compression-quadtrees, EPIC, SPIHT, Transform coding,JPEG,JPEG-2000,JBIG

Unit V: Video Compression
Video signal representation,Video compression techniques-MPEG,Motion estimation techniques-H.261.Overview of Wavelet based compression and DVI technology,Motion video compression,PLV performance,DVI real time compression

References

1. Mark Nelson,Dta compression book,BPB Publishers,New Delhi,1998
2. Sayood Khaleed,Introduction to data compression,Morgan Kauffman, London, 1995

3. Watkinson,J.Compression in video and audio,Focal press,London.1995
4. Jan Vozer,Video compression for multimedia,AP profes,NewYork,1995.
5. David Poloman data Compression, 2000, SIE Stranger International Edition

SCHOOL

OF

ELECTRICAL SCIENCES

ADDITIONAL SUBJECTS

Code	Subject Name	Credit
EC260	Analog Electronics	4:0:0
EC261	Electronic Instrumentation	4:0:0
EC262	Communication Systems	4:0:0
EC263	Computer Architecture	4:0:0
EC264	Computer Networks	4:0:0
EC265	Television and Video Engineering	4:0:0
EC266	Digital Electronics Lab	0:0:2
EC267	Electronics Lab	0:0:2
EC348	Advanced Computer Architecture	4:0:0
EC349	Analog VLSI Design	4:0:0
EC350	Low Power VLSI Design	4:0:0
EC351	Digital Image Processing	4:0:0
EC352	Advanced Digital System Design and Testing	4:0:0

EC260 ANALOG ELECTRONICS

Credits: 4:0:0 **Marks: 40+60**

UNIT – I: Rectifier – Regulators – Wave Shaping Circuits:-
Rectifiers – Half wave rectifier – Full wave rectifier – Filters – Voltage and current regulators –High pass and Lowpass RC circuits – Response for step, pulse, square wave, ramp and exponential signals as input – High pass circuit as a differentiator – Lowpass circuit as integrator –attenuators – Non-Linear Waveshaping Circuits: Diode and transistor clippers – clamping circuits

UNIT – II: Theory of BJT, FET, UJT ,TRIAC, SCR,IGBT: -
BJT operation – Input output characteristics – FET structure – Enhancement MOSFET – Depletion MOSFET – UJT operation – Static characteristics –TRIAC- SCR – Construction – Static characteristics – IGBT –Construction – characteristics – Firing characteristics.

UNIT – III: Amplifiers and Oscillators:
Frequency response – RC coupled – Transformer coupled amplifier – Class A power amplifier – Class B push pull power amplifier – Differential amplifier – Barkhausen criterion – RC and LC Oscillators – RC phase shift oscillator – Wien-Bridge Oscillator

UNIT- IV: OP Amp Characteristics and Applications:
Characteristics of ideal OP amp – Bias – Offset and drift – Bandwidth and Slewrate – Frequency Compensation – Log and antilog amplifiers – Multiplier and Divider

Applications: Inverting and non-inverting amplifiers –summers – differentiator and integrator.

UNIT – V: Comparators and Signal Conditioners:-
Comparators – Regenerative comparator – 555 Timer - Astable multi-vibrator – Monostable multi-vibrator – Instrumentation Amplifier – Differential Amplifier.

Text Books:

1. Millman. J & Halkias. C, “Electron Devices and Circuits”, 1995.
2. Millman and Taub, “Pulse Digital and Switching Waveforms’, McGraw Hill, 1995.

References:

1. Roy Choudhury.D., Shail Jain, “Linear Integrated Circuits”, Wiley Eastern Ltd., 1996.
2. Boylestred. R and Nashelsky, “Electronics Devices and Circuits Theory”, Prentice Hall India, 2003.
3. David A. Bell, “Solid State Pulse Circuits”, Prentice Hall Inc., 1991.

EC261 ELECTRONIC INSTRUMENTATION

Credits: 4:0:0 **Marks: 40+60**

UNIT – I: Introduction to Measurements:
Introduction to measurement systems – Classification and characteristics of Instruments – Errors in measurements – Standards of measurement – Electronic weighing system – AC/DC Bridge measurements.

UNIT – II: Transducers:
Classification and characteristics of transducer – Selection of transducer – Resistive transducer – Strain gauges – Thermistor – Inductive transducer – LVDT – Capacitive transducer – Load cell – Piezoelectric transducer – Photo electric transducer.

UNIT – III: Signal Generators and Analyzer:
Generator: Audio frequency generator – Pulse generator – Function generator – Sweep generator.
Analyzer: Wave analyzer – logic analyzer – Spectrum analyzer – Distortion analyzer.

UNIT – IV: Oscilloscopes and Recorders:
Oscilloscopes: Functional blocks of CRO – Dual beam oscilloscope – Digital storage oscilloscope – Sampling oscilloscope.
Recorder: XY Recorders – Strip chart recorders – FM recording – Digital memory waveform recorder.

UNIT – V: Digital Instruments and Computerized Test Systems:
Digital voltmeters – Digital measurement of frequency and period.
Testing of audio amplifier and radio receiver – Microprocessor based measurements – IEEE 488 - standard - computer controlled test systems.

Text Book:

1. Kalsi.G.C., “Electronic Instrumentation”, TMH, 1998.

Reference Books:

1. Cooper. W.D and Helfrick. A.D, “Electronic Instrumentation and Measurement Techniques”, 3rd Edition, PHI, 1991.
2. Oliver and Cage, “Electronic Measurements and Instrumentation”, McGraw Hill, 3rd Edition, 1999.

EC262 COMMUNICATION SYSTEMS

Credits: 4:0:0 **Marks: 40+60**

UNIT – I: Amplitude Modulation:

Basic communication system – Signals – Types – Energy and power of signals – Spectra and mathematical representation of Amplitude Modulation – Introduction to Analog Communication Systems – Amplitude modulation – Modulation index – Diode modulator – BJT modulator – Diode detector – AM transmitter – Amplitude Modulation Superhetrodyne receiver systems.

UNIT – II: Frequency Modulation:

Mathematical representation of FM – Narrow band and Wide band FM – Bandwidth requirement of FM – Varactor diode modulator –FM generation using Armstrong method – Balanced slope detector (Round Traves Detector) – FM transmitter – FM receiver – Pre-emphasis and De-emphasis circuits.

UNIT – III: Digital Communication:

Pulse Amplitude Modulation – Sampling theorem – Pulse Code Modulation – Digital Modulation Techniques: Frequency Shift Keying, Phase Shift Keying, Quadrature Phase Shift Keying – Multiplexing: Time Division Multiplexing, Frequency Division Multiplexing.

UNIT – IV: Wireless Communication:

Spread spectrum in communication systems – DSSS – FHSS – CDMA – Introduction to Mobile Communication Systems – Terminology – Mobile communication.

UNIT – V: Noise in Communication Systems:

Internal and External Noise – Signal to Noise Ratio – Performance of AM and FM in the presence of noise – Noise in Digital Communication.

Text Books:

1. Taub and Schilling, “Principles of Communication Systems”, McGraw Hill, 2nd Edition, 25th Reprint, 2003.
2. G.Kennedy, “Electronic Communication Systems”, McGraw Hill, 4th Edition, 8th Reprint, 2003.

References:

1. Simon Haykins, “Communication Systems”, 3rd Edition, John Wiley Inc., 1995.

2. Jochen Schiller, “Mobile Communications”, Addison Wesley, 2000.
3. William Stallings, “Data and Computer Communications”, Prentice Hall of India, 2004.
4. Anokh Singh,”Principles of Communication Engineering”’S.Chand &Company Ltd

EC263 COMPUTER ARCHITECTURE

Credits: 4:0:0 **Marks: 40+60**

UNIT-I : Introduction:
Basic structure of Computer Hardware-Von-Neumann Architecture-Functional units-Instruction formats and types-Addressing modes.

UNIT-II: Arithmetic And Logic Unit:
Fixed point arithmetic operation-addition, substraction, multiplication, division-Floating point arithmetic operation- Bit-slice processors.

UNIT-III: Processor Unit:
Data path implementation-Control unit-hardwired control, microprogrammed control, nanoprogramming- Concepts of pipelining.

UNIT-IV: Memory System:
Memory hierarchy-Internal organization of RAM, ROM, Interleaved memory-Cache and associative memories- Virtual memory.

UNIT-V : Input / Output and Peripherals
Basic concepts-programmed I/O-Interrupts and DMA-I/O processors-input devices-display devices-printers-magnetic disk drives-optical drives.

Text Books:
1. M. Morris Mano,”Computer System Architecture” ,Prentice Hall India, Third Edition, 1996.
2. Heuring V.P., Jordan H.F., "Computer System Design and Architecture", Addison Wesley, 1999.

References:
1. Patterson and Hennessey, "Computer Organization and Design". The Hardware/Software Interface, Harcourt Asia Morgan Kaufmann, 1999.
2. Hayes, " Computer Architecture and Organization ", Tata McGraw Hill, 1998.
3. Carl Hamacher V., Zvonko G.Vranesic, Safwat G. Zaky, "Computer organization", Tata McGraw Hill, Latest Edition.

EC264 COMPUTER NETWORKS

Credits: 4:0:0 **Marks: 40+60**

UNIT 1: Data Communication:
Components – Directions of Data flow-networks – Components and Categories – types of Connections – Topologies – Protocols and Standards – ISO/OSI Model – Transmission Media – Co-axial Cable – Fiber Optics-Line Coding – Modems – RS 232 Interfacing sequences.

UNIT II: Data Link Layer:
Error – detection and correction – Parity – LRC – CRC – Hamming code – Flow control and Error control: Stop and wait – Go back N ARQ – Selective repeat ARQ – Sliding window techniques – HDLC. LAN: Ethernet IEEE 802.3,IEEE 802.4 and IEEE 802.5 – IEEE 802.11-FDDI, SONET-Bridges

UNIT III: Network Layer:
Internet works – Packet switching and Datagram approach – IP addressing methods – Subnetting – Routing-Distance vector Routing – Link State Routing – Routers

UNIT IV: Transport Layer:
Duties of transport layer – Multiplexing – Demultiplexing – Sockets – User Datagram protocol (UDP) – Transmission Control Protocol (TCP) – Congestion Control – Quality of Services (QOS) – Integrated Services.

UNIT V: Application Layer:
Domain Name Space (DNS) – SMTP, FDP, HTTP, WWW – Security – Cryptography.

Text Books:

1. Andrew S. Tennenbaum, "Computer Networks", PHI, Fourth edition 2003.
2. Behrouz A. Foruzan, "Data Communication and Networking", Tata McGraw Hill, 2004.

References:

1. James. F Kurouse & W. Rouse, "Computer Networking: A Topdown Approach Featuring" Pearson Education.
2. William Stallings, "Data and Computer Communication", Sixth Edition, Pearson Education, 2000

EC265 TELEVISION AND VIDEO ENGINEERING

Credits: 4:0:0 **Marks: 40+60**

UNIT – I: Fundamentals of Television
Characteristics of eye and television pictures – Resolution and brightness gradation. Theory of Scanning. Camera tubes – Vidicon and Silicon diode array vidicon. Monochrome picture tube, Composite.

UNIT – II: Monochrome Television Receiver
Transmission and Propagation of TV signal, TV antenna, Receiver: VHF Tuners, Vision IF subsystem, Inter carrier sound system. Video amplifiers, Synchronous separation AFC and deflection Oscillators frame and line deflection circuits.

UNIT – III: Colour Television Systems
Color Characteristics – Color cameras Color picture tubes, Color signal generation and encoding, NTSC, PAL and SECAM Systems.

UNIT – IV: Colour Television Receivers
Block diagram of PAL-D receivers, Luminance channel. Chrominance amplifier, Color burst separation and burst phase discriminator. Sub carrier Oscillator AGC circuits. Ident and color killer circuits. U and V demodulators. R, G, B matrix and drivers.

UNIT – V: Special Topics in Television
Digital tuning techniques, Remote control. Introduction to cable and Satellite television. Video tape readers and recorders. Videodisc system, LCD Projectors. Fundamental of digital TV and high definition Television.

Text Book:

1. Gulati.R.R, "Modern Television Practice, Principle of Technology and Servicing", New age International Pvt., Ltd., 2002.

References:

1. Dhake.A.M, "Television and Video Engineering", Tata McGraw-Hill, 1995.
2. Grob.B, Herndon. C.E., "Basic television and video systems", McGraw-Hill,1999.

EC266 DIGITAL ELECTRONICS LAB

Credits: 0:0:2 **Marks: 50+50**

12 experiments will be notified by HOD from time to time

EC267 ELECTRONICS LAB

Credits: 0:0:2 **Marks: 50+50**

12 experiments will be notified by HOD from time to time

EC348 ADVANCED COMPUTER ARCHITECTURE

Credits: 4:0:0 **Marks: 40+60**

UNIT – 1: Parallel Computer Models
Evolution of computer architecture - System attributes to performance - Multiprocessors and Multicomputers - Multivector and SIMD computers - PRAM and VLSI models - Parallelism in programming - Conditions for parallelism - Program partitioning and scheduling - Program Flow mechanisms. Performance metrics and measures - Speedup

Amdahls law - Gustafsons law -Memory bounded speedup model - Scalability metric and goals.

UNIT – II: Advanced Processors
Instruction set architectures - CISC scalar processor - RISC scalar processors - super scalar processors - VLIW architecture - Multi-vector and SIMD computers - Vector processing principles - Memory access schemes - SIMD computer - Models - Inter processor communication.

UNIT – III: Memory Systems
Memory hierarchy - Virtual memory technology - Back plane bus specification - Arbitration, Transaction and Interrupt - Cache memory organization - Shared memory organizations.

UNIT – IV: Multiprocessors and Multicomputers
Multiprocessor system interconnects - Hotspot problems - Cache coherence and synchronization mechanisms - Message passing mechanisms.
Pipelined processors - Linear pipeline - Non-Linear pipeline-Instruction pipeline Design - Arithmetic pipeline design architectures.

UNIT – V: Software for Parallel Programming and Multithreading
Parallel models, languages and compilers - Parallel programming models, Code optimization and scheduling.
Principles of Multithreading - Multithreading Issues and solutions - Multiple context processors.

Text Book:

1. KAI. Hwang, “Advanced Computer Architecture Parallelism, Scalability, Programmability”, McGraw Hill, New York, 1993.

References:

1. William Stallings, “Computer Organization and Architecture”, Pearson Education India, Edn., 2002.
2. K. Hwang and F.A. Briggs, ‘Computer Architecture and Parallel Processors’, McGraw Hill, N.Y, 1999.

EC349 ANALOG VLSI DESIGN

Credits: 4:0:0 **Marks: 40+60**

UNIT I: VLSI Technology
Introduction- IC Production process: Processing steps, Packaging and testing- Semiconductor Processes: MOS Process-NMOS- CMOS-Bipolar Technology-Hybrid Technology-Design rules and process parameters.

UNIT II : Device Modeling
Modeling-MOS Models: dc, small signal and high frequency model, Measurement of MOSFET Parameters- Diode models: dc, small signal and high frequency diode model –

Bipolar Models: dc, small signal and high frequency BJT model- Measurement of BJT model parameters-Passive component model- Monolithic capacitors and Resistors.

UNIT III: Analog Systems
Analog signal processing-Digital-to- Analog converters; Current scaling, Voltage scaling and charge scaling-Serial D/A Converters-analog-to Digital Converters: Serial A/D Converters, Successive approximation A/D –Parallel-High Performance A/D Converters - Continuous Time filters: Low pass filters- High pass filters- Band pass filters.

UNIT IV: Design Automation and Verification
Integrated circuit layout-Symbolic circuit representation-Design rule Checks- Circuit Extraction – Digital circuit Simulation- Logic and Switch simulation- Timing analysis- Register Transfer- Level simulation.

UNIT V: Analog Signal Processing Circuits & Analog Cell Layout
Modulators- Oscillators- Phase locked loops-Layout Techniques- Resistor layout- Capacitor Layout- Analog cell layout.

Text Book:

1. Philip E. Allen, Douglas R. Halberg, "CMOS Analog Circuit Design", Oxford University Press, II Edn.2003.

Reference Books:

1. Randall L.Geiger, Philip E.Allen, Noel K.Strader, " VLSI Design Techniques for Analog and Digital Circuits", McGraw Hill International Co, 1990.
2. Mohammed Ismail, Terri Fiew, "Analog VLSI Signal and information Processing", McGraw Hill International Edn., 1994
3. Malcom R.Haskard , Lan C. May, "Analog VLSI Design, NMOS and CMOS", Prentice Hall, 1998.
4. JoseE.France ,Yannis Tsividis," Design of Analog Digital VLSI Circuits for Telecommunications and Signal Processing.", Prentice Hall-1994.

EC350 LOW POWER VLSI DESIGN

Credits: 4:0:0 **Marks: 40+60**

UNIT – I: Simulation Power Analysis
Need for Low Power VLSI chips – Charging and discharging capacitance – Short circuit current – Leakage current – Static current – Basic principles of low power design – Gate level logic simulation – Architecture level analysis.

UNIT – II: Circuit and Logic Level Power Estimation
Transistor and gate sizing – Equivalent pin ordering – Network restructuring and reorganization – Special latches and flip flops – Gate reorganization – Signal gating – Logic encoding – State machine encoding – Pre-computation logic – Power reduction in clock networks – CMOS floating node – Low power bus – Delay balancing.

UNIT – III: Power Estimation and Behavioral level Transforms
Modeling of signals – Signal probability calculation – Probabilistic techniques for signal activity estimation – Statistical techniques – Estimation of glitching power – Behavioral level transforms.

UNIT – IV: Circuit Design Techniques and SRAM Architecture
Circuit design style – Leakage current in deep sub-micrometer transistors – Deep sub-micrometer device design issues – Low voltage circuit design techniques – Multiple supply voltages.

MOS static RAM memory cell – Banked SRAM – Reducing voltage swing – Reducing power in write drives and sense amplifier.

UNIT – V: Energy Recovery and Software Design for Low Power
Energy recovery circuit design – design with partially reversible logic – source of software power dissipation – software power estimation – software power optimization – co-design for low power.

Text Books:

1. Gary Yeap, "Practical Low Power Digital VLSI Design", Klwver Academic Publishers, 2001.

References:

1. Koushik Roy and Sharat Prasad, "Low Power CMOS VLSI Circuit Design", John Wiley & Sons Inc., 2000.
2. Anatha Chandrakasan and Robert Broderson, "Low Power CMOS Design", Standard Publishers Distributors, 2000.

EC351 DIGITAL IMAGE PROCESSING

Credits: 4:0:0 **Marks: 40+60**

UNIT-I: Continuous And Discrete Images And Systems
Image Processing Problems and Applications, Linear Systems And Shift Invariance, Fourier Transform, Z-Transform, OTF, MTF. Matrix Theory Results, Block Matrices and Kronecker Products - problems. Eye, Simultaneous Contrast, Mach Bands, Monochrome Vision Model, 2-D Sampling Theory, Image Quantization, Lloyd Max Quantizer, Dither, Color representation, Chromaticity diagram.

UNIT-II: Image Transforms
2-D orthogonal and Unitary transforms, Properties of Unitary transforms, 1-D and 2-D DFT, Cosine, Sine, Walsh Hadamard, Haar, Slant, Karhunen-loeve, Singular Value Decomposition transforms- problems.

UNIT-III: Image Enhancement
Contrast stretching, clipping and thresholding, intensity level slicing, Histogram equalization, modification and specification, spatial averaging, low pass, high pass, band pass filtering, Directional smoothing, median filtering, generalized cepstrum and

homomorphic filtering, pseudo coloring, edge enhancement using 2-D IIR and FIR filters, color image enhancement.

UNIT-IV: Image Restoration And Image Reconstruction From Projections
Image observation models, sources of degradation, inverse and Wiener filtering, geometric mean filter, non linear filters, smoothing splines and interpolation, constrained least squares restoration. Radon transform, back projection operator, inverse radon transform, back projection algorithm, fan beam and algebraic restoration techniques.

UNIT-V: Image Data Compression
Image raw data rate, compression ratio. Sub sampling, coarse quantization, frame repetition and interlacing. PCM, Entropy coding, Run-length coding, Bit-plane coding. DPCM, Delta modulation. Transform coding, zonal and threshold coding, Hybrid coding and color image coding.

Text Book:

1. Anil K. Jain, "Fundamentals of Digital Image Processing", PHI 2002.

References:

1. R.Gonzalaz and P.Woods, "Digital Image Processing", Pearson Education, Inc. 2nd Ed, 2002.
2. M.A.Said Ahmed, "Image Processing", McGraw Hill, Inc, 1995.
3. William. K.Pratt, "Digital Image Processing", Wiley Interscience, 2nd Ed, 1991.

EC352 ADVANCED DIGITAL SYSTEM DESIGN AND TESTING

Credits: 4:0:0 **Marks: 40+60**

UNIT I: Programmable Logic Devices
Basic concepts, Programming techniques, Programmable Logic Element (PLE), Programmable Logic Array (PLA), Programmable Array Logic (PAL), Structure of Standard PLD's, Complex PLD's (CPLD), Altera Max-7000 Series. Design of combination and sequential circuits using PLD's.
Type of FPGA – Xilinx XC3000 Series – Logic Cell Array (LCA) – Configurable Logic Blocks (CLB) Input/Output Blocks (I/OB) – Programmable Interconnection Points (PIP) – Xilinx XC4000 families – Design examples.

UNIT II: Sequential Logic Circuits
Mealy machine, More machine, State diagrams, State table minimization, Incompletely specified sequential machines, State assignments, Design of synchronous and asynchronous sequential logic circuits working in the fundamental mode and pulse mode.

UNIT III: Symmetric Functions
Elementary symmetric functions, partially symmetric and totally symmetric functions, Mc Cluskey de-composition method, Synthesis of symmetric function by contact networks.

UNIT IV: Testing and Simulation Techniques in Digital Circuits
Detection and location of faults in combinational logic circuits – Path sensitizing method – Boolean difference method – D Algorithm – Series, Single-fault propagation, Deductive, Parallel and concurrent simulation – Design for testability – Built-in-self-test.

UNIT V: Introduction to VHDL
Design process flow – Software tools – Hardware description language – VHDL: Data Objects – Data types – Operators – Entities and Architecture – Component declaration – Component instantiation – Concurrent signal assignment – Conditional signal assignment – Selected signal assignment – Concurrent statements – sequential statements – Behavioural, Data flow and structural modeling.

Text Books

1. James E. Palmer & David E. Perlman, "Introduction to Digital Systems", Tata McGraw Hill, 1996.
2. Bhutgani, "Digital Logic Design", Prentice Hall International, Simon & Schuster (Asia) Ptd., Ltd, 1996.
3. Navabi. Z, "VHDL: Analysis and Modelling of Digital Systems", Prentice Hall Inc., 1989.

References

1. Robert J. Feugate, Jr. Steven M.Mc/n tyre, "Introduction to VLSI Testing", Prentice Hall, Englewood Cliffs, 1998.
2. M. Abramovici, M.A, Breuer and A.D. Friedman, "Digital Systems Testing and Testable Design", Computer Sciences Press, 2nd Edition, 2002.

ADDITIONAL SUBJECTS

Code No.	Subject Name	Credits
EC268	Mass Communication	4:0:0
EC269	Audio Production and Presentation	4:0:0
EC270	Satellite and Community Radio	4:0:0
EC271	Studio Management	4:0:0
EC272	Video Production and Editing	4:0:0
EC273	Graphics and Animation	4:0:0
EC274	Web Designing and Production	4:0:0
EC275	Advertising and Public Relation	4:0:0
EC276	Advertising Lab	0:0:2
EC277	Audio Lab	0:0:2
EC278	Video Lab	0:0:2
EC279	Graphics and Animation Lab	0:0:2
EC280	Transmission Lines and Wave Guides	4:0:0
EC281	Electric Circuit Analysis and Networks	3:1:0
EC282	Antennas and Wave Propagation	3:1:0
EC353	Solid State Device Modeling and Simulation	4:0:0
EC354	Genetic Algorithms for VLSI Design	4:0:0
EC355	Electromagnetic Interference and Compatibility in System Design	4:0:0
EC356	MEMS and Nano Technology	4:0:0
EC357	RF System Design	4:0:0
EC358	Advanced Embedded System Design	4:0:0
EC359	ASIC Design Lab	0:0:2

EC268 MASS COMMUNICATION

Credits 4:0:0 **Marks 40+60**

Unit I: Communication
Definition, history and Background; Nature, Process of mass Communication; functions and objects of communication, kinds of mass communication, Communication today.

Unit II: Models of Communication
Models of communication; needs of models and their importance

Unit III: Theories of Mass Communication
Theories of mass communication; diverse systems of media ; issues and organizations of modern media.

Unit IV: Social Systems and Media Responsibility
Social systems and media responsibility; philosophy and influence; information, communication and Entertainment/Education (ICE) and the resultant implications; Gate-keepers.

Unit V: Comparative Theories
Eastern and western theories, comparison and critique

Text Book:
1. Mcquail, Dennis, “Mass Communication Theories “ 4th edition sage publication (2000)
2. Asa berger, “Essentials of Mass Communication” Sage publication (2000)

References:

1. Silverstone, Roger “Why study media? “sage Publication.(1999)
2. Rosenberg, Karl Erik “communication, an Introduction” Sage Publication. (2000)
3. “International Encyclopedia of Communication” (VOL 1-IV) Oxford.
4. Webster, frank “Theories of Information Society “ Routledge ,Londen.(1995)

EC269 AUDIO PRODUCTION AND PRESENTATION

Credits 4:0:0 **Marks 40+60**

Unit I: Basics of Radio Programming
Characteristics of radio- radio and other media; Assessment and analysis of target audience; Basics of radio Programming - from conception to execution of ideas; Research - collection of background materials; Formats and styles in radio production.

Unit II: News Writing and Interview
Writing for the ear – Basic rules or radio Writing; audio script – types of audio scripts; News – Concept and definition, elements of news values, news gathering and writing ; Interview, types of interviews.

Unit III: Radio Jingle
Radio jingles production; Radio Drama – Fiction and Drama, Drama audition; Discussion programmes – selection of subjects for discussion; phone-in programes.

Unit IV: Documentary
Radio Feature and Documentary – Difference between feature and documentary; Public Service announcements; Day parting; Media fusion; Planning and scripting for educational radio programmes, programmes for special occasions.

Unit V: Radio Station Organisation and Management
Radio Station Organisation and Management; Use of effects; Use of background music; Advanced radio production techniques – Using digital technologies, Creating audio special Effects.

Text Book:

1. Jan Maes and March Vereammen "Digital audio Technology", Focal Press 4th Edition (2001)
2. William Moylan "The art of Recording" Focal press, 4th edition. (2002).

References:

1. David Miles Huber "Modern recording Techniques" Focal press 5th edition (2001)

EC270 SATELLITE AND COMMUNITY RADIO

Credits 4:0:0 **Marks 40+60**

Unit I:
Introduction to community radio - Technology for community radio - Managing your stations.

Unit II:
Money and monitoring accountability - Broad casting Rules and laws .

Unit III:
Programming Volunteer support - Access and Disability - Developing communities .

Unit IV:
Training Individuals - Finding community Radio

Unit V:
Selling your service - Rural radio

Text Books:

1. David Page william Crawely "Saellites over south Asia" sage publication(1999)
2. Rural radio Parama Roy "Indian Traffic" sage publication (2000)

References:

1. Ananda Mitra "India Through The western lens" " sage publication (2000)

EC271 STUDIO MANAGEMENT

Credits 4:0:0 **Marks 40+60**

Unit I:
Assisting with production planning -consulting on logistics. -Ensuring all staging, furniture and props are ready before the show starts. -Ensuring all equipment is in place and technical checks have been done. -Briefing presenters and talent. -Preparing the audience. -Coordinating rehearsals.

Unit II:
Relaying information between the control room, floor staff and talent. -Providing cues, timing and other information to presenters and talent.

Unit III:
Informing the director of any relevant off-camera action. -Preparing for upcoming parts of the show.

Unit IV:
Maintaining control of the audience and ensuring they are looked after.

Unit V:
Overseeing safety issues on the floor. -In outside broadcasts; liasing with venue staff, organizing talent, etc.

Text Book:

1. David French Michal Richards “Television in contemporary Asia”sage publication (1999)

Reference:

1. Peter ward “TV Technical Operations” sage Publications (2000)
3. J Watson “Media Communication” Elsevier Publishers(1999)

EC272 VIDEO PRODUCTION AND EDITING

Credits 4:0:0 **Marks 40+60**

Unit I: Evolution of Video
The evolution of Video. Analog & Digital mode production of a programme & its stages. Shot, scene, story-board & scripting. Pre-production, Treatment, Draft preparation, Selecting personnel, Area of research, Script development, Project management, selection of concept, programme treatment, crew members, Equipments required, set direction & colour correction if needed, location scouting, budget & scheduling, finalizing props, use of lights, costumes, hair style & make-up.

Unit II: Production
Shooting on location, Video Log Sheets 9Logging Tapes), Schedule alternations if changes in utlists dates/location problems. Online, offline, recorded & live programmes. Pros & cons of single & multi-camera. Mics arrangements, camera placement**.**

Unit III: Post-Production:
Footage review, Final scripting, Video Editing, Video tape format, Basic software & Hardwares required, editing, re-recording, audio mixing-music also, Voice-over, graphics, etc. Knowing the tracks A/V International tracks & its use in dubbed programmes. A-B roll & its advantages. Chroma-Keying. Final master output – mixed & unmixed version.

Unit IV: Video & Audio Codecs
Various formats & types available, CD/DVD/BD9Blue-ray Disc) Defining – montage, promos, special promos, credits & end scroll, music bed. Various stages a programme undergoes after mixed master-Script committee approval, production & technical FT (Fit for Telecast) certificate Capsule/Packaging.

Unit V: The Final Steps

Curtain raiser, teaser, Medley, peppier fonts for supers with the right colour strips. Luminescense & chrominance, end scroll 7 credits with innovative ways. Test-run transmission, launching & pipeline of a programme, Marketing-getting sponsors. Publicity-stills & write-ups. Syndicated programmes.

Text Book:

1. Barbara Clark, Guide to post Production for TV and Film: managing the Process, Susan Spohr, Focal Press, 2^{nd} edition-October (2002)
2. Deslyver & Graham Swainson, Basics of video production, Focal Press, 2^{nd} edition, (2001)

References:

1. Maxie D Collier, The IFILM Digital Video Filmmaker's Handbook, Lone Eagle Publishing Company, 1^{st} Edition January (2001)

EC273 GRAPHICS AND ANIMATION

Credits 4:0:0 **Marks 40+60**

Unit I: Animation Histroy

Evolution of Disney animation – Types of animation – styles of animation – Principles of 2-D animation – Animation market today

Unit II: Diffferent Animation Styles

Disney animation – Japanese animation – Russian Animation – Comparative study of different Animation styles – basic Anatomy – Proportions – Staging – Posing – Timing – Actions

Unit III: Pre Production

Scripting – story board – screen Play – timing – Duration Character designs – Turn Around - Color Schemes – Attitudes – Props

Unit IV: Tools for 2D Animation

Color keys – background – layout – source of light – Styles – Paper sources Paper Quality

Unit V: Compositing

Special Effects – Foley – Sound Design – Software packages – US animation – Flash – Animation.

Text Books:

1. Mark Simon, Producing Independent 2D Character Animation, Focal press – Feb (2003)
2. Jayne Pilling, animation 2D and Beyond, Rotovision – September (2000)

References:

1. GSBaluja,Dhanpat rai & CO, Computer graphics & Multimedia, First Edition, Dhanpat Rai & CO(P) Ltd, (2003).
2. Hedley griffin, The animator's Guide to 2D computer Animation, focal Press – December (2000)

EC274 WEB DESIGNING AND PRODUCTION

Credits 4:0:0 **Marks 40+60**

Unit I: Introduction to Internet

Introduction of Internet, History of Internet, Technologies and applications of world wide web, basics of web site designing, style and formats for web designing, applications in web designing, web standards and languages of HTML, XML, Action script and java script.

Unit II: Fundamentals of Web Designing

Web Architecture, Web design templates, designing, implementing and evaluating user centred tools and techniques, HTML tags, interaction between HTML user, client and server, introduction to CSS, style and style sheets with CSS.

Unit III: Managing Database on the Web

Introduction to data base and concepts, datas on the web, key concepts of web scripting languages, data types, variables, expressions, operation and functions. Introduction to server side scripting languages, features of java, OOP principles. Interactive web pages, basics of data base query language SQL, browser side language java script, interactive web pages, web based production.

Unit IV: Content and Style of Web Writing

Web templates and colours, content, structure and presentation elements in design of a simple web site, basics of creating content for website, writing entertainment content, edutainment content, news content and blogs, writing for online advertisements, writing for banner advertisements, organizing content and headlines, integrating graphic content, maintaining on line document.

Unit V: Business Applications in Website

E-commerce, e-content production, e-learning, web streaming, pre production elements and post production phases of web technology, web based broadcast technologies and content production, e-magazines, presentation of audio, video, animated and digital images in the web.

Text Book:

1. Jeffrey Zeldman, Designing with web standards, New Riders, 1st Edition (May 2003)

Reference Books:

1. Jakob Jielsen, Designing web usuability, The practice of simplicity, New Riders, 1st edition (December 1999).
2. Deitel and Deitel, Internet and World Wide Web how to programme, Prentice Hall, (2000).

EC275 ADVERTISING AND PUBLIC RELATION

Credits 4:0:0 **Marks 40+60**

Unit I: Nature and Scope of Advertising

Definition, nature and scope of advertising, Roles of advertising; Societal communication, Marketing and Economic Functions of advertising, Effects o advertising, Legal and Ethical issues in advertising.

Unit II: Types of Advertising

Target audience, Geographic area, Media and Purpose. Institutional and Promotional Advertising, Web Advertising (home page designing, overall look of the site , web writing content management.

Unit III: Advertising Agency

Environment, Components – Advertiser, Advertising agency and media, Indian advertising, Latest trends in advertising – (India and abroad) Ad Agency – Structure and function structure of small medium and big agencies. Types of agencies – In–House, Independent, Full- service and specialized Multinational accounts and Global advertising

Unit IV: Media Research and Planning

Client Brief, Account planning, Creative strategy and Brief, communication Plan Brand Management, Positioning .Brand personality , Brand image, brand equity, case studies.Media Research, Planning and Budgeting, Media buying, creative Media options and Media vehicles Rural Communication – Alternative media Options, below-the-line activities and low-budget advertising

Unit V: Public Relations

Public relations – evolution and growth, definition and relevance of PR role – Mass media & PR; PR in Government, public and private sectors; PR and corporate Communications writing for PR; PR ethics and regulations.

Text Book:

1. S.H.H.Kazmi, Satish K Batra, “Advertising and sales Promotion”, Excel Book, New Delhi,(2000).
2. J.Vilanilam, G.K.Varghese, “Advertsising basics”, Response books, New Delhi,(2001).

References:

1. Sean Brierley, “The advertising and hand book”, 2nd Edition, New York, (2000).
2. McGraw hill, “Principles of Advertising and IMC”, 2nd edition, New York, (2000)
3. John McDonough , “ Encyclopedia of Advertising”, Vol 1,(2000)

EC276 ADVERTISING LAB

Credits 0:0:2 **Marks 50+50**

12 Experiments will be notified by HOD from time to time

EC277 AUDIO LAB

Credits 0:0:2 **Marks 50+50**

12 Experiments will be notified by HOD from time to time

EC278 VIDEO LAB

Credits 0:0:2 **Marks 50+50**

12 Experiments will be notified by HOD from time to time

EC279 GRAPHICS AND ANIMATION LAB

Credits 0:0:2 **Marks 50+50**

12 Experiments will be notified by HOD from time to time

EC280 TRANSMISSION LINES AND WAVE GUIDES

Credits 4:0:0 **Marks 40+60**

Unit I: Transmission Line Theory

Different types of transmission lines – Characteristic impedance – The transmission line as a cascade of T-Sections - Propagation Constant.

General Solution of the transmission line – The two standard forms for voltage and current of a line terminated by an impedance – physical significance of the equation and the infinite line – The two standard forms for the input impedance of a transmission line terminated by an impedance – reflection coefficient – wavelength and velocity of propagation.

Waveform distortion – distortion less transmission line – The telephone cable – Inductance loading of telephone cables.

Input impedance of lossless lines – reflection on a line not terminated by characteristic impedance - Transfer impedance – reflection factor and reflection loss – T and ∏ Section equivalent to lines.

Unit II: The Line at Radio Frequencies

Standing waves and standing wave ratio on a line – One eighth wave line – The quarter wave line and impedance matching – the half wave line.

The circle diagram for the dissipationless line – The Smith Chart – Application of the Smith Chart – Conversion from impedance to reflection coefficient and vice-versa. Impedance to Admittance conversion and viceversa – Input impedance of a lossless line terminated by an impedance – single stub matching and double stub matching.

Unit III: Guided Waves

Waves between parallel planes of perfect conductors – Transverse electric and transverse magnetic waves – characteristics of TE and TM Waves – Transverse Electromagnetic waves

– Velocities of propagation – component uniform plane waves between parallel planes – Attenuation of TE and TM waves in parallel plane guides – Wave impedances.

Unit IV: Rectangular Waveguides
Transverse Magnetic Waves in Rectangular Wave guides – Transverse Electric Waves in Rectangular Waveguides – characteristic of TE and TM Waves – Cutoff wavelength and phase velocity – Impossibility of TEM waves in waveguides – Dominant mode in rectangular waveguide – Attenuation of TE and TM modes in rectangular waveguides – Wave impedances – characteristic impedance – Excitation of modes.

Unit V :Circular Wave Guides and Resonators
Bessel functions – Solution of field equations in cylindrical co-ordinates – TM and TE waves in circular guides – wave impedances and characteristic impedance – Dominant mode in circular waveguide – excitation of modes – Microwave cavities, Rectangular cavity resonators, circular cavity resonator, semicircular cavity resonator, Q factor of a cavity resonator for TE101 mode.

Text Books

1. J.D.Ryder "Networks, Lines and Fields", PHI, New Delhi, 2003. (Unit I & II)
2. E.C. Jordan and K.G.Balmain "Electro Magnetic Waves and Radiating System, PHI, New Delhi, 2003. (Unit III, IV & V)

References

1. Ramo, Whineery and Van Duzer: "Fields and Waves in Communication Electronics" John Wiley, 2003.
2. David M.Pozar: Microwave Engineering – 2^{nd} Edition – John Wiley.
3. David K.Cheng,Field and Waves in Electromagnetism, Pearson Education, 1989.

EC281 ELECTRIC CIRCUIT ANALYSIS AND NETWORKS

Credits 3:1:0 **Marks 40+60**

Unit I : Basic Circuit Concepts
Lumped circuits -Kirchoffs Laws -VI relationships of R, L and C -independent sources - dependent sources –simple resistive circuits -network reduction -voltage division -current division -source transformation.

Unit II : Sinusoidal Steady State Analysis
Phasor- sinusoidal steady state response -concepts of impedance and admittance -analysis of simple circuits- power and power factor -series resonance and parallel resonance - bandwidth and Q factor. Solution of three-phase balanced circuits -power measurements by two-wattmeter methods.

Unit : III : Mesh-Current And Node-Voltage Methods
Formation of matrix equations and analysis of complex circuits using mesh-current and nodal-voltage methods - mutual inductance- coefficient of coupling -ideal transformer.

Unit IV : Network Theorems And Applications
Superposition theorem -reciprocity theorem –compensation theorem -substitution theorem - maximum power transfer theorem -Thevenin's theorem. -Norton's theorem and Millman's theorem with applications.

UNIT V : Transient Analysis & Graph Theory
Forced and free response of RL, RC and RLC circuits with D.C. and sinusoidal excitations. - Network graph, tree - tie set and cut-set schedules-dual networks.

Text Book

1. William H.Hayt, Jv: Jack E.Kemmerly and Steven M. Durbin – Engineering Circuits Analysis – Tata Mc.Graw – Hill - 6th edition- 2002.
2. Edminister, J.A., 'Theory and Problems of Electric Circuits', Schaum's outline series McGraw Hill Book Company, 2nd Edition, 1983.

References:

1. Schaum’s series – Basic Circuit Analysis – Mc.Graw – Hill - 1998
2. K.V.V. Murthy and M.S Kamath – Basic Circuit Analysis – Jaico Publishing House, 1999
3. Norman Balabanian – Electrnic Circuits – Mc Graw – Hill Intenational edition – 1994
4. David E. Johnson: Johnny R.Johnson; John L.Hilliburn and Peter D. Scott – Electric Circuit Analysis – Prentice Hall International -Third Edition – 1997

EC282 ANTENNAS AND WAVE PROPAGATION

Credits 3:1:0 **Marks 40+60**

UNIT I : Radiation Fields of Wire Antennas
Concept of vector potential-modification of time varying retarded case. Fields associated with Hertizian dipole-Radiation power, resistance and gain of current element- Radiation resistance of elementary dipole with linear current distribution- Radiation from half-wave dipole and quarter wave monopole-Assumed current distribution for wire antennas-Use of capacity hat and loading coil for short antennas

UNIT II : Antenna Fundamentals and Antenna Arrays
Definitions: Radiation intensity-Directive gain-Directivity-Power gain-Beam width-Band width. Radiation resistance and gain of half wave dipole and folded dipole-Reciprocity principle-Effective length and effective area. Relation between gain effective length and radiation resistance
Loop Antennas: Radiation from small loop and its radiation resistance- Radiation from loop with circumference equal to wavelength and resultant circular polarization on axis
Helical Antennas: Normal and axial mode of operation
Antenna Arrays: Expression for electric field from two or three element arrays-uniform linear array-method of pattern multiplication-binomial array-image method

UNIT III : Travelling Wave Antennas
Radiation from a traveling wave on a wire
Rhombic Antenna: Analysis and design

Coupled Antennas: Self and mutual impedence-2 and 3 element yagi antennas-Log periodic antennas-feeding and transposing of lines- effects of decreasing α.

UNIT IV : Aperture and Lens Antennas

Radiation from Huygen's source- Radiation from the open end of a coaxial line- Radiation from a rectangular aperture treated as an array of Huygen's source-Equivalence of fields of slot and complementary dipole- Relation between dipole and slot impedances.

Feeding of slot antennas-Thin slot in an infinite cylinder-Field on E plane horn-Radiation from circular aperture-Beam width and effective area

Reflector antennas-Lens antennas-Spherical waves and biconical antennas

UNIT V: Propagation

Sky wave propagation: Structure of ionosphere-Effective dielectric constant of ionized region-Refraction-Refractive index-critical frequency-Skip distance-Effect of earth's magnetic field-collisions-Max usable frequency-fading-diversity reception

Space wave propagation: Reflection of polarized waves-Reflection characteristics of earth-Resultant of direct and reflected wave at the receiver-Duct propagation

Ground wave propagation: Attenuation characteristics-calculation of field strength

Text Book:

1. John D Kraus and Ronalatory Marhefka "Antennas" Tata Mc Graw Hill 2002
2. Jordan and Balmain, "Electromagnetic waves and radiating systems", PHI, 1968, Reprint 2003

Reference:

1. R.E. Collins "Antennas and Radio wave propagation" Mc Graw Hill 1987
2. Balanis, C.S "Antenna Theory Analysis and Design" John Wiley & Sons, II Edition 2003.

EC353 SOLID STATE DEVICE MODELING AND SIMULATION

Credit: 4:0:0 **Marks (40 + 60)**

Unit I : Basic Semiconductor Physics

Quantum Mechanical Concepts, Carrier Concentration, Transport Equation, Bandgap, Mobility and Resistivity, Carrier Generation and Recombination, Avalanche Process, Noise Sources.

Unit II : Bipolar Device Modeling

Injection and Transport Model, Continuity Equation, Diode Small Signal and Large Signal (Change Control Model), Transistor Models: Ebber - Molls and Gummel Port Model, Mextram model, SPICE modeling temperature and area effects.

Unit III : MOSFET Modeling
Introduction Interior Layer, MOS Transistor Current, Threshold Voltage, Temperature Short Channel and Narrow Width Effect, Models for Enhancement, Depletion Type MOSFET, CMOS Models in SPICE.

Unit IV : Parameter Measurement
General Methods, Specific Bipolar Measurement, Depletion Capacitance, Series Resistances, Early Effect, Gummel Plots, MOSFET: Long and Short Channel Parameters, Statistical Modeling of Biopolar and MOS Transistors.

Unit V : Optoelectronic Device Modeling
Static and Dynamic Models, Rate Equations, Numerical Technique, Equivalent Circuits, Modeling of LEDs, Laser Diode and Photodetectors.

Reference Books:

1. Philip E. Allen, Douglas R.Hoberg, "CMOS Analog Circuit Design" Second Edition, Oxford Press - 2002.
2. Kiat Seng Yeo, Samir S.Rofail, Wang-Ling Gob, "CMOS / BiCMOS VLSI - Low Voltage, low Power", Person education, Low price edition, 2003.
3. S.M.Sze "Semiconductor Devices - Physics and Technology", John Wiley and sons, 1985.
4. Giuseppe Massobrio and Paolo Antogentti, "Semiconductor Device Modeling with SPICE" Second Edition, McGraw-Hill Inc, New York, 1993.
5. Mohammed Ismail & Terri Fiez "Analog VLSI-Signal & Information Processing" 1st ED,Tata McGraw Hill Publishing company Ltd 2001.

EC354 GENETIC ALGORITHMS FOR VLSI DESIGN

Credit : 4:0:0 **Marks (40 + 60)**

Unit I
Introduction, GA Technology-Steady State Algorithm-Fitness Scaling-Inversion

Unit II
GA for VLSI Design, Layout and Test automation- partitioning-automatic placement, routing technology, Mapping for FPGA- Automatic test generation- Partitioning algorithm Taxonomy-Multiway Partitioning

Unit III
Hybrid genetic – genetic encoding-local improvement-WDFR-Comparison of GAS - Standard cell placement-GASP algorithm-unified algorithm.

Unit IV
Global routing-FPGA technology mapping-circuit generation-test generation in a GA frame work-test generation procedures.

Unit V

Power estimation-application of GA-Standard cell placement-GA for ATG-problem encoding- fitness function-GA vs Conventional algorithm.

References

1. Pinaki Mazumder, E.M Rudnick,"Genetic Algorithm for VLSI Design,Layout and test Automation", Prentice Hall,1998.
2. Randy L. Haupt, Sue Ellen Haupt, "Practical Genetic Algorithms" Wiley – Interscience,1977.
3. Ricardo Sal Zebulum, Macro Aurelio Pacheco, Marley Maria B.R. Vellasco, Marley Maria Bernard Vellasco "Evolution Electronics: Automatic Design of electronic Circuits and Systems Genetic Algorithms", CRC press, 1st Edition Dec 2001.
4. John R.Koza, Forrest H.Bennett III, David Andre , Morgan Kufmann, "Genetic Programming Automatic programming and Automatic Circuit Synthesis", 1st Edition May 1999.

EC355 ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY IN SYSTEM DESIGN

Credit : 4:0:0 **Marks (40 + 60)**

Unit I : EMI Environment

EMI/EMC concepts and definitions, Sources of EMI, conducted and radiated EMI, Transient EMI, Time domain Vs Frequency domain EMI, Units of measurement parameters, Emission and immunity concepts, ESD.

Unit II : EMI Coupling Principles

Conducted, Radiated and Transient Coupling, Common Impedance Ground Coupling, Radiated Common Mode and Ground Loop Coupling, Radiated Differential Mode Coupling, Near Field Cable to Cable Coupling, Power Mains and Power Supply coupling.

Unit III : EMI/EMC Standards And Measurements

Civilian standards - FCC,CISPR,IEC,EN,Military standards - MIL STD 461D/462, EMI Test Instruments /Systems, EMI Shielded Chamber, Open Area Test Site, TEM Cell, Sensors/Injectors/Couplers, Test beds for ESD and EFT, Military Test Method and Procedures (462).

Unit IV : EMI Control Techniques

Shielding, Filtering, Grounding, Bonding, Isolation Transformer, Transient Suppressors, Cable Routing, Signal Control, Component Selection and Mounting.

Unit V : EMC Design of PCBs

PCB Traces Cross Talk, Impedance Control, Power Distribution Decoupling, Zoning, Motherboard Designs and Propagation Delay Performance Models.

References

1. Henry W.Ott, "Noise Reduction Techniques in Electronic Systems", John Wiley and Sons, NewYork. 1988.

2. C.R.Paul, “Introduction to Electromagnetic Compatibility” , John Wiley and Sons, Inc, 1992
3. V.P.Kodali, "Engineering EMC Principles, Measurements and Technologies", IEEE Press, 1996.
4. Bernhard Keiser, "Principles of Electromagnetic Compatibility", Artech house, 3rd Ed, 1986.

EC356 MEMS AND NANO TECHNOLOGY

Credit : 4:0:0 **Marks (40 + 60)**

Unit I : Introduction to MEMS and Micro Systems

Microsystems and Microelectronics – Miniaturization – Microsensors: Chemical Sensors, Optical Sensors, Pressure Sensors, Thermal Sensors – Microactuators and Micromotors.

Unit II : Microsystem Materials

Molecular Theory and Intermolecular Forces – Silicon Piezo Resistors – Electrochemistry – Substrates and Wafers – Silicon Compounds – Polymers – Packaging Materials.

Unit III : Microsystem Fabrication Process

Photolithography – Ion Implantation – Diffusion – Oxidation – Chemical Vapor Deposition – Etching – Applications Of MEMS in Automatic, Telecom and Other Industries.

Unit IV : Nanotechnology Basics

Nanobuilding Blocks – Atoms and Molecular Structure – Molecular Recognition – Tools For Measuring Nanostructures – Electron Microscopy – Spectroscopy – Molecular Synthesis and Polymerisation – Encapsulation.

Unit V : Applications Of Nanotechnology In Medicines

Nanobiosensors – Electronic Nose – Photo Dynamic Therapy – Molecular Motors – Protein Engineering.

Text Books

1. Tai-Ran Hsu, “MEMS & Microsystems Design & Manufacture”, Tata Mc Graw Hill, 2002.
2. Richard Booker, Earl Boysen,”Nanotechnology”, Wiley Dreamtech(p) Ltd, 2006.

References

1. Mart Ratner, Daniel Ratner, “Nanotechnology”, Pearson Education, 2003.

EC357 RF SYSTEM DESIGN

Credit : 4:0:0 **Marks (40 + 60)**

Unit I : RF Issues

Importance of RF design, Electromagnetic Spectrum, RF behaviour of passive components, Chip components and Circuit Board considerations, Scattering Parameters, Smith Chart and applications.

Unit II : RF Filter Design
Overview , Basic resonator and filter configuration, Special filter realizations, Filter implementations, Coupled filter.

Unit III : Active RF Components & Applications
RF diodes, BJT, RF FETs, High electron mobility transistors; Matching and Biasing Networks – Impedance matching using discrete components, Microstripline matching networks, Amplifier classes of operation and biasing networks.

Unit IV : RF Amplifier Designs
Characteristics, Amplifier power relations, Stability considerations, Constant gain circles, Constant VSWR circles, Low Noise circuits, Broadband , high power and multistage amplifiers.

Unit V : Oscillators, Mixers & Applications
Basic Oscillator model, High frequency oscillator configuration, Basic characteristics of Mixers ; Phase Locked Loops ; RF directional couplers and hybrid couplers ; Detector and demodulator circuits. Microwave integrated circuits.

References:

1. Reinhold Ludwig and Powel Bretchko, RF Circuit Design – Theory and Applications, Pearson Education Asia, First Edition, 2001.
2. Joseph . J. Carr, Secrets of RF Circuit Design , McGraw Hill Publishers, Third Edition, 2000.
3. Mathew M. Radmanesh, Radio Frequency & Microwave Electronics, Pearson Education Asia, Second Edition, 2002.
4. Ulrich L. Rohde and David P. NewKirk, RF / Microwave Circuit Design, John Wiley & Sons USA 2000.
5. Roland E. Best, Phase - Locked Loops: Design, simulation and applications, McGraw Hill Publishers 5TH edition 2003.

EC358 ADVANCED EMBEDDED SYSTEM DESIGN

Credit : 4:0:0 **Marks (40 + 60)**

Unit I : ARM Processor Architecture
CISC & RISC Architecture – Block diagram-Introduction to ARM7/ARM9…. and ARM extensions – Pipelines – Memory - Architecture – Memory interfacing – Bus architecture – AMBA; Examples of embedded ARM cores – Philips ARM7 core – Architecture – Peripheral interfacing

Unit II : ARM Instructions & Programming
Programming in assembly language (ALP) – The **ARM** instruction set – Introduction to arm thumb – Thumb programmers model – **ARM**/Thumb inter working-Example and exercises

Unit III : Embedded C Programming for ARM
Support for high-level languages-Review of C-Programming-C Program Elements, Macros and functions.-Use of Pointers- NULL Pointers-Use of Function Calls-Function Queues and

Interrupt Service Routines Queues Pointers-Concepts of EMBEDDED PROGRAMMING in C-“C” Program compilers- Cross compiler

Unit IV : Real Time Operating Systems

Definitions of process, tasks and threads – ISRs and tasks by their characteristics –Structures-Kernel-Process Management-Memory Management-Device Management-File System Organisation and Implementation-I/O Subsystems-Interrupt Routines Handling in RTOS-Task scheduling models-Message Queues-Mailboxes-Pipes

Unit V : RTOS Implementation with ARM

Study of Micro C/OS-IT & Embedded LINUX RTOS-RTOS System Level Functions-Task Service Functions-Time Delay Functions-Memory Allocation Related Functions-Semaphore Related Functions-Mailbox Related Functions- Queue Related Functions-Case Studies-Multiple Tasks and their functions-Creating a list of tasks.

Textbooks

1. Rajkamal, Embedded Systems Architecture, Programming and Design, TATA McGraw-Hill, First reprint Oct ,2003
2. Steve Heath, Embedded Systems Design, Second Edition-2003, Newness
3. David E. Simon, An Embedded Software Primer, Pearson Education Asia, First Indian Reprint 2000.
4. Wayne Wolf, Computers as Components, Principles of Embedded Computing System Design-Harcourt India, Morgan Kaufman Publishers, First Indian Reprint 2001
5. Jean J. Labrosse, Micro C/OS-II The Real-Time Kernel, Second Edition, CMP Books
6. ARM System-on Chip Architecture by Steve Furber, Publisher, Addison Wesley, ISBN: 0201675196

Websites :

1. WWW.arm com

EC359 ASIC DESIGN LAB

Credits 0:0:2 **Marks 50+50**

1. 6 experiments will be notified by the HOD from time to time
2. Mini Project work using Menter Graphics front end and back end tools

SCHOOL OF

ELECTRICAL SCIENCES

ADDITIONAL SUBJECTS

Code No.	Subject Name	Credits
EC283	Electron Devices	4:0:0
EC284	Digital Electronics	3:1:0
EC285	Signals & Systems	3:1:0
EC286	Radar and Navigational Aids	4:0:0
EC287	Speech Processing	4:0:0
EC360	Digital Signal Processor Architectures and Applications	4:0:0
EC361	Modelling of Digital System Using HDL	4:0:0
EC362	Analysis and Design of Analog Integrated Circuits	4:0:0
EC363	Computer Aided VLSI Design	4:0:0
EC364	Embedded System Design	4:0:0
EC365	Analog VLSI Design	4:0:0
EC366	High Performance Communication Networks	4:0:0
EC367	Analysis and Design of Analog Integrated Circuits	4:0:0
EC368	Soft Computing	4:0:0
EC369	Modern Digital Communication Techniques	4:0:0
EC370	Advanced VLSI Design	4:0:0
EC371	Applied Electronics Lab – I	0:0:2
EC372	Applied Electronics Lab – II	0:0:2
EC374	Wavelet Transforms and Applications	4:0:0
EC375	Global Tracking and Positioning Systems	4:0:0

EC283 ELECTRON DEVICES

Credit : 4:0:0

Unit I: Electron Ballistics

Charged Particles – Constant electric Field – Two dimensional motions – Electrostatic Deflection in CRT – CRO – Force in magnetic Field – Motion in a magnetic field – Magnetic deflection in CRT – Combined electric and Magnetic Field.

Unit II: Theory of PN Diodes

Mobility and conductivity – Drift and diffusion currents - Hall effect - Continuity equation – PN junction – Open circuit junction – Depletion Region – Barrier Potential – Diode Equation – Forward and Reverse characteristics – Transition and diffusion capacitance.

Unit III: Theory of Junction Transistors

Transistor action – Transistor parameters – Transistor current components – emitter injection efficiency – base transport factor – collector efficiency – Large signal current gain - Eber

Moll equation – static characteristics of transistors (CE,CB,CC) – comparison of transistor configuration.

Unit IV: Theory of FET, UJT and SCR
Junction FET operation – Static characteristics – FET structure – Enhancement MOSFET, Depletion MOSFET – Comparison of JFET and MOSFET– Power MOSFET UJT : Operation, Static characteristics– SCR: Construction- Static- Characteristics

Unit V: Special Semiconductor Devices
Zener diodes – Schotky Barrier diode – Tunnel diodes – DIAC – TRIAC – Photo diodes – Photo transistors – LED – LCD – optocouplers – Gunn diodes - Varactor diode- Digital electronic display- plasma display, nano crystal display.

Text Books

1. Jacob Millman, Christos C Halkias, Satyabrata Jit, "Electronic Devices & Circuits",Tata McGraw Hill, 2008.
2. Albert Malvino, David A Bates, "Electronic Principles", Tata McGraw Hill, Seventh Edition, 2008.

Reference Books

1. David.A.Bell, "Electronic Devices & Circuits ", PHI, 1998.
2. Robert Boylestad, "Electronic Devices & Circuit Theory", Sixth Edition, PHI, 2002.
3. Charles A Schuler, Roger L Tokheim, "Electronics Principles and Applications", Tata McGraw Hill, Sixth edition, 2003.

EC284 DIGITAL ELECTRONICS

Credit : 3:1:0

Unit I : Number Systems & Boolean Algebra
Review of binary, octal, & hexadecimal number systems-representation of signed numbers-floating point number representation-BCD-ASCII-EBCDIC-Excess 3 codes-gray code-error detecting & correcting codes. Boolean Algebra:Postulates & theorems of Boolean Algebra – canonical forms –simplification of logic functions using karnaugh map Quine Mcclausky method.

Unit II : Combinational Logic Design
Logic gates –implementation of combinational logic functions – encoders & decoders – multiplexers & demultiplexers –code converters – comparator - half adder, full adder – parallel adder – binary adder – parity generator/checker – implementation of logical functions using multiplexers.

Unit III :Counters &Registers
RS, JK, JK Master–slave, D&T flip flops – level triggering and edge triggering – excitation tables –asynchronous & synchronous counters – modulus counters–shift register –Johnson counter- ring counter – timing waveforms-counter applications.

Unit IV: Synchronous Sequential Logic Design

Basic models of sequential machines – concept of state table – state diagram – state reduction through partitioning & implementation of synchronous sequential circuits

Unit V: Digital Logic Families
LOGIC FAMILIES: RTL, DTL, TTL families, schottky – clamped TTL, Emitter Coupled (ECL), Integrated Injection Logic (IIL), MOS inverters, CMOS inverters, comparison of performance of various logic families.

Text Book

1. Morris Mano, "Digital logic and computer Design", 3rd edition Prentice Hall Of India, 2002.

Reference Books

1. Tokheim R.L, "Digital Electronics-Principles and Applications", Tata McGraw Hill, 1999.
2. JAIN R.P, "Modern Digital Electronics", third edition, Tata Mcgraw Hill, 2003
3. Floyd T.L., "Digital Fundamentals ", Prentice Hall, 9th edition, 2006
4. Alan B Marcovitz, "Introduction to Logic and Computer Design", Tata McGraw Hill, 2003.

EC285 SIGNALS AND SYSTEMS

Credit: 3:1:0

Unit I: Introduction
Continuous Time (CT) signals – CT signal operations – Discrete Time(DT) signals – Representation of DT signals by impulses – DT signal operations – CT and DT systems – Properties of the systems – Linear Time Invariant(LTI) and Linear Shift Invariant(LSI) systems – Continuous and Discrete Convolutions – CT system representations by differential equations – DT System representations by difference equations.

Unit II: Fourier Analysis of Ct Signals and Systems
Fourier series representation of periodic signals – Properties – Harmonic analysis of LTI systems – Convergence of Fourier series – Representation of a periodic signals by Continuous Time Fourier Transform (CTFT) – Properties – Frequency response of systems characterized by Differential Equations – Power and Energy Spectral Density–Parseval's Relation.

Unit III: Sampling and Laplace Transform
Representation of CT signals by samples – Sampling Theorem – Sampling Methods – Impulse, Zero – order hold method – Reconstruction of CT signal from its samples – Effect of under sampling – Aliasing Error – Discrete Time processing of CT signals. Analysis and Characterization of LTI system using the Laplace Transform, System function algebra and block diagram representation – Unilateral Laplace transform

Unit IV: Fourier Analysis of DT Signals and Systems

Discrete Time Fourier series representation of DT periodic signals – Properties – Representation of DT aperiodic signals by Discrete Time Fourier Transform(DTFT) – Properties – Frequency response of systems characterized by Difference Equations – Power and Energy Spectral Density concepts related to DT signals – Parseval's Relation.

Unit V: Transform Operations of DT Signals and Systems
Z transforms and its properties – Inverse Z transform – Solution of Difference equations – Analysis of LSI systems using Z transform.

Text Books

1. Alan V Oppenheim, Alan S Wilsky and Hamid Nawab S, "Signals & Systems", II Edition, PHI, New Delhi, 1997.
2. Simon Haykin and Barry Van Veen, "Signals & Systems", Second Edition, John Wiley and Sons Inc., 2005

Reference Books

1. Ashok Ambardar, "Introduction to Analog and Digital Signal Processing", PWS Publishing Company, Newyork, 1999.
2. Samir S Solimon and Srinath M.D., "Continuous and Discrete Signals and Systems", II Edition, PHI, 1998.
3. Rodger E Zaimer and William H Tranter, "Signals & Systems – Continuous and Discrete", McMillan Publishing Company, Fourth edition, 1998.

EC286 RADAR AND NAVIGATIONAL AIDS

Credit: 4:0:0

Unit I: Radar Equation
Radar block diagram and operation - Radar frequencies -Radar range equation - Prediction of range performance - Minimum detectable signal - Radar cross section of targets - cross section fluctuations - Transmitter power - Pulse repetition frequency and range ambiguities - system loss and propagation effects

Unit II: CW and FM CW Radar
Doppler Effect CW radar- Basic principle and operation of FMCW radar - MTI and pulse Doppler line cancellers - Range gated Doppler filter - Non Coherent MTI - Pulse Doppler radar - Tracking radars - sequential lobing - Conical scan and simultaneous lobing monopulse

Unit III: Synthetic Aperture and Air Surveillance Radar
Synthetic aperture radar - resolution; Radar equation, SAR signal processing- Inverse SAR, Air surveillance radar- User's requirements- Characteristics and frequency consideration. ECCM and BIOSTATIC RADAR: Electronic counter - Counter measures- bistatic radar- Description bistatic radar equation - Comparison of monostatic radars.

Unit 1V: Radar Signal Detection and Propagation on Waves
Detection Criteria ; Automatic detection : constant false alarm rate receiver. Information available from a radar; Ambiguity diagram; Pulse Compression. Propagation over plane

earth; Anomalous propagation and diffraction. Introduction to clutter, surface clutter, Radar equation

Unit V: Radio Navigation
Adcock directional finder- automatic Directional finder- VHF omni directional range- Hyperbolic systems of navigation - Loren and Decca Navigation system" Tactical air navigation ILS and GCA as aids to approach and landing

Text Book

1. Merrill. I. Skolnik "Introduction to Radar Systems", Tata McGraw-Hill (3rd Edition) 2003

Reference Books

1. Peyton Z. Peables, "Radar Principles", John Wiley, 2004.
2. J.C. Toomay, "Principles of Radar" 2nd edition – PHI, 2004.

EC287 SPEECH PROCESSING

Credit: 4:0:0

Unit I: Nature of Speech Signal
Speech production mechanism- Classification of speech- sounds- nature of speech signal-models of speech production. Speech signal processing : purpose of speech processing-digital models for speech signal- Digital processing of speech signals- Significance- short time analysis.

Unit II: Time Domain Methods for Speech Processing
Time domain parameters of speech- methods for extracting the parameters- Zero crossing-Auto correlation functions - pitch estimation.

Unit III: Frequency Domain Methods for Speech Processing
Short time Fourier analysis- filter bank analysis- spectrographic analysis- Format extraction-pitch extraction- Analysis – synthesis systems.

Unit IV: Linear Predictive Coding of Speech
Formulation of linear prediction problem in time domain- solution of normal equations-interpretation of linear prediction in auto correlation and spectral domains.

Unit V: Homomorphic Speech Analysis
Central analysis of speech- format and pitch estimation- Applications of speech processing - Speech recognition- Speech synthesis and speaker verification.

Text Book

1. Ben Gold- Nelson Mergan, "Speech & Audio Signal Processing: Processing and perception of speech and music," John Wiley & Sons, 2000

Reference Books

1. Thomas F. quatieri, “Discrete Time Speech Signal Processing : Principles & Practice” Prentice Hall Signal Processing Series, 2001.
2. L.R. Rabiner and R.E Schafer: Digital Processing of speech signals, Prentice Hall, 1978

EC360 DIGITAL SIGNAL PROCESSOR ARCHITECTURES AND APPLICATIONS

Credit: 4:0:0

Unit I: Introduction to DSP Processors
Difference between DSP and other Microprocessor Architectures- Their Comparison- Need for Special ASPs- RISC Vs CISC- Overview of Various DSP Architectures

Unit II: Fixed Point DSP’s
Architecture of TMS320C5X & C54X Processors- Assembly Instructions- Addressing Modes- Pipelining and Peripherals

Unit III: Floating Point DSP’s
Architecture of TMS320C3X- Instruction Set- Addressing Modes- Data Formats- Floating Point Operation- Pipelining and Peripherals

Unit IV: DSP Interfacing and Development Tools
Interfacing with I/O- A/D Converters- Interfacing to PC- Dual Ported RAM- EEPROMS. DSP Tools: Assembler- Debugger- C Compiler- Linker and Loader.

Unit V: Overview of Other DSP’s and Applications
VLIW Architecture- SHARC- SIMD- MIMD Architectures- Multiprocessor DSPs and Other DSPs. Applications: Adaptive Filter- Spectrum Analyzer - Echo Cancellation- Modem- Voice Synthesis and Recognition.

Text Book
1. B.Venkatramani & M.Baskar, “Digital Signal Processor”, McGraw Hill, 2000

Reference Books
1. C.Marven & G.Ewers, “A Simple Approach to Digital Signal Processing”, Wiley Inter Science, 1996.
2. K.K Parthi, “VLSI Digital Signal Processing Systems”, John Wiley, 1999.
4. K.Slin, “DSP Application with the TMS320 Family”, Volume 3, Prentice Hall, 1990

EC361 MODELLING OF DIGITAL SYSTEM DESIGN USING HDL

Credit: 4:0:0

Unit I: Introduction to Advanced Digital System Design

Minimization of Boolean expression- K-Map- Quine McClusky method- Combinational Circuits- Sequential Circuits- Design of CLC- Multiple output minimization- Design of static hazard free and dynamic hazard free logic circuits- Programmable logic primer : PLA- PAL – PLDs- Programmable Gate Arrays. FPGAs : Xilinx 3000 series and 4000 series- Altera complex programmable logic devices (CPLDs)- Altera flex 10k series CPLDs.

Unit II: Sequential & Asynchronous Circuit Design
Mealy machine - Moore machine - State diagrams - State table minimization - Incompletely specified sequential machines - State assignments. Analysis of Clocked Synchronous Sequential Networks (CSSN) Modeling of CSSN –State Stable Assignment and Reduction – Design of CSSN – Design of Iterative Circuits – ASM Chart – ASM Realization. Analysis of Asynchronous Sequential Circuit (ASC) – Flow Table Reduction Racesin ASC – State Assignment – Problem and the Transition Table – Design of ASC –Static and Dynamic Hazards – Essential Hazards – Data Synchronizers – Designing Vending Machine Controller – Mixed Operating Mode Asynchronous Circuits.

Unit III: Symmetric Functions
Elementary symmetric functions - Partially symmetric and totally symmetric functions - Mc Cluskey de-composition method - Synthesis of symmetric function by contact networks.

Unit IV: Introduction to VHDL
Entity - Architecture - Data Types Variables – Signals – Constants – Arrays – Operators – Functions – Procedures – Packages – Libraries – Attributes – Operator Overloading – Generics – Modeling Delays - Modeling Synchronous Logic and State Machine Modeling.

Unit V: Introduction to Verilog
Design methodology – Modules – Ports – Basic concepts – Operators – Nos. specification – Data types – Arrays – Parameters – Gate delays – Operator types – Conditional statements – Multiway branches - Loops - Switch – Modeling elements.

Text Books

1. Charles. H. Roth, Jr, “Digital System Design using VHDL”, PWS Publishing Company, 2001
2. M. Bolton, “Digital System Design with Programmable Logic”, Addition Wesly, 1990.

Reference Books

1. A.P. Godse, D.A. Godse, “Digital Systems”, Technical Publications, Pune, 2003.
2. P.K.Chan & S. Mourd,” Digital Design using Field programmable Gate Array”, Prentice Hall 1994.
3. Samir Palnitkar, “Verilog HDL”, Pearson Publication”, II Edition. 2003.
4. J. Bhaskar, “A VHDL Synthesis Primer”, BS Publications, III Edition, 2004.
5. William I.Fletcher, “An Engineering Approach to Digital Design”, Prentice Hall of India, 1996.
6. R.F. Tinder, “Engineering Digital Design” Academic Press. 2000

EC362 ANALYSIS AND DESIGN OF ANALOG INTEGRATED CIRCUITS

Credit: 4:0:0

Unit I: Models for Integrated Circuit Active Devices
Depletion region of a pn junction – large signal behavior of bipolar transistors- small signal model of bipolar transistor- large signal behavior of MOSFET- small signal model of the MOS transistors- short channel effects in MOS transistors – weak inversion in MOS transistors- substrate current flow in MOS transistor.

Unit II: Circuit Configuration for Linear Ic
Current sources- Analysis of difference amplifiers with active load using BJT and FET- supply and temperature independent biasing techniques- voltage references- Output stages: Emitter follower- source follower and Push pull output stages.

Unit III: Operational Amplifiers
Analysis of operational amplifiers circuit- slew rate model and high frequency analysis- Frequency response of integrated circuits: Single stage and multistage amplifiers- Operational amplifier noise

Unit IV: Analog Multiplier and PLL
Analysis of four quadrant and variable trans conductance multiplier- voltage controlled oscillator- closed loop analysis of PLL- Monolithic PLL design in integrated circuits: Sources of noise- Noise models of Integrated-circuit Components – Circuit Noise Calculations – Equivalent Input Noise Generators – Noise Bandwidth – Noise Figure and Noise Temperature

Unit V: Analog Design with MOS Technology
MOS Current Mirrors – Simple- Cascode- Wilson and Widlar current source – CMOS Class AB output stages – Two stage MOS Operational Amplifiers- with Cascode- MOS Telescopic-Cascode Operational Amplifier – MOS Folded Cascode and MOS Active Cascode Operational Amplifiers

Text Books

1. Gray, Meyer, Lewis, Hurst, “Analysis and design of Analog IC’s”, 4th Edition,Wiley International, 2002.
2. Behzad Razavi, “Design of Analog CMOS Integrated Circuits”, S.Chand and company ltd, 2000

Reference Books

1. Nandita Dasgupata, Amitava Dasgupta,”Semiconductor Devices,Modelling and Technology”, Prentice Hall of Indiapvt.ltd,2004.
2. Grebene, Bipolar and MOS Analog Integrated circuit design”, John Wiley & sons,Inc.,2003.
3. Phillip E.Allen Douglas R. Holberg, “CMOS Analog Circuit Design”, Second Edition, Oxford University Press, 2003

EC363 COMPUTER AIDED VLSI DESIGN

Credit: 4:0:0

Unit I: Introduction to Data Structure and Basic Algorithms

Introduction to VLSI Methodologies- A quick tour of VLSI Design Automation Tools -Data structures and Basic Algorithms- Algorithmic graph theory and computational complexity.

Unit II: Placement & Partitioning

Tractable and Intractable problems-Placement and Partitioning- Circuit representation - Placement algorithms – partitioning

Unit III: Floorplanning & Routing

Floorplanning concepts - shape functions and floorplan sizing - Types of local routing problems - Area routing - channel routing - global routing - algorithms for global routing.

Unit IV: Simulation & Synthesis

Simulation - Gate-level modeling and simulation - Switch-level modeling and simulation - Combinational Logic Synthesis - Binary Decision Diagrams - Two Level Logic Synthesis. High level Synthesis - Hardware models - Internal representation - Allocation assignment and scheduling - Simple scheduling algorithm - Assignment problem – High level transformations.

Unit V : Compaction & FPGAs and MCMs

Layout Compaction - Design rules - problem formulation - Physical Design Automation of FPGAs – MCMs

Text Book

1. N.A. Sherwani, “Algorithms for VLSI Physical Design Automation”, JOHN WILEY, 1999.

Reference Books

1. S.H. Gerez, “Algorithms for VLSI Design Automation”, John Wiley, 1999.
2. Mark Bimbaum, “Essential EDA”, Prentice Hall, 2003.

EC364 EMBEDDED SYSTEM DESIGN

Credits: 4: 0: 0

Unit I: Embedded Architecture

Embedded Computers- Characteristics of Embedded Computing Applications- Challenges in Embedded Computing system design- Embedded system design process- Requirements- Specification- Architectural Design- Designing Hardware and Software Components- System Integration- Formalism for System Design- Structural Description- Behavioral Description- Design Example: Model Train Controller

Unit II: Embedded Processor and Computing Platform

ARM processor- processor and memory organization- Data operations- Flow of Control-

SHARC processor- Memory organization- Data operations- Flow of Control- parallelism with instructions- CPU Bus configuration- ARM Bus- SHARC Bus- Memory devices- Input/output devices- Component interfacing- designing with microprocessor development and debugging- Design Example : Alarm Clock.

Unit III: Networks
Distributed Embedded Architecture- Hardware and Software Architectures- Networks for embedded systems- I2C- CAN Bus- SHARC link ports- Ethernet- Myrinet- Internet- Network-Based design- Communication Analysis- system performance Analysis- Hardware platform design- Allocation and scheduling- Design Example: Elevator Controller.

Unit IV: Real Time Characteristics
Clock driven Approach, weighted round robin Approach, Priority driven Approach, Dynamic Versus Static systems, effective release times and deadlines, Optimality of the Earliest deadline first (EDF) algorithm, challenges in validating timing constraints in priority driven systems, Off-line Versus On-line scheduling**.**

Unit V: System Design Techniques
Design Methodologies- Requirement Analysis- Specification- System Analysis and Architecture Design- Quality Assurance- Design Example: Telephone PBX- System Architecture- Ink jet printer- Hardware Design and Software Design- Personal Digital Assistants- Set-top Boxes.

Text Book

1. Wayne Wolf, Computers as Components: Principles of Embedded Computing System Design, Morgan Kaufman Publishers, 2001.

Reference Books

1. Jane.W.S. Liu Real-Time systems, Pearson Education Asia, 2000
2. C. M. Krishna and K. G. Shin , Real-Time Systems, ,McGraw-Hill, 1997
3. Frank Vahid and Tony Givargi Embedded System Design: A Unified Hardware/Software Introductions, John Wiley & Sons, 2000.

EC365 ANALOG VLSI DESIGN

Credit: 4:0:0

Unit I: Introduction to Analog VLSI and Basic CMOS Circuit Techniques
Introduction to Analog VLSI: VLSI Microelectronics- Mixed-Signal VLSI chips- Potential of Analog VLSI. Basic CMOS circuit Techniques: MOS Models- Current Division Technique- Basic Gain Stage- Limitations- Gain-Boosting Technique- Super MOS Transistor

Unit II: Device Modelling
Modelling-MOS Models: DC, small signal and high frequency model, Measurement of MOSFET Parameters- Diode models: DC, small signal and high frequency diode model – Bipolar Models: DC, small signal and high frequency BJT model- Measurement of BJT model parameters-Passive component model- Monolithic capacitors and Resistors.

Unit III: Analog Systems
Analog signal processing-Digital-to- Analog converters; Current scaling, Voltage scaling and charge scaling-Serial D/A Converters-analog-to Digital Converters: Serial A/D Converters, Successive approximation A/D –Parallel-High Performance A/D Converters - Continuous Time filters: Low pass filters- High pass filters- Band pass filters.

Unit IV: Design Automation and Verification
Integrated circuit layout-Symbolic circuit representation-Design rule Checks- Circuit Extraction – Digital circuit Simulation- Logic and Switch simulation- Timing analysis-Register Transfer- Level simulation.

Unit V: Bicmos Circuit Techniques and Current-Mode Signal Processing
BiCMOS Circuit Techniques: Devices and Technology- Basic Analog Sub circuits. Current-Mode Signal Processing: Continuous-Time Signal Processing- Sampled-Data Signal Processing- Switched-Current Data Converters.

Text Book

1. Philip E. Allen, Douglas R. Halberg, "CMOS Analog Circuit Design", Oxford University Press, II Edition, 2003.

Reference Books

1. Randall L.Geiger, Philip E.Allen, Noel K.Strader, "VLSI Design Techniques for Analog and Digital Circuits", McGraw Hill International Co, 1990.
2. Mohammed Ismail, Terri Fiew, "Analog VLSI Signal and information Processing", McGraw Hill International Edition., 1994
3. Malcom R.Haskard, Lan C. May, "Analog VLSI Design, NMOS and CMOS", Prentice Hall, 1998.
4. Jose E.France, Yannis Tsividis," Design of Analog Digital VLSI Circuits for Telecommunications and Signal Processing" Prentice Hall, 1994.

EC366 HIGH PERFORMANCE COMMUNICATION NETWORKS

Credits: 4:0:0

Unit I: Basics of Networks
Telephone- computer- Cable television and Wireless network- networking principles-Digitalization: Service integration- network services and layered architecture- traffic characterization and QOS- networks services: network elements and network mechanisms

Unit II: Packet Switched Networks
OSI and IP models: Ethernet (IEEE 802.3); token ring (IEEE 802.5)-FDDI-DQDB- frame relay-: SMDS: Internet working with SMDS

Unit III: Internet and TCP/IP Networks
Overview;internet protocol;TCP and VDP;performance of TCP/IP networks circuit switched networks:SONET;DWDM-Fibre to home-DSL.Intelligent networks-CATV.

Unit IV: ATM and Wireless Networks
Main features-adressing- signalling and routing; ATM header structure-adaptation layer-management and control; BISDN; Internetworking with ATM -Wireless channel- link level design- channel access; Network design and wireless networks- wireless network standard- IEEE 802.11

Unit V: Optical Networks and Switching
Optical links- WDM systems- cross-connects -optical LAN's- optical paths and networks; TDS and SDS: modular switch designs-Packet switching- distributed- shared- input and output buffers. - Optical network standards- IEEE 802 LAN/ MAN

Text Book

1. Jean warland and Pravin Varaiya, “High Performance Communication Networks ", 2nd Edition, Harcourt and Morgan Kauffman, London, 2000.

Reference Books

1. Leon Gracia, Widjaja, “Communication networks ", Tata McGraw-Hill, New Delhi, 2000.
2. Sumit Kasera, Pankaj Sethi, “ATM Networks ", Tata McGraw-Hill, New Delhi, 2000.
3. Behrouz.a. Forouzan, “Data Communication and Networking ", Tata McGraw-Hill, New Delhi, 2000.

EC367 ANALYSIS AND DESIGN OF ANALOG INTEGRATED CIRCUITS

Credit: 4: 0: 0

Unit I: Circuit Configuration for Linear IC
Current sources- analysis of difference amplifiers with active load- supply and temperature independent biasing techniques- voltage references.

Unit II: Operational Amplifiers
Analysis of Operational amplifier circuits- slew rate model and high frequency analysis- operational amplifier noise analysis and low noise operational amplifiers.

Unit III: Analog Multiplier and Pll
Analysis of four quadrant and variable transconductance multiplier- voltage controlled oscillator- closed loop analysis of PLL.

Unit IV: MOS Analog ICs
Design of MOS Operational Amplifier- CMOS voltage references- MOS Power amplifier and analog switches.

Unit V: MOS Switched Capacitor Filters
Design techniques for switched capacitor filter- CMOS switched capacitor filters- MOS integrated active RC Filters.

Text Book

1. Gray and Meyer, "Analysis and Design of Analog ICs", Wiley International, 1996.

Reference Books

1. Gray, Wooley and Brodersen, "Analog MOS Integrated Circuits", IEEE Press, 1989.
2. Kenneth R. Laker, Willey M.C. Sansen and William M.C. Sansen, "Design of Analog Integrated Circuits and Systems", McGraw Hill, 1994.
3. Behzad Razavi, "Principles of Data Conversion System Design", S. Chand & Company Ltd., 2000.

EC368 SOFT COMPUTING

Credit: 4: 0: 0

Unit I: Artificial Neural Networks

Basic concepts – Supervised and Unsupervised learning- Single layer perception – Multilayer Perception — Back Propagation networks – Kohonen's self organizing networks – Hopfield network. – Radial Basis Function Networks –Adaptive Resonance Theory

Unit II: Fuzzy Systems

Fuzzy sets and Fuzzy reasoning – Fuzzy matrices – Fuzzy functions – Decomposition - Fuzzy automata and languages – Fuzzy control methods – Fuzzy decision making.

Unit III: Neuro – Fuzzy Modeling

Adaptive networks based Fuzzy interface systems – Classification and Regression Trees – Data clustering algorithms – Rule based structure identification – Neuro–Fuzzy Controls – Simulated Annealing – Evolutionary Computation.

Unit IV: Genetic Algorithms

Derivative-based Optimization – Descent Methods – The Method of steepest Descent – Classical Newton's Method – Step Size Determination – Derivative-free Optimization – Genetic Algorithms – Simulated Annealing – Random Search – Downhill Simplex Search.

Unit V: Applications

Printed Character Recognition – Inverse Kinematics Problems – Automobile Fuel Efficiency prediction – Soft Computing for Color Recipe Prediction.

Text Books

1. Jang J.S.R, Sun C.T and Mizutani. E, "Neuro-Fuzzy and Soft Computing", Prentice hall 1998.
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill 1997.

Reference Books

1. Laurene Fausett, "Fundamentals of Neural Networks", Prentice Hall, 1994.
2. George. J Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic", Prentice Hall, USA 1995.
3. D.E. Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley. N.J, 1989.

EC369 MODERN DIGITAL COMMUNICATION TECHNIQUES

Credit: 4: 0: 0

Unit I: Coherent and Non-Coherent Communication
Coherent receivers – Optimum receivers in WGN – IQ modulation & demodulation – Noncoherent receivers in random phase channels; M-FSK receivers – Rayleigh and Rician channels – Partially coherent receives – DPSK,M-PSK,M-DPSK,BER Performance Analysis.

Unit II: Bandlimited Channels and Digital Modulations
Eye pattern; demodulation in the presence of ISI and AWGN; Equalization techniques – IQ modulations; QPSK- QAM- QBOM- BER Performance Analysis. – Continuous phase modulation; CPFM; CPFSK; MSK- OFDM.

Unit III: Block Coded Digital Communication
Architecture and performance – Binary block codes; Orthogonal; Biorthogonal; Transorthogonal – Shannon's channel coding theorem; Channel capacity; Matched filter; Concepts of Spread spectrum communication – Coded BPSK and DPSK demodulators – Linear block codes; Hammning; Golay; Cyclic; BCH ; Reed – Solomon codes.

Unit IV : Convolutional Coded Digital Communication
Representation of codes using Polynomial- State diagram- Tree diagram- and Trellis diagram – Decoding techniques using Maximum likelihood- Viterbi algorithm- Sequential and Threshold methods – Error probability performance for BPSK and Viterbi algorithm- Turbo Coding.

Unit V: Spread Spectrum Signals for Digital Communication
Model of spread Spectrum Digital Communication System-Direct Sequence Spread Spectrum Signals- Error rate performance of the coder- Generation of PN Sequences-Frequency-Hopped Spread Spectrum Signals- Performance of FH Spread Spectrum Signals in an AWGN Channel- Synchronization of Spread Spectrum Systems.

Text Book

1. M.K.Simon, S.M.Hinedi and W.C.Lindsey," Digital communication techniques; Signalling and detection", Prentice Hall India, New Delhi. 1995.

Reference Books

1. Simon Haykin, "Digital communications", John Wiley and sons, 1998
2. Wayne Tomasi," Advanced electronic communication systems", 4th Edition Pearson Education Asia, 1998
3. B.P.Lathi,"Modern digital and analog communication systems", 3rd Edition, Oxford University press 1998.
4. 5 John G. Proakis, Digital Communications, 4th Edition, McGraw-Hill, New york, 2003

EC370 ADVANCED VLSI DESIGN

Credits: 4: 0: 0

Unit I: Overview of VLSI Design Technology
The VLSI design process – Architectural design – Logical design – physical design – Layout styles – Full custom – Semi custom approaches. Basic electrical properties of MOS and CMOS circuits: Ids versus Vds relationships – Transconductance – pass transistor – nMOS inverter – Determination of pull up to pull down ratio for an nMOS inverter – CMOS inverter – MOS transistor circuit model.

Unit II: VLSI Fabrication Technology
Overview of wafer fabrication – wafer processing – oxidation – patterning – Diffusion – Ion implantation – Deposition – Silicon gate nMOS process – nwell CMOS process – pwell CMOS process – Twintub process – Silicon on insulator.

Unit III: MOS and CMOS Circuit Design Process
MOS layers – Stick diagrams – nMOS design style – CMOS design style – Design rules and layout – Lambda based design rules – Contact cuts – Double metal MOS process rules – CMOS lambda based design rules – Sheet resistance – Inverter delay – Driving large capacitive loads – Wiring capacitance.

Unit IV: Subsystem Design
Switch logic – pass transistor and transmission gates – Gate logic – inverter – Two input NAND gate – NOR gate – other forms of CMOS logic – Dynamic CMOS logic – Clocked CMOS logic – CMOS domain logic – simple combinational logic design examples – Parity generator – Multiplexers.

Unit V: Sequential Circuits
Two phase clocking – Charge storage – Dynamic shift register – precharged bus – General arrangement of a 4 bit arithmetic processor – Design of a 4 bit shifter – FPGAs and PLDs.

Text Books

1. E. Eshranghian, D.A. Pucknell and S. Eshraghian, "Essentials of VLSI circuits and systems", PHI, 2005.
2. Neil H.E. Weste, David Harris and Ayan Banerjee, "CMOS VLSI Design, A circuits and Systems Perspective", (3/e), Pearson, 2006.

Reference Books

1. W. Wolf, "Modern VLSI Design", (3/e), Pearson, 2002.
2. S.M. Sze, "VLSI Technology",(2/e), McGraw Hill, 1988.

EC371 APPLIED ELECTRONICS LAB – I

Credits: 0:0:2

10 Experiments will be notified by the HOD from time to time

EC372 APPLIED ELECTRONICS LAB - II

Credits: 0:0:2

10 Experiments will be notified by the HOD from time to time

EC374 WAVELET TRANSFORMS AND APPLICATIONS

Credits: 4:0:0

Unit I : Mathematical Preliminaries
Linear spaces – Vectors and vector spaces – Basis functions – Dimensions – rthogonality and biorthogonalilty – Local basis and Riesz basis – Discrete linear normed space – Approximation by orthogonal projection – Matrix algebra and linear transformation.

Unit II : Multiresolution Analysis
Definition of Multi Resolution Analysis (MRA) – Haar basis - Construction of general orthonormal MRA-Wavelet basis– Continuous time MRA interpretation for the DTWT – Discrete time MRA- Basis functions for the DTWT – PR-QMF filter banks

Unit III : Continuous Wavelet Transform
Wavelet Transform - definition and properties - concept of scale and its relation with frequency - Continuous Wavelet Transform (CWT) - Scaling function and wavelet functions (Daubechies, Coiflet, Mexican Hat, Sinc, Gaussian, Bi- Orthogonal) - Tiling of time -scale plane for CWT.

Unit IV : Discrete Wavelet Transform
Filter Bank and sub band coding principles - Wavelet Filters - Inverse DWT computation by Filter banks -Basic Properties of Filter coefficients - Choice of wavelet function coefficients - Derivations of Daubechies Wavelets - Multi-band Wavelet transforms. Introduction to lifting Scheme

Unit V : Applications
Signal Compression – Image Compression techniques: EZW-SPHIT Coding – Image denoising techniques: Noise estimation - Shrinkage rules -. Shrinkage Functions - Edge detection and object Isolation, Image Fusion, and Object Detection.

Text Book

1. Rao .R.M and A.S.Bopardikar, "Wavelet Transforms: Introduction to theoryand Applications”, Pearson Education Asia Pte. Ltd., 2000.

Reference Books

1. Strang G, Nguyen T, "Wavelets and Filter Banks," Wellesley Cambridge Press, 1996
2. Vetterli M, Kovacevic J., "Wavelets and Sub-band Coding," Prentice Hall,1995
3. Mallat S., "Wavelet tour of Signal Processing”, Academic Press, 1996
4. David C.Lay., “Linear Algebra and its applications” Pearson education, 2007.(Unit I only)

EC375 GLOBAL TRACKING AND POSITIONING SYSTEMS

Credits: 4:0:0

Unit I : Introduction

Satelites-Introduction to Tracking and GPS System-Applications of Satelite and GPS for 3D position-Velocity-determination as function of time-Interdisciplinary applications(eg-.Crystal dynamics-gravity field mapping-reference frame-atmospheric occulation)Basic concepts ofGPS.Space segment-Control segment-user segment-History of GPS constellation-GPS measurement charecteristics-selective availability(AS)-antispoofing(AS).

Unit II: Orbits and Reference Systems

Basics of Satelite orbits and reference systems-Two-body problem-orbit elements-timre system and timre transfer using GPS-coordinate systems-GPS Orbit design-orbit determination problem-tracking networks-GPS force and measurement models for orbit dtermination-orbit broadcast ephemeris-precise GPS ephemeris.Tracking problems

Unit III GPS Measurements

GPS Observable-Measurement types(C/A Code-P-code-L1 and L2 frequencies for navigation-pseudo ranges)-atmospheric delays(tropospheric and ionospheric)-data format(RINEX)-data combination(narrow/wide lane combinations-ionosphere-free combinations-single-double-triple differences)-undifferenced models-carrier phase Vs Intergrated Doppler-integer biases-cycle slips-clock error

Unit IV: Processing Techniques

GPS Observable-Measurement types(C/A Code-P-code-L1 and L2 frequencies for navigation-pseudo ranges)-atmospheric delays(tropospheric and ionospheric)-data format(RINEX)-data combination(narrow/wide lane combinations-ionosphere-free combinations-single-double-triple differences)-undifferenced models-carrier phase Vs Intergrated Doppler-integer biases-cycle slips-clock error

Unit V : GPS Applications

Pseudo range and carrier phase processing-ambiguity removal-Least square methods for state parameter determination-relation positioning-dilution of precision Surveying-Geophysics-Geodsey-airborne GPS-Ground-transportation-Spaceborne GPS orbit determination-attitude control-meteorological and climate research using GPS

Text Book

1. B.Hoffman,Wellenhof,H.Lichtenegger and J.Collins,"GPS: Theory and Practice ".4th revised Edition, Springer Wein, New york,1997

Reference Books

1. A.Leick,"GPS Satelite Surveying", 2nd Edition, John Wiley & Sons, NewYork,1995
2. B.Parkinson,J.Spilker,Jr.(Eds),"GPS:Theory and Applications",Vol.I & Vol.II,AIAA,370 L'Enfant Promenade SW,Washington DC,1996
3. A.Kleusberg and P.Teunisen(Eds),”GPS for Geodesy” ,Springer-Verlag,Berlin,1996

4. L.Adams,"The GPS.A Shared National Asset, Chair, National Accademy Press, Washington DC,1995

SCHOOL OF

ELECTRICAL SCIENCES

ADDITIONAL SUBJECTS

Code	Subject Name	Credit
EC288	Solid State Circuits	4:0:0
EC289	Pulse and Wave Shaping Circuits	4:0:0
EC290	Information Theory and Coding	4:0:0
09EC201	Fundamentals of Signals and Systems	3:0:0
09EC202	Neural Networks	3:0:0
09EC203	Microprocessors and Interfacing	3:0:0
09EC204	Communication Engineering	3:0:0
09EC205	Electron Devices and Circuits	3:0:0
09EC206	Introduction to Digital Signal Processing	3:0:0
09EC207	Opto Electronic Devices	3:0:0
09EC208	Digital Image Processing	3:0:0
09EC209	Basic VLSI Design	3:0:0
09EC210	Digital Design Using VHDL	3:0:0
09EC211	Microcontrollers and its Applications	3:0:0
09EC212	Embedded Systems	3: 0:0
09EC213	Neural Networks and Fuzzy Systems	3:0:0
09EC214	Digital Integrated Circuits	3:0:0
09EC215	Satellite Communication	3:0:0
09EC216	Digital Integrated Circuits Lab	0:0:2
09EC217	Microprocessor and Interfacing lab	0:0:2
09EC218	Basic Electronics	3:0:0
09EC219	Electronics and Microprocessor Lab	0:0:1
09EC220	Linear Integrated Circuits and Applications	3:1:0
09EC221	Electromagnetic Fields	3:1:0
09EC222	Communication Theory and Systems	4:0:0
09EC223	Microwave and Optical Communication Engineering	4:0:0
09EC224	Digital Signal Processing	3:1:0
09EC225	Digital Communication	4:0:0
9EEC226	Electronics and Communication Lab	0:0:2
09EC227	Digital Signal Processing Lab	0:0:2
09EC228	Advanced Communication Lab	0:0:2
09EC229	Linear Integrated Circuits Lab	0:0:2
09EC230	Digital Electronics Lab	0:0:2
09EC231	VLSI Design Lab	0:0:2
09EC232	Microprocessor and Microcontroller Lab	0:0:2
09EC233	Microprocessors and Micro Controllers	4:0:0
09EC234	Computer Communication	4:0:0
09EC235	Electronics and Microprocessors	4:0:0
09EC236	Workshop Practice on PCB Design	0:0:2
09EC237	Microwave and Optical Communication Lab	0:0:2
09EC238	Electron Devices and Circuits Lab	0:0:2

09EC239	Solid State Circuits –I	4:0:0
09EC301	Advanced Radiation Systems	4:0:0
09EC302	Modern Digital Communication Techniques	4:0:0
09EC303	Optical Fiber Communication	4:0:0
09EC304	Communication Network Security	4:0:0
09EC305	Multimedia Compression Techniques	4:0:0
09EC306	Communication Lab-1	0:0:2
09EC307	Mobile Communication Networks	4:0:0
09EC308	Error Control Coding	3:1:0
09EC309	High Performance Communication Networks	4:0:0
09EC310	Microwave Integrated Circuits	4:0:0
09EC311	Satellite Communication	4:0:0
09EC312	Communication Engineering Lab-2	0:0:2
09EC313	Advanced Digital System Design	4:0:0
09EC314	FPGA Design Using VHDL & Verilog	4:0:0
09EC315	CMOS VLSI Design	4:0:0
09EC316	Testing of VLSI Circuits	4:0:0
09EC317	Computer Aided Design for VLSI Circuits	4:0:0
09EC318	Simulation Lab	0:0:2
09EC319	Genetic Programming and Particle Swarm Optimization	4:0:0
09EC320	Advanced Digital Image Processing	4:0:0
09EC321	Neuro-Fuzzy Modelling	4:0:0
09EC322	Pattern Recognition	4:0:0
09EC323	Artificial Neural Networks	4:0:0

EC288 SOLID STATE CIRCUITS

Credit: 4: 0 : 0

UNIT I : Rectifiers and Filters
Diode as Rectifiers – Half wave rectifier – Full wave rectifier – ripple factors – DC and AC components in rectifiers – Capacitor and inductor filters – Analysis and design of L section and Pi section filters – Regulators: Voltage and current regulators – Short circuit and over load protection.

UNIT II : Transistor And FET Biasing
Transistor Biasing: Location of the Q point – Fixed bias circuit – Collector to base circuit – Self bias circuit – Graphical DC bias analysis – Design of DC bias circuit.
FET biasing - Self biasing – Voltage feedback biasing.

UNIT III : Amplifiers
Frequency response – RC coupled and Transformer coupled amplifiers – Single stage – Multistage amplifiers – Wideband amplifiers – Cascode – Video amplifiers – Peaking circuits – Power amplifiers : Class A, AB, B and class D amplifiers – Distortion – Push pull amplifiers – Complementary symmetry.

UNIT IV : Feedback Amplifiers & DC Amplifiers
Positive and Negative feedback – Current and Voltage feedback – Effect of feedback on gain – Input and Output impedance – Noise and Distortion. DC amplifiers : Drift in amplifiers – Differential amplifiers – Chopper Stabilization.

UNIT V : Oscillators And Tuned Amplifiers
Barkhausen criterion – RC and LC Oscillators – Crystal oscillators – Tuned amplifiers – Single tuned – Double tuned – Stagger tuned.

TEXT BOOKS

1. Millman .J. & Halkias.C , "Electronic Devices And Circuits", Tata McGraw Hill, 2007.
2. Mathur S.P,m Kulshrestha D.C., Chanda P.R., "Electronic Devices Applications and Integrated Circuits, Umesh Publications, 2004.

REFERENCE BOOKS

1. Malvino A.P., "Electronic Principles", McGraw Hill International, 2005.
2. Boylestred R and Nashelsky, "Electronic Devices and Circuits Theory", PHI, 2005.
3. Allen Moltershed, "Electronic Devices and Circuits", PHI, 1998.

EC289 PULSE AND WAVE SHAPING CIRCUITS

Credits: 4 : 0 : 0

Unit I : Linear Wave Shaping Circuits
High pass and low pass RC circuits – response for step, pulse, square wave, ramp and exponential signals as input – High pass circuit as a differentiator – low pass circuit as an

integrator – attenuators – Non Linear Wave Shaping Circuits: Diode and transistor - clippers – Clamping Circuits – clamping theorem – practical clamping circuits.

UNIT II : Bistable And Schmitt Trigger Circuits
Fixed and self bias bistable circuits – Loading – Commutating capacitors – Triggering methods – Design of bistable circuits – Schmitt trigger circuit, critical voltages, Design example – Applications: Comparator, Sine wave to square wave converter.

UNIT III : Monostable And Astable Circuits
Collector and emitter coupled monostable circuits – Waveforms – equation for delay – collector coupled, emitter coupled astable circuits – VCO – Design examples for monostable and astable circuits.

UNIT IV : Voltage And Current Time Base Generators
General feature of a time base signal – exponential sweep circuit – A transistor constant current sweep – Miller and Bootstrap time base generators – General considerations – Current time base generator: A simple current sweep – A transistor current time base generator – Transistor Television sweep circuit.

UNIT V : Blocking Oscillator Circuits And Sampling Gates
Blocking oscillators – Triggering Transistor blocking oscillators – Base and emitter timings – Triggering circuits – Astable blocking oscillators – Sampling gates: Unidirectional and bi-directional sampling gates using diodes and transistors.

TEXT BOOKS

1. Millman & Taub “Pulse Digital and Switching Waveforms”, McGraw Hill, Second Edition 2007.

REFERENCE BOOKS

1. Ronald Tocci, “Fundamentals of Pulse and Digital Circuits”, Merrill Publishing Company, Third Edition, 1997.
2. David A Bell, “Solid State Pulse Circuits”, Prentice Hall Inc, Fourth Edition, 2005.

EC290 INFORMATION THEORY AND CODING

Credits: 4 : 0 : 0

UNIT I: INFORMATION ENTROPY FUNDAMENTALS
Uncertainty, Information and Entropy – Source coding Theorem – Huffman coding –Shannon Fano coding – Discrete Memory less channels – channel capacity – channel coding Theorem – Channel capacity Theorem.

UNIT II:DATA AND VOICE CODING

Differential Pulse code Modulation – Adaptive Differential Pulse Code Modulation – Adaptive subband coding – Delta Modulation – Adaptive Delta Modulation – Coding of speech signal at low bit rates (Vocoders, LPC).

UNIT III:ERROR CONTROL CODING
Linear Block codes – Syndrome Decoding – Minimum distance consideration – cyclic codes – Generator Polynomial – Parity check polynomial – Encoder for cyclic codes – calculation of syndrome – Convolutional codes.

UNIT IV:COMPRESSION TECHNIQUES
Principles – Text compression – Static Huffman Coding – Dynamic Huffman coding – Arithmetic coding – Image Compression – Graphics Interchange format – Tagged Image File Format – Digitized documents – Introduction to JPEG standards.

UNIT V:AUDIO AND VIDEO CODING
Linear Predictive coding – code excited LPC – Perceptual coding, MPEG audio coders – Dolby audio coders – Video compression – Principles – Introduction to H.261 & MPEG Video standards.

TEXT BOOKS

1. Khalid Sayood," Introduction to Data Compression", Morgan Kauffman, Second Edition,2004.
2. Simon Haykin, "Communication Systems", John Wiley and Sons, 4th Edition, 2001.
3. Fred Halsall, "Multimedia Communications, Applications Networks Protocols and Standards", Pearson Education, Asia 2002; Chapters: 3,4,5.

REFERENCE BOOKS

1. Mark Nelson, "Data Compression Book", BPB Publication 1992.
2. Watkinson J, "Compression in Video and Audio", Focal Press, London, 1995.

09EC201 FUNDAMENTALS OF SIGNALS AND SYSTEMS

Credits: 3:0:0
Objective:
It covers the fundamentals of continuous-time and discrete-time signals as well as systems. It covers Fourier analysis of signals and systems.

Outcome:
The concepts studied can be applied to real –time signal processing.

UNIT I
Signals and Systems
Continuous Time (CT) signals – CT signal operations – Representation of CT signals by samples – Sampling Theorem, Discrete Time (DT) signals – Representation of DT signals by impulses – DT signal operations – CT and DT systems – Properties of the systems

UNIT II

Linear Time Invariant Systems
Introduction – Discrete Time LTI systems: Convolution sum – Continuous Time LTI systems: Convolution Integral – Properties of Linear Time-Invariant systems – Causal LTI systems described by differential and difference equations

UNIT III
Fourier analysis of CT Signals and Systems
Fourier series representation of periodic signals – Properties – Harmonic analysis of LTI systems –Representation of a periodic signals by Continuous Time Fourier Transform (CTFT) – Properties – Frequency response of systems characterized by Differential Equations

UNIT IV
Fourier analysis of DT Signals and Systems
Discrete Time Fourier series representation of DT periodic signals – Properties – Representation of DT aperiodic signals by Discrete Time Fourier Transform(DTFT) – Properties – Frequency response of systems characterized by Difference Equations

UNIT V
Transform Operations of DT Signals and Systems
Z transform and its properties – Region of convergence of Z transform – The inverse Z Transform Some common Z transform pairs - Analysis and Characterization of LTI system using the Z transform – System function algebra and block diagram representation – Unilateral Z transform.

TEXT BOOKS
1. Simon Haykin and Barry Van Veen, "Signals & Systems", John Wiley and Sons Inc., 2005.
2. Alan V Oppenheim, Alan S Wilsky and Hamid Nawab S, "Signals & Systems", II Edition, PHI, New Delhi, 1997.

REFERENCE BOOK
1. Rodger E. Ziemer, William H. Tranter and D. Ronald Fannin, *Signals and Systems – Continuous and Discrete*, Fourth Edition, Pearson Education Inc., 1998.

09EC202 NEURAL NETWORKS

Credits: 3:0:0

Objective
This course introduces the basics of Neural Networks and essentials of Artificial Neural Networks with Single Layer and Multilayer Feed Forward Networks. Also deals with Associate Memories. This subject is very important and useful for doing Project Work.

Outcome
On successful completion of this course, the student should be able to understand the following things:
Basic neuron models: McCulloch-Pitts model, nearest neighbor model etc.

Basic neural network models: multilayer perceptron, nearest neighbor based multilayer perceptron, associative memory, etc.
Basic learning algorithms: the back propagation algorithm, Hebbian algorithm etc.

UNIT I
Introduction to Neural Networks
Introduction, Humans and Computers - Organization of the Brain - Biological Neuron, Biological and Artificial Neuron Models - Characteristics of ANN - McCulloch-Pitts Model - Historical Developments - Potential Applications of ANN.
UNIT II
Essentials of Artificial Neural Networks
Artificial Neuron Model - Operations of Artificial Neuron - Types of Neuron Activation Function - ANN Architectures - Classification Taxonomy of ANN – Connectivity - Learning Strategy (Supervised, Unsupervised, Reinforcement) - Learning Rules.

UNIT III
Single Layer Feed Forward Neural Networks
Introduction- Perceptron Models: Discrete, Continuous and Multi-Category- Training Algorithms: Discrete and Continuous Perceptron Networks - Limitations of the Perceptron Model.

UNIT IV
Multilayer Feed forward Neural Networks
Generalized Delta Rule, Derivation of Backpropagation (BP) Training - Summary of Backpropagation Algorithm - Learning Difficulties and Improvements.

UNIT V
Associative Memories
Paradigms of Associative Memory - Pattern Mathematics - Hebbian Learning - General Concepts of Associative Memory - Bidirectional Associative Memory (BAM) Architecture - BAM Training Algorithms: Storage and Recall Algorithm - BAM Energy Function. Architecture of Hopfield Network: Discrete and Continuous versions - Storage and Recall Algorithm - Stability Analysis.

TEXT BOOK
1. Laurence Fausett, “Fundamentals of Neural Networks, Architecture, Algorithm and Applications”, Prentice-Hall, Inc, 2004.

REFERENCE BOOKS

1. Phillip D. Wasserman, “Neural Computing Theory and Practice”, Van Nostrand Reinhold, New York, 1989.
2. Kosko.B, “Neural Networks and Fuzzy Sytems” A Dynamic systems Approach to Machine Intelligence, Engle wood Cliffs, N.J.Prentice Hall, First Edition, 1992.
3. Jacek M. Zurada, “Introduction to Artificial Neural Networks”, Jaico Publishing House, 1997.
4. Limin Fu, ‘Neural Networks in Computer Intelligence’, McGraw Hill, 1994.

09EC203 MICROPROCESSORS AND INTERFACING

Credits: 3:0:0

Objective:

To impart basic concepts of microprocessor 8 bit (8085), 16 bit (8086), interfacing devices, programmable peripheral devices and applications.

Outcome:

Geared to engineers who work microprocessors, the microprocessor program emphasizes operations, maintenance and troubleshooting.

UNIT I

8085 Microprocessor

Organization of 8085 microprocessor –Instruction set-Addressing modes- Assembly language programming

UNIT II

8086 Microprocessor

Organization of 8086 microprocessor – memory segmentation -Address modes in 8086 – Assembly language programming – minimum mode and maximum mode

UNIT III

Microprocessor Interfacing Techniques

8255 Programmable Peripheral Interface (PPI) - 8251A Programmable communication interface -DMA -8237 Programmable DMA controller.

UNIT IV

Programmable Peripheral Devices

8259A Programmable interrupt controller - 8279 Programmable Keyboard/display interface - 8253 programmable interval timer

UNIT V

Applications

Temperature controller -Stepper motor controller – DC Motor Controller – Traffic light controller.

TEXT BOOKS

1. *Ramesh.S.Goankar "Microprocessor Architecture, Programming & Applications with 8085/8080A" Penram International, 2008*
2. *D.V. Hall "Microprocessor and Interfacing Programming and Hardware", McGraw Hill Publishing Company, 2nd Edition, 1990.*

REFERENCE BOOKS

1. *Yu.Cheng Liu & Glenn A Gibson, "Microcomputer System,8086/8088 Family" 2nd Edition, PHI, 2003*
2. *Ajit Pal "Microprocessor Principles And Applications", Tata McGraw Hill, 1st Reprint, 2003*
3. *Avatar Singh And Walter A.Tribel "The 8088 and 8086 Microprocessor, Architecture, Software and Interface Techniques", PHI, 1985.*

4. *Rafiquzzaman M., "Microprocessor Theory And Applications-Intel And Motorola", PHI, 2002*

09EC204 COMMUNICATION ENGINEERING

Credits: 3:0:0

Objective:

To introduce the basic concepts of Digital Communication modulation to baseband signals, fundamental concepts in Mobile communication, Satellite Communication and Optical communication.

Outcome:

It will help to enable the student to become familiar with different types of communications services.

UNIT I

Introduction

Need for wireless transmission and modulation – Concept of baseband and bandwidth –Multichannel Transmission-Modulation of AM signals-Demodulation of AM signals -Modulation of FM signals-Demodulation of FM signals-Noise in Communication Networks-Noise and interference – Thermal noise and shot noise – signal to noise ratio – Noise figure – Equivalent noise BW – Available noise power density – Noise temperature.

UNIT II

Digital Communication

Review of Sampling Theorem, PAM and TDMA Principles, Quantization, PCM, DPCM and Delta Modulation-Adaptive Delta Modulation

UNIT III

Mobile Communication Systems

Cellular engineering concepts– Frequency Reuse- Channel Assignment, Co-channel interference and Handoff-GSM Architecture.

UNIT IV

Elements of Satellite Communication

Satellite systems, Orbital description and Orbital mechanics of LEO, MEO and GEO, Placement of a satellite in a GSO, Satellite – description of different Communication Subsystems, Bandwidth allocation.

UNIT V

Optical Communication

Overview of optical communication - Need for optical communication – Comparison with the electrical communication - Snell's law – Critical angle – Acceptance angle – Numerical Aperture. Types of fibers: Step and Graded index fibers. Wave propagation in multi mode and single mode optical fibers –Attenuation – dispersion – Polarization.

TEXT BOOK

1. *Simon Haykins, "Digital Communications", John Wiley, 1st edition, Reprinted, 2004.*

REFERENCE BOOKS

1. *Lathi B.P., "Introduction to Communication Systems", John Wiley Sons Inc., 19th reprint, 1992.*
2. *T.S.Rappaport," - Wireless digital communications; Principles and practice,PrenticeHall,NJ,1996.*
3. *Dennis Roddy, "Satellite Communications", McGraw -Hill International ,Fourth Edition,2006.*
4. *Gerd Keiser, "Optical Fiber Communication" McGraw -Hill International, Singapore, 3rd ed., 2000.*

09EC205 ELECTRON DEVICES AND CIRCUITS

Credits: 3:0:0

Objective

To learn the operation and characteristics of various semiconductor devices

Outcome

Able to design electronic application circuits.

UNIT I

Theory of Semiconductors

Energy band structure of conductors, insulators and semiconductors – Comparison of Germanium, Silicon and gallium arsenide – Electron hole generation and recombination –Intrinsic and extrinsic semiconductors – Conductivity – Temperature dependence – Hall effect – drift and diffusion in semiconductors.

UNIT II

Theory of PN Junction and BJT

PN junction -depletion region – barrier potential – diode equation – Forward and Reverse characteristics – Transition and diffusion capacitance. Static characteristics of transistors. Analysis of CE, CB and CC circuits – Voltage gain – Current gain – Input impedance.

UNIT III

Special Semiconductor Devices (Qualitative Treatment Only)

Zener diodes – Schotky Barrier Diode – Tunnel diodes – DIAC – TRIAC – Photo diodes-
Photo transistors –LCD- LED-Gunn diodes -Varactor diode.

UNIT IV

Design of DC Power Supply

Half wave rectifier – Full wave rectifier – ripple factors – DC and AC components in rectifiers.
Full wave rectifier with Capacitor and inductor filters. Voltage regulators-Transistorized series pass regulator.

UNIT V

Amplifiers and Feedback Amplifiers

Single stage- RC coupled amplifiers- Power amplifiers: Class A, AB, B power amplifiers-Pushpull amplifiers- Oscillators – RCphase shift-Hartley Oscillator- Single tuned amplifiers.

TEXT BOOKS

1. *VK.Metha."Principles of Electronics",Chand Publications,2008.*
2. *Millman .J. & Halkias.C , "Electronic Devices And Circuits", Tata McGraw Hill, 2005*
3. *Boylestred R and Nashelsky, "Electronic Devices and Circuits Theory", PHI, 2006*

09EC206 INTRODUCTION TO DIGITAL SIGNAL PROCESSING

Credits: 3:0:0

OBJECTIVES

To study DFT and its computation
To study the design techniques for digital filters
To study the finite word length effects in signal processing
To study the fundamentals of digital signal processors

OUT COME

One can able to apply the concepts (studied in this course) in the field of Digital signal processing.

UNIT I

Introduction to DSP and Fourier Transform

Review of Discrete Time LTI Systems – Linear, circular and sectioned convolutions - DFS,DTFT, DFT – FFT computations using DIT and DIF algorithms

UNIT II

Infinite Impulse Response Digital Filters

Review of classical analog filters-Butterworth,Chebyshev and Elliptic filters– Transformation of analog filters into equivalent digital filters using impulse invariant method and Bilinear transform method-Realization stuctures of IIR filters-Direct,cascade,parallel forms

UNIT III

Finite Impulse Response Digital Filters

Amplitude and phase responses of FIR filters – Linear phase filters – Windowing techniques for design of Linear phase FIR filters – Rectangular, Hamming, Kaiser windows – frequency sampling techniques– realization structures of FIR filters – transversal and linear phase structures.

UNIT IV

Finite Word Length Effects

Representation of numbers in registers- Fixed point and binary floating point number representation – comparison -ADC quantization noise- derivation for quantization noise power – – over flow error – truncation error – coefficient quantization error-Product quantization error – Limit cycles due to product round-off error, Round –off -Noise reduction scheme-Addition over flow errors-Principle of scaling.

UNIT V
Digital Signal Processors
Introduction to general and special purpose hard ware for DSP – Harvard architecture – Dedicated MAC unit - Multiple ALUs, Advanced addressing modes - pipelining-Special instruction-Replication-Hardware digital filter – Overview of Texas Instruments TMS320C5X – Instruction set of TMS320C5X – Simple programs**.**

TEXT BOOKS
1. John G. Proakis and Dimitris G.Manolakis, "Digital Signal Processing, Algorithms and Applications", PHI of India Ltd., New Delhi, 3rd Edition, 2000.
2. Dinniz, "Digital Signal Processing – A Computer based Approach", Cambridge Publications, first edition 2002

REFERENCE BOOKS
1. Opeenheim and Schafer, "Digital Time Signal Processing", Prentice Hall of India, Reprint, 2002
2. Emmanuel C. Ifeacher and Barrie W. Jervis, "Digital Signal Processing – A Practical Approach", Addition – Wesley Longman Ltd., UK, 2nd 2004
3. Sanjit K.Mitra, "Digital Signal Processing - A Computer Based Approach", Tata McGraw-Hill, New Delhi, 2nd Edition, 2001
4. Texas Instruments Manual for TMS320C5416 Processor

09EC207 OPTO ELECTRONIC DEVICES

Credits: 3:0:0

Objective
To learn different types of optical emission, detection, modulation and opto electronic integrated circuits and their applications.

Outcome:
To know the basics of solid state physics and understand the nature and characteristics of light.
To understand different methods of luminescence, display devices and laser types and their applications.
To learn the principle of optical detection mechanism in different detection devices.
To understand different light modulation techniques and the concepts and applications of optical switching.
To study the integration process and application of opto electronic integrated circuits in transmitters and receivers.

UNIT I
Elements Of Light And Solid State Physics
Wave nature of light – Polarization – Interference – Diffraction - Light Source - review of Quantum Mechanical concept - Review of Solid State Physics - Review of Semiconductor Physics and Semiconductor Junction Device.

UNIT II
Display Devices And Lasers

Introduction - Photo Luminescence - Cathode Luminescence - Electro Luminescence - Injection Luminescence - Injection Luminescence - LED, Plasma Display - Liquid Crystal Displays - Numeric Displays - Laser Emission – Absorption – Radiation - Population Inversion - Optical Feedback - Threshold condition - Laser Modes - Classes of Lasers - Mode Locking - laser applications.

UNIT III
Optical Detection Devices
Photo detector - Thermal detector - Photo Devices - Photo Conductors - Photo diodes - Detector Performance.

UNIT IV
Optoelectronic Modulator
Introduction - Analog and Digital Modulation - Electro-optic modulators - Magneto Optic Devices - Acoustoptic devices – Optical - Switching and Logic Devices.

UNIT V
Optoelectronic Integrated Circuits
Introduction - hybrid and Monolithic Integration - Application of Opto Electronic Integrated Circuits - Integrated transmitters and Receivers - Guided wave devices.

TEXT BOOK
1. J. Wilson and J.Haukes, "Opto Electronics – An Introduction", Prentice Hall of India Pvt. Ltd., New Delhi, 2003.

REFERENCE BOOKS
1. Bhattacharya "Semiconductor Opto Electronic Devices", Prentice Hall of India Pvt., Ltd., New Delhi, 1995.
2. Jasprit Singh, "Opto Electronics – As Introduction to materials and devices", McGraw-Hill International Edition, 1998.

09EC208 DIGITAL IMAGE PROCESSING

Credits: 3:0:0
Objective:
To learn the fundamental concepts of Image processing techniques
Outcome:
Can develop simple algorithms for image processing.

UNIT I
Introduction
Fundamental steps and applications of digital image processing – Elements of visual perception – Image sensing and acquisition – Image sampling and quantization - Basic relationship between pixels – 2D DFT and its properties – Computing inverse Fourier transform - Need for padding – Convolution and correlation

UNIT II
Image Enhancement
Basic gray level transformations – Histogram Equalization and matching – Arithmetic and logic operations – Spatial averaging – Directional smoothing – Median filtering – Unsharp masking – Gradient and Laplacian operators - Zooming - Smoothing and sharpening frequency domain filters – Homomorphic filtering

UNIT III
Image Restoration & Color image Processing
Image degradation/restoration model – Restoration in the presence of noise only spatial filtering – Periodic noise reduction by frequency domain filtering - Inverse and Wiener filtering concept – Color models – Pseudocolor image processing – Color transformations – Smoothing and sharpening

UNIT IV
Image Compression
Fundamentals – Image compression models – Elements of information theory – Variable length coding – LZW coding – Bit plane coding – Lossless predictive coding – Lossy predictive coding – Transform coding

UNIT V
Image Segmentation
Detection of discontinuities – Edge linking based on local processing and Hough transform – Thresholding: local, global, Adaptive and multispectral – Region based segmentation

TEXT BOOK
1. Rafael C.Gonzalez and Richard E. Woods, "Digital Image Processing", PHI 2nd edition, 2002

REFERENCE BOOKS
1. Anil K.Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, 9th edition, Indian Reprint, 2002
2. William, K.Pratt, "Digital Image Processing", John Wiley and Sons, 3rd edition,2002

09EC209 BASIC VLSI DESIGN

Credits: 3 : 0 : 0
Objective
The purpose of this course is to give an exposure to the standard algorithms for VLSI Physical design Automation.
Outcome
Introduction to VLSI Design Automation Tools
Placement and Routing Algorithms
Floor Planning Algorithms
Simulation and Logic Synthesis Concepts
High Level Synthesis

UNIT I

Overview of VLSI Design Methodology
VLSI Design Process – Arcitectural Design – Logical Design – Physical Design – Layout Styles – Full Custom Semi Custom Approaches – Overview of wafer fabrication – Wafer processing – Silicon gate NMOS process – CMOS process – N well – P well – Twin Tub – Silicon On Insulator

UNIT II
Layout Design
MOS & CMOS Layers – stick diagram – design rules & layout – subsystems design: switch logic – gate logic, combinational logic design example:passing generator – bus arbitration logic multiplexers – gray to binary code converter –sequential circuit example: two phase clocking – dynamic register element – dynamic shift register

UNIT III
Design of System
PLA – Finite state machine – PLA based finite state machine design – design of 4-bit shifter – design of ALU subsystem: adders – multiplexers – memory: dynamic shift register – dynamic RAM cells – one transistor dynamic memory cell – 4*4 bit register
array

UNIT IV
Tools for Design
Grounds rules for successful design – design styles & philosophy – CAD tools for design & simulation: textual entry layout language – graphical entry layout – design verification – design rule checkers – simulators – tests & testability.

UNIT V
CMOS Design Projects & Fast VLSI Circuits
Incremental/decremental – left/right – serial/parallel shift register – comparator – GaAs device – layout design for GaAs devices.

TEXT BOOK
1. Pucknell D.A., & Eshraghian K., "Basic VLSI Design", PHI, third edition,2007.

REFERENCE BOOK
1. *Neil H E West and Kamran Eshranghian, "Principles of CMOS VLSI Design : A System Perspective", Addison Wesley, 2nd edition, 2002*

09EC210 DIGITAL DESIGN USING VHDL
Credits:3 : 0 : 0

Objective:
To know about the various flow of VHDL and the programming technologies.
Outcome
Knowledge in VHDL Programming and Programmable devices will be obtained

UNIT I

Programmable Logic Devices
Introduction - Programming Technologies - Programmable Read only Memory (PROM or PLE) - Programmable Logic Array (PLA) - Programmable Array Logic (PAL). System Design using PLD's: Design of Combinational and Sequential circuits using PLD's -

UNIT II
Programmed Logic
Introduction – Register transfer language (RTL) – RTL notations – Microprogrammed Controller – Designing of micro programmed controller – Preparing a Micro instruction – ROM simulation – Emulation – Bit sliced computers – Advanced Boolean expression language.

UNIT III
FPGA And CPLD
Semi custom and full custom IC design- Xilinx XC3000 series, Xilinx XC4000 series -Logic cell Array (LCA)-Configurable Logic block (CLB) - Input and output block (IOB) – Programmable Interconnection Point (PIP) – structure of PLD and Complex PLD – Altera 7000 series – Introduction to ACT2 family.

UNIT IV
Introduction to VHDL
Design flow process – Software tools – Data objects – Data types – Data operators – Entities and Architectures – Component declaration and instantiation.

UNIT V
Data Flow, Behavioral and Structural Modeling
Concurrent signal assignment – conditional signal assignment – selected signal assignment – concurrent and sequential statements – Data flow, Behavioral and Structural Modeling - Test bench

TEXT BOOKS
1. Palmer. J.E, Perlman. D.E, "Introduction to Digital Systems", McGraw Hill Book Co., International Student Edn., 2001
2. Nelson. V.P, Nagale. N.T, Carroll. B.D and Irwin. J.D, "Digital Logic Circuit Analysis and Design", Prentice Hall International Inc., New Jersy, 1995.

REFERENCE BOOKS

1. John V. Oldfield and Richard C. Dorf, "Field Programmable Gate Arrays: Reconfigurable Logic for Rapid Prototyping and Implementation of Digital Systems", John Wiley, 1995.
2. Navabi. Z, "VHDL: Analysis and Modeling of Digital Systems", Prentice Hall Inc., 2nd Edition, 1998
3. David Pellerin and Douglas Taylor, "VHDL Made Easy", Prentice Hall Inc., 1997.
4. Bhutgani, "Digital Logic Design", Prentice Hall International, Simon & Schuster (Asia) Pte., Ltd, 1996.5. J. Bhaskar, "A VHDL Synthesis Primer", BS Publications, III Edn., 2004.

09EC211 MICROCONTROLLERS AND ITS APPLICATIONS
Credits: 3:0:0

Objective:
To learn about the basics of PIC Interfacing and ARM Processor.
Outcome:
On successful completion of the subject, students can able to write the assembly language coding for Various application in Linux Environment.

UNIT 1: Introduction to PIC Microcontroller:
Overview of PIC18 MCU – Architecture - PIC18 Memory Organization- CPU Registers – Pipelining- Instruction Format- Addressing Modes- Instruction Sets.

UNIT 2: PIC Interfacing:
PIC Interrupts- Parallel Ports – Interfacing with simple output Devices- D/A Converter- Timers- USART- SPI- I^2C- A/D converter.

UNIT 3: ARM Processor Fundamentals:
ARM Design philosophy - Embedded System Hardware - Embedded System Software - Registers, Program Status Register – Pipeline – Exceptions – Interrupts - and the Vector table - Core Extensions - Architecture revisions - ARM Processor families.

UNIT 4: Introduction to the ARM and Thumb Instruction Set:
Data processing Instructions - Branch Instructions – Load - store instructions - Software Interrupt Instruction - Program Status Register Instructions - Loading Constants - ARM V5E Extensions - Conditional Executions.
Thumb Register usage - ARM Thumb Interworking - Data Processing Instructions - Single – Register Load – Store Instructions - Multiple Register Load - Store Instructions - Stack Instructions - Software Interrupt Instructions.

UNIT 5: Exception and Interrupt Handling:
Interrupts - Interrupt Handling Schemes - Non-nested Interrupt Handler - Nested Interrupt Handler - Reentrant Interrupt Handler - Prioritized Simple Interrupt Handler - Prioritized Standard Interrupt Handler

TEXT BOOKS

1. *Han-Way Huang, " PIC Microcontroller- An Introduction to Software and Hardware Interfacing", First Indian Reprint CENGAGE Learning – 2008.*
2. *Andrew N. Sloss, Dominic Symes & Chris Wright, "ARM System Developer's Guide – Designing and Optimizing System Software", Morgan – Kaufmann Publishers*

REFERENCE BOOK

1. *ARM Architecture Reference Manual.*

09EC212 EMBEDDED SYSTEMS

Credits: 3: 0: 0
Objective

To learn about Real time Embedded system, Programming languages and tools

Out Come

The student can able to do embedded projects

UNIT I

Introduction to Embedded Systems

An Embedded System – Processor in the System – Other hardware units – Software embedded into a System – Exemplary Embedded Systems - Embedded System On Chip and in VLSI circuit

UNIT II

Real Time Systems

Introduction – Issues in Real time Computing – Structure of a Real Time System – Architecture of Real Time Systems – Performance measures for Real Time Systems – Properties of Performance Measures

UNIT III

Real Time Operating Systems

Task and Task States, tasks and data, semaphores and shared Data Operating system Services-Application of Semaphores -Message queues-Timer Function-Events – Memory management

UNIT IV

Programming Languages and Tools

Language features-Programming environments-Introduction to-assembler-compiler-cross compilers and Integrated Development Environment (IDE). Simulators, Emulators-

UNIT V

Programming Concepts and Embedded Programming in C and C++

Software programming in Assembly Language and in High level language – C Program Elements – Queues – Stacks – lists and ordered lists – Embedded programming in C++

TEXT BOOKS

1. W. Valvano ,Thomson Brroks,"Embedded Microcomputer Systems", Jonathan, 1st Edtion, 2002
2. Jane W.S. Liu, "Real Time Systems", Pearson International Edition, 1st Indian Reprint, 2001

REFERENCE BOOKS

1. C.M. Krishna, Kang G. Shin, "Real Time systems", McGraw Hill, 2 nd Edition, 2005.
2. Raj Kammaal, "Embedded System" McGraw Hill, 1st Edition, 2003.

09EC213 NEURAL NETWORKS AND FUZZY SYSTEMS

Credits: 3:0:0

OBJECTIVE

To learn the fundamentals of soft computing techniques

OUTCOME

Able to solve the simple practical problems in an efficient manner

UNIT I

Fundamentals of Artificial Neural Network

Artificial neuron - Biological Neural networks – Applications - Typical architectures – Training - Common activation functions - Single layer net - Back Propogation neural network.

UNIT II

Neural Nets for Pattern Classification & Pattern Association

Hebb Net - Perceptron - Adaline - hopfield Net - Bidirectional Associative Memory(BAM)-Architecture -Algorithm and Applications.

UNIT III

Neural Nets for Clustering

Fixed Weight Competitive Nets : Maxnet-Hamming Net- Kohonen Self organising Maps - Adaptive Resonance Theory-Architecture - algorithm and application.

UNIT IV

Fundamentals of Fuzzy Logic

Fuzzy sets - Fuzzy Relations - Fuzzy Equivalence Relations - Membership functions - Defuzzification methods - Rule based systems.

UNIT V

Fuzzy Logic Applications

Fuzzy classification - Fuzzy Pattern Recognition - Fuzzy Control systems - Fuzzy optimization**.**

TEXT BOOKS

1. Laurence Fausett, "Fundamentals of Neural Networks, Architecture, Algorithm and Applications", Prentice-Hall, Inc, 2004.
2. *Timothy J.Ross, "Fuzzy Logic with Engineering Applications", Mc.Graw Hill International Editions, 1997***.**

REFERENCE BOOKS

1. Phillip D. Wasserman, "Neural Computing theory and practice, Van Nostrand Reinhold", New York, 1989.
2. Jacek M. Zurada, "Introduction to Artificial Neural Networks", Jaico Publishing House, 1997.
3. George J. Klir and Bo Yuan, 'Fuzzy Sets and Fuzzy Logic – Theory and Applications', Printice Hall of India, 2002.
4. Limin Fu, 'Neural Networks in Computer Intelligence', McGraw Hill, 1994.

09EC214 DIGITAL INTEGRATED CIRCUITS

Credits: 3:0:0

Objective

To learn the fundamentals of Digital Design concepts

Outcome
Able to design simple digital application circuits.

UNIT I
Number Systems
Need for binary numbers - Conversions: binary to decimal - decimal to binary - octal to decimal - decimal to octal - hexadecimal to binary and vice versa. ASCII code - Excess-3 code -Gray code. Arithmetic Circuits: Binary Addition – subtraction – multiplication – division – signed - unsigned numbers - 2’s complement arithmetic - arithmetic building blocks: adder - subtractor.

UNIT II
Logic Circuits Analysis And Design
Binary number system- NOT, OR, AND, NAND, NOR gates, Boolean algebra - laws and theorems, sum of products - products of sum method - Karnaugh map. Data Processing Circuits: Multiplexer – Demultiplexer – Decoder – Encoder - XOR gate - Parity Generator and Checker.

UNIT III
Digital ICs
TTL circuits and CMOS circuits - 7400 devices - TTL parameters - AND-OR-invert gate - open collector gates - Three state TTL devices - External drive for TTL loads - positive and negative logic - CMOS Circuits: E-type MOSFET - MOS inverter - 74C00 CMOS characteristics - TTL-CMOS interface - TTL clock.

UNIT IV
Flip flops
RS, JK and D Flip-flops - Schmitt trigger - Types of shift register - synchronous and asynchronous counter.

UNIT V
Memories
Semiconductors Memories: Memory Addressing - ROMs, PROMs, EPROMs, RAMs - DRAMs, memory cells. (In all the five units, trouble-shooting section not included)

TEXT BOOK
1. Albert Paul Malvino and Donald P. Leech, Digital Principles and Applications, Fourth Edition, Tata McGraw Hill, 2006.

REFERENCE BOOK
1. M. Morris Mano, Digital Logic and Computer Design, Fourth Edition, Prentice-Hall of India Private Limited, 2007.

09EC215 SATELLITE COMMUNICATION

Credits: 3:0:0
Objective:
To introduce the basic concepts of satellite communication.
Outcome:

The students will be equipped to design simple transmitter and receiver circuits.

UNIT I
Orbit and Description
Kepler's laws- Orbital period and velocity – Azimuth and elevation -Placement of satellite in a geo-stationary orbit – satellite description – transponder subsystem– Telemetry, Command and ranging subsystem – Attitude control and electrical power.

UNIT II
Earth Station
Earth Station Transmitters, Receivers-antenna types – Gain and radiated power – Noise temperature – G/T ratio – High power amplifiers – Redundancy configurations – Low noise amplifiers – Redundancy configuration – Monitoring& control.

UNIT III
Interference
Basic link analysis – Interference analysis – Carrier to noise plus interference ratio –Terrestrial interference – Cross polarization interference – Adjacent channel and inter symbol interference – Rain induced cross polarization interference.

UNIT IV
Multiple Access Techniques
Frequency Division multiple access (FDMA) – Time division multiple access (TDMA) and code division multiple access (CDMA) – Performance comparison of various multiple access schemes.

UNIT V
Applications and Services
Mobile satellite (MSAT) networks – Low orbital satellites – Domestic satellite systems-the INSAT System-International systems-INTELSAT

TEXT BOOKS
1. Wilbur L.Pritchard & Joseph A.Sciulli, "Satellite Communication Systems Engineering", Prentice Hall Inc, 2nd Edition, 1st Indian print, 2003
2. Tri. T. Ha, "Digital Satellite Communications", second edition, McGraw-Hill Publishing Co., 2008.
REFERENCE BOOKS
1. Timothy Pratt and Charles W. Bostian, "Satellite Communication", John Wiley and Sons, 2nd edition, 2006.
2. B.N. Agarwal, "Design of Geosynchronous Spacecraft", prentice Hall, 2nd edition,1986.
3. D.Roody, "Satellite Communication", McGraw Hill, 4th edition, 2006.

09EC216 DIGITAL INTEGRATED CIRCUITS LAB
Credits: 0:0:2

12 Experiments will be notified by HOD from time to time

1. Study of logic gates
2. Multiplexer and Demultiplexer
3. Encoder and Decoder
4. Adder and Subtractor
5. Design of counter
6. Design of Flip flops
7. Frequency response of Inverting & Non inverting amplifier
8. Measurement of op-amp parameters
9. Design of adder and Subtractor
10. Design of Schmitt trigger using op-amp
11. Design of Integrator & Differentiator
12. Design of Digital to Analog converter
13. Design of Astable multivibrator using op-amp
14. Design of Schmitt trigger using 555 timer.

09EC217 MICROPROCESSOR AND INTERFACING LAB

Credits: 0:0:2

1. Arithmetic operations of 8085
2. Sorting of n-number
3. Searching of n
4. Block transfer
5. Arithmetic operations of 8086
6. Square wave generation
7. Serial communication
8. Analog to digital Convertor
9. Digital to Analog Converter
10. Stepper motor
11. DC motor
12. 7 segment display

09EC218 BASIC ELECTRONICS

Credits: 3:0:0

Objective: To know the basics about semiconductor, integrated circuits and communication system.
Outcome: Students will get overview about the basics of electronics.

UNIT I
Introduction to Semiconductor
Covalent bond – N type & P type semiconductor – conduction in semiconductor – semiconductor devices : diode, transistor, FET, MOSFET, UJT.

UNIT II
Integrated Circuits

IC: OP-amp – introduction-Ideal characteristics-inverting and non-inverting amplifier –adder subtractor-differentiator-integrator- Monolithic IC fabrication techniques.

UNIT III
Digital Systems
Number system – Boolean algebra – logic gates –truth table - combinational circuit -4 x 1 multiplexer – 1 x 4 demultiplexer - digital computer principles.

UNIT IV
Communication
Basic block of communication system – need for modulation – Derivation of AM and FM signal - Amplitude and Frequency Modulation (Balanced modulator and varactor diode modulator)- Demodulation(AM diode detector and balanced slope detector.

UNIT V
Communication systems
Block diagram of AM and FM transmitter - Superheterodyne receiver – satellite communication – Fibre optic communication

TEXT BOOK

1. Muthusubramanian ,R, Salivahanan S, Muraleedharan Ka , "Basic Electrical Electronics & Computer Engineering "Tata Mc.Graw Hill, 2005

REFERENCE BOOKS
1. Robert Boylestad, "Electronic Devices & Circuit Theory", Eigth Edition, PHI,2002.
2. Anokh Singh, "Principles of Communication Engineering" S.Chand Co., 2001
3. V.K.Metha."Principles of Electronics",Chand Publications,2008.

09EC219 ELECTRONICS AND MICROPROCESSOR LAB

Credits:0:0:1

Any 6 experiments

1. Characteristics of semi conductor diode.
2. Characteristics of zener diode.
3. Study of Half -Wave and Full-Wave rectifier
4. Study of Bridge Rectifiers.
5. Transistors as a Switch and Amplifier
6. Operational amplifier Configurations: Adder, Integrators, and Current to Voltage
7. Converters.
8. Verifications of truth tables of logic gates AND, OR, NOT, NAND exclusive OR.
9. Combination logic realisation: Adder, Subtrator.
10. Sequential logic: Counters, Shift Registers with display devices.
11. Study of Microprocessor Kits.

12. Arithmetic operations on 8085.
13. StepperMotor Interface.
14. Display Interface

09EC220 LINEAR INTEGRATED CIRCUITS AND APPLICATIONS

Credits: 3: 1: 0

OBJECTIVE
To get knowledge about IC fabrication and applications

OUTCOME
Students will be able to design circuits using ICs

UNIT I
Integrated Circuit Technology
Monolithic Integrated Circuit Technology – Planar process – Bipolar Junction Transistor fabrication – Fabrication of FET's – CMOS Technology – Monolithic diodes – Metal – Semiconductor contact – Integrated Circuit Resistors – Integrated Circuit Capacitors – Integrated Circuit Packaging – Characteristics of Integrated Circuit Components –Microelectronic Circuit Layout.

UNIT II
OP-AMP Characteristics And Applications
Characteristics of ideal op-amp. Pin configuration of 741 op-amp – Bias - offsets and drift - bandwidth and slew rate - Frequency compensation - Applications: inverting and non-inverting amplifiers - inverting and non-inverting summers - difference amplifier - differentiator and integrator - Log and antilog amplifiers - Multiplier and divider - analog computers.

UNIT III
Comparators And Signal Generators
Comparators - regenerative comparators - input output characteristics - astable multivibrator - Monostable multivibrator - Triangular wave- generators - RC-phaseshiftoscillator -Wein's bridge oscillator.

Voltage Regulator
Series op amp regulator - IC voltage regulator -723 general purpose regulator - Switching Regulator.

UNIT IV
Active Filters, Timers And Multipliers
Low pass - High pass - Band pass and Band Reject filters – Butterworth - Chebychev filters - first and second order filters-switched capacitor filters.555 Timer functional diagram, monostable and astable operation - multiplier -application.

UNIT V
PLL, ADC And DAC

PLL- basic block diagram and operation - capture range and lock range simple applications of PLL - AM detection - FM detection and FSK demodulation. Weighted resistor DAC, R-2R and inverted R-2R DAC, monolithic DAC - Flash ADC - counter type ADC - successive approximation ADC - dual slope ADC - conversion times of typical ADC.

TEXT BOOK

1. *Roy Choudhury.D., Shail Jain, "Linear Integrated Circuits", New age international publications,Third Edition,2007.*

REFERENCE BOOKS

1. Gayawad.A.R., "Op-Amps & Linear IC's", PHI, fourth edition,2004
2. Coughlin.Frand.Driscoll.F.F., "Operational Amplifiers & Linear IC's", PHI, 1997.
3. Franco, "Design With Operational Amplifier And Analog Integrated Circuits", TMH, 1998.

09EC221 ELECTROMAGNETIC FIELDS

Credits: 3: 1:0

OBJECTIVE
To get knowledge about electric and magnetic fields
OUTCOME
Students can make use of electromagnetic field concepts in wave guide applications.

UNIT I
Static Electromagnetic Fields
Introduction to co-ordinate system - Gradient, Divergence - Curl, Divergence Theorem - Stoke's Theorem - Coulomb's Law - Electric field Intensity - Principle of superposition - Electric Scalar potential - Line charge distribution by Moment method - Electric flux Density - Gauss Law and its applications - Field Computations and Problems.

UNIT II
Static Magnetic Field
Magnetic field of a current carrying element - Ampere's Force law - The Biot-Savart Law - Magnetic Flux density - Gauss law for magnetic fields - Torque on a loop - Magnetic moment, Ampere's Law and Magenetic field intensity - Magnetomotive force - Field cells and permeability - Vector potential - Field computation and problems.

UNIT III
Electric Field In Dielectrics
Permitivity – Polarization - Boundary relation – Capacitance - Dielectric strength - Energy and energy density - Poisson's and Laplace equations and applications - Electric Current - Current Density - Ohms law at a point - Resistance and Conductance - Continuity relations for current problems.
UNIT IV
Magnetic Field In Ferromagnetic Materials

Magnetic materials - Magnetic dipoles - Loops and Solenoids – Magnetization – Inductance - Energy in an Inductor and Energy Density - Boundary relations - Ferro magnetism – Hysteresis - Reluctance and Permeance - Problems.

UNIT V
Time Varying Electric And Magnetic Fields
Faraday's La - Transformer and Motional Induction - Maxwell's equation from Faraday's Law - Self and Mutual Inductance - Displacement current - Maxwell's equation from Ampere's Law and its in-consistency - Boundary relation - Poynting Vector - Comparision of field and circuit theory - Circuit Application of Poynting Vector.

TEXT BOOKS
1. John D. Kraus, "Electromagnetics", McGraw Hill, 2003.
2. David K. Chang, " Field and Wave Electromagnetics ", Second edition, Addison Wesley, New Delhi,2001.

REFERENCE BOOKS
1. Hayt W.H., "Engineering Electromagnetics", McGraw Hill, 2003.

09EC222 COMMUNICATION THEORY AND SYSTEMS

Credits: 4:0:0

OBJECTIVE
To get knowledge about various modulation techniques, transmitters, receivers Inference
OUTCOME
Students can design communication circuits

UNIT I
Base Band Signals and Systems
Introduction, Definition of communication - Communication system block diagram – Need for wireless communication – Need for modulation – General definition of modulation – Types of modulation - General concepts about base band signal and bandwidth of signals.

UNIT II
Analog Modulation Techniques
Amplitude Modulation: Introduction – Theory of Amplitude Modulation – AM power calculations – AM with a complex wave – Need for suppression of carriers – Suppressed carrier systems (DSB SC, SSB & VSB systems).Angle Modulation: Theory of Frequency modulation, Mathematical analysis of FM and representation of FM – Spectra of FM signals – Narrow band FM and wide band FM. Theory of PM, PM obtained from FM – Comparison of AM & FM, Comparison of PM & FM.

UNIT III
Modulation and Demodulation Techniques

Amplitude Modulation: Introduction – generation of AM signal – low level and high level modulation – square law diode modulation – AM in amplifier circuits – suppressed carrier AM generation (Balanced Modulator, Ring Modulator, Product Modulator)
AM Demodulation: Square law detector, envelope (or) diode detector – distortion in diodedetectors – synchronous demodulation.Frequency Modulation: Generation FM signal by Direct method (Varactor diode modulator) – Indirect generation of FM (Armstrong method, RC phase shift method).FM Demodulation: Direct methods frequency demodulation (Travis detector, Balanced slope detector, Foster seeley discriminator, ratio detector, limiters), Indirect methods (Detection using PLL, zero crossing detector)

UNIT IV
AM & FM Transmitters and Receivers
AM Transmitter and Receiver: Allocation of frequency for various services- AM transmitters- block schematic- high level and low level transmitters- class C- R.F tuned amplifiers- frequency multiplier- SSB transmitters- ISB transmitters. Tuned radio frequency receivers – Super heterodyne receiver- Basic elements of AM super heterodyne receiver: - RF amplifier, Classes of operation of RF amplifier, Image frequency rejection – frequency conversion – IF amplifier – tracking and alignment – merits and demerits of different receivers. Characteristics of Receivers.
FM Transmitter and Receivers: Block diagram of FM transmitter and methods of frequency stabilization – Armstrong FM transmitter system – Pre-emphasis. Block diagram of FM receiver – De-emphasis – RF amplifier – AFC – Diversity reception techniques – Spurious response in receivers.

UNIT V
Noise
Noise and Interference-Thermal and Shot noise-Signal to Noise ratio - Noise figure – Noise temperature. Noise in AM and FM: SSB-SC - calculation of output signal to noise ratio. DSBS Ccalculation of output signal to noise ratio-figure of merit-frequency modulation-calculation of output signal to noise ratio-comparison of SNR with respect to AM and FM.

TEXT BOOKS
1. Anokh Singh, "Principles of Communication Engineering" S.Chand Co., 2001
2. Roody & Coolen, "Electronic Communication", PHI, 4th Edition, 2003

REFERENCE BOOKS
1. Taub and Schilling – "Principles of Communication Systems", Mc Graw Hill, 2nd Edition, 25th Reprint, 2003
2. G.Kennedy, "Electronic Communication Systems", Mc Graw Hill, 4th Edition, 8th Reprint, 2003

09EC223 MICROWAVE AND OPTICAL COMMUNICATION ENGINEERING

Credits 4: 0: 0
OBJECTIVE
To get knowledge about Microwave Devices

OUTCOME

Student knows more about Microwave and its propagation

UNIT I

Microwave Passive Devices

Review of electromagnetic theory on Transverse magnetic and electric waves in rectangular and circular wave-guides - Passive microwave devices: Coaxial Connectors and Adapters - Wave guide Choke Flanges - Matched Terminations - Short Circuit Plunger - Rectangular to circular wave guide transition -Tuning screws - Wave guide Corners - Bends and Twists – Windows - Coaxial line to Wave guide Adapters - Coupling Loops and Coupling Aperture – Attenuators - Phase shifters - Wave guide Tees - E plane Tee - H plane Tee - Magic Tee and their applications – Isolators - Circulators - Directional couplers - Scattering matrix derivation for all components.

UNIT II

Microwave Vaccum Tube Devices

Introduction - Two cavity Klystron Amplifier – Mechanism and mode of Operation - Power output and Efficiency - Reflex Klystron Oscillator – Mechanism and mode of Operation - Modulation of Reflex Klystron; Applications - TWT amplifier - Principle of Operation gain and applications; Magnetron Oscillator – Hull cut-off voltage, Mechanism of Operation - Mode separation.

UNIT III

Microwave Solid State Devices and Measurement

Microwave diodes – Crystal diode, Schottky diode, Harmonic Mixer; PIN diode – Gunn diode – Mode of operation - Oscillator Circuit – TRAPAT - IMPATT and BARITT diodes - Mechanism of Operation - Application as Oscillator and Amplifiers - Microwave transistors – Unipolar and Bipolar - Applications. Power measurements – Low and High power measurement, Insertion loss and Attenuation measurement, VSWR - measurement – Low and High VSWR, Impedance measurement -Frequency measurement.

UNIT IV

Optical Communication

Overview of optical communication - Need for optical communication – Comparison with the electrical communication - Optical Fiber light guides theory: Ray theory – Mode theory. Snell's law – Critical angle – Acceptance angle – Numerical Aperture. Types of fibers: Step and Graded index fibers. Wave propagation in multi mode and single mode optical fibers Attenuation – dispersion – Polarization.

UNIT V

Optical Transmitters and Receivers

Optical sources and Transmitters: Review of Physical Electronics - Physics of light emission and amplification in semiconductors - LEDs - types of LEDs – principle of operation - Laser Diodes – working principle -Power launching and coupling – Numerical Aperture.Optical Detectors and Receivers: Photo detectors - photodiodes - pin and Avalanche photo detectors - Photo detector requirements for optical communications - Mechanisms of photon detection – Quantum Efficiency - Detector responsively –Phototransistors.

TEXT BOOKS

1. Samuel.Y.Liao, “Microwave Devices and Circuits”, Prentice Hall of India Pvt Ltd., 3rd Edition, 5th Reprinting, 2000
2. Keiser.G. "Optical Fiber Communications”, McGraw Hill, 3rd edition, 2000

REFERENCE BOOKS

1. Collin. R.E, “Foundation of Microwave Engineering”, McGraw-Hill, II Edition, 1992.
2. Annapurna Das, Sisir K. Das, “Microwave Engineering”, Tata McGraw-Hill Co., Ltd., 1st Edition, 1999. Reprint 2001.
3.John Senior “optical communications” Prentice Hall India , Second Edition, 2004.

09EC224 DIGITAL SIGNAL PROCESSING

Credits: 3:1:0

OBJECTIVE

To know more about digital signal processing concepts

OUTCOME

Students can make use of signal processing concepts in TMS processors

UNIT I

Introduction to DSP and Fourier Transform

Review of Discrete Time LTI Systems – Linear, circular and sectioned convolutions - DFS, DTFT, DFT – FFT computations using DIT and DIF algorithms - Time response and frequency response analysis of discrete time systems to standard input signals.

UNIT II

Finite Impulse Response Digital Filters

Symmetric and Antisymmetric FIR filters – Linear phase response and its implication – FIR filter design using window method – frequency sampling method – design of optimal linear phase FIR filters – realization structures of FIR filters – transversal and linear phase structures.

UNIT III

Infinite Impulse Response Digital Filters

Calculation of IIR coefficients using pole –zero placement method-Review of classical analog filters-Butterworth,Chebyshev and Elliptic filters–Transformation of analog filters into equivalent digital filters using impulse invariant method and Bilinear Z transform method Realization stuctures of IIR filters-Direct,cascade,parallel forms

UNIT IV

FiniteWord Length Effects

Representation of numbers in registers-ADC quantization noise-coefficient quantization error-Product quantization error –Limit cycles due to product round-off error, Round –off Noise reduction scheme-Addition over flow errors-Principle of scaling.

UNIT V

Special Topics in DSP And DSP Processors
Adaptive filtering – basic wiener filter theory – LMS adaptive algorithm – recursive least square algorithm. Introduction to general and special purpose hard ware for DSP – Harvard architecture –pipelining-Special instruction-Replication-Hardware digital filter – Texas Instruments TMS320C5416 – Instruction set of TMS320C5416 – Simple programs.

TEXT BOOK
1. John G. Proakis and Dimitris G.Manolakis, 'Digital Signal Processing, Algorithms and Applications', PHI of India Ltd., New Delhi, 3rd Edition, 2000.

REFERENCE BOOKS
1. Opeenheim and Schafer, 'Digital Time Signal Processing', Prentice Hall of India, Reprint, 2002
2. Emmanuel C. Ifeacher and Barrie W. Jervis, 'Digital Signal Processing – A Practical Approach', Addition – Wesley Longman Ltd., UK, 2nd 2004 Low Price Edition
3. Sanjit K.Mitra, 'Digital Signal Processing - A Computer Based Approach', Tata McGraw-Hill, New Delhi, 2nd Edition, 2001
4. Texas Instruments Manuel for TMS320C5416 Processor.

09EC225 DIGITAL COMMUNICATION

Credits: 4:0:0

OBJECTIVE
To know more about digital communication concepts
OUTCOME
Students can use digital coding techniques in communication

UNIT I
Sampling And Bandlimited Signalling
Review of Sampling Theorem, PAM and TDMA Principles, Quantization, PCM, DPCM and Delta Modulation – International standard (CCCIT, CEPT) Power Spectra of PAM signals -Inter symbol Interference - Ideal Nyquist channel - Raised cosine channels – Correlative coding and precoding.

UNIT II
Digital Modulation
Introduction - Binary phase shift keying - differential phase shift keying – differentially encoded PSK - Quadrature phase shift keying – M-ary PSK – quadrature amplitude shift keying - Binary frequency shift keying – similarity of BFSK and BPSK – M-ary FSK – Minimum shift keying – Duo binary encoding.

UNIT III
Data Transmission – Detection and Estimation
Base band signal receiver – Probability of error – Optimum filter – White noise: Matched filter – Probability of error of the matched filter – Coherent reception: Correlation – Phase-shift Keying – Non-coherent detection of FSK – Differential PSK – Four phase PSK (QPSK)
.

UNIT IV
Information Theory and Coding
Discrete messages-amount of information-average information-entropy information rate-Shannon's theorem-capacity of gaussian channel-bandwidth-S/N trade off-coding-parity check bit coding-block codes coding and decoding probability of error with coding- - Convolution codes – Cyclic codes.

UNIT V
Spread Spectrum Systems
Pseudo Noise sequences, generation and correlation properties - direct sequence spread spectrum systems - Frequency Hop systems - processing gain - antijam and multipath performance.

TEXT BOOKS

1. Taub and Schilling "Principles of Communication Systems", Mc Graw Hill, 2nd Edition, 25th Reprint, 2003
2. Simon Haykins, "Digital Communications", John Wiley, 1st edition, Reprinted, 2004.

REFERENCE BOOKS

1. Harold kolimbinis "Digital Communication Systems" Prentice Hall India, Indian print, 2001
2. John.G.Proakis, "Digital Communication", McGraw-Hill Inc., 4th edition, Malaysia, 2000
3. M.K.Simen, "Digital Communication Techniques" Signal Design & Detection', Prentice Hall of India, Reprint, 2003
4. Leon.W.Couch II "Digital and Analog Communication", Pearson Education Asia, Indian print 2001.

09EC226 ELECTRONICS AND COMMUNICATION LAB

Credits: 0:0:2

1. Amplitude modulation
2. Diode detection
3. Frequency modulation
4. Pre-emphasis and de-emphasis
5. Pulse amplitude modulation
6. IF amplifier
7. Attenuators
8. Equalizer
9. Pulse duration modulation

10. Study of sampling theoremmonostable multivibrator
11. Astable multivibrator
12. Clippers and clampers

09EC227 DIGITAL SIGNAL PROCESSING LAB

Credits: 0:0:2

1. Waveform generation
2. Basic operations on dt-signals
3. Properties of discrete time system
4. Sampling rate conversion
5. Discrete convolution
6. Discrete fourier transform
7. Fast fourier transform
8. Analog butterworth filters
9. Analog chebyshev filters
10. Design of IIR filter
11. Design of FIR filter
    Time domain response of IIR &FIR system

    Frequency response of dt- systems

09EC228 ADVANCED COMMUNICATION LAB

Credits: 0:0:2

1. Modulation and Demodulation of PAM, PWM, PPM
2. Digital Modulation techniques
3. Pulse code modulation and demodulation
4. Delta modulation and demodulation
5. RF filters
6. RF tuned amplifier
7. Measurement of antenna resonance and VSWR
8. Inverse square law of propagation and verification of reciprocity theorem
9. Determination of characteristics impedance & dielectric constant of transmission line
10. Measurement of VSWR, Refection coefficient & return loss of transmission line
11. Study of serial communication
12. Modulation using MATLAB
13. Study of GPS

09EC229 LINEAR INTEGRATED CIRCUITS LAB

Credits: 0:0:2

List of Experiments:

1. Measurement of op-amp parameters
2. Design of inverting and non-inverting amplifier

3. Design of adder and subtractor using op-amp
4. Design of integrator and differentiator using op-amp
5. Precision rectifiers using op-amp
6. Design of astable multivibrator using op-amp
7. Design of astable multivibrator using 555 Timer
8. Design of active filters using op-amp
9. Design of Weinbridge Oscillator
10. Design of Schmitt Trigger using op-amp
11. Design of Schmitt Trigger using 555 Timer
12. Design of Digital to Analog Converter

09EC230 DIGITAL ELECTRONICS LAB

Credits: 0:0:2

1. Realization of logic gates
2. Half adder & full adder
3. Half subtractor & full subtractor
4. Multiplexer & demultiplexer
5. Encoder & decoder
6. Odd and even parity generator and checker
7. Bcd to excess three coverter
8. Code conversion
9. Flip flops
10. Shift register
11. Counters
12. Comparator

09EC231 VLSI DESIGN LAB

Credits: 0:0:2

1. Design and simulation of half adder & fulladder circuits
2. Design and simulation of JK flip flop
3. Design and simulation of D flip flop
4. Design and simulation of 4*1 multiplexer
5. Design and simulation of 2*4 decoder
6. Design and simulation of priority encoder
7. Design and simulation of shift registers
8. Design and simulation of counters
9. Design and simulation of memory units
10. Design and simulation of sequential logic circuits represented by mealy model
11. Design and testing of parity generators
12. Design and testing of 8-bit ALU

13. Design and testing of magnitude comparator
14. Design and simulation of half adder & full adder circuits using verilog
15. Design and simulation of logic gates using verilog
16. Design and simulation of clock generator/counter circuit using verilog

09EC232 MICROPROCESSOR AND MICROCONTROLLER LAB

Credits: 0:0:2

Any 10 experiments.

1) Programs involving Data Transfer instructions
2) Programs involving Arithmetic and Logical operations
3) Programs on Code conversions
4) Programs on finding largest/smallest number,
5) Programs on ascending/descending order.
6) Stepper motor Interfacing
7) DC Motor Interfacing
8) ADC Interfacing
9) Traffic Light Controller
10) DAC Interfacing
11) Serial Communication
12) Square wave generation.
13) Keyboard Display Interfacing

09EC233 MICROPROCESSORS AND MICRO CONTROLLERS

Credits: 4:0:0

Objective

To learn about the basics of microprocessors and microcontroller with applications.

Outcome

On successful completion of the subject, students can able to write the assembly language coding for various applications

UNIT I: 8085 Microprocessor

Organization of 8085 microprocessor –Instruction set-Addressing modes- Assembly Language programming-machine cycles-Read, Write – Interrupt acknowledge – Bus Cycles.

UNIT II: 8086 Microprocessor

Organization of 8086 microprocessor – memory segmentation – Addressing bytes and Words – Address formation –Address modes in 8086 – Assembly language programming – Minimum mode and maximum mode

UNIT III : Microprocessor Interfacing techniques:

Programmable parallel ports-8255 PPI -8253 programmable interval timer.
8251A Programmable communication interface -8279 Programmable Keyboard/display interface- - 8259A Programmable interrupt controller-

UNIT IV: Microcontroller 8051
Organization of 8031 and 8051 microcontrollers – I/O ports-External memory –
– Interrupts – Instruction set – Addressing Modes – Assembly language programming,

UNIT V: Applications
Counter and Timers – Serial data input and output – Interrupts – simple applications - LCD, Keyboard interfacing, ADC, Sensor interfacing and Signal conditioning,

TEXT BOOKS

1. Ramesh.S.Gaonkar "Microprocessor Architecture, Programming & Applications With 8085/8080a" – Penram International – 2006.
2. D.V.Hall "Microprocessor and Digital System", McGraw Hill Publishing Company, 2008.
3. Kenneth J.Ayala "The 8051 Microcontroller Architecture, Programming & Applications" – Penram International Publishing –2008.
4. Muhammad Ali Mazidi,J.G.Mazidi,R.D.Mckinlay, "The 8051 Microcontroller and Embedded Systems" Second Edition Prentice Hall-2007.

REFERENCE BOOKS

1. Yu.Cheng Liu & Glenn A Gibson," Microcomputer System, 8086/8088 Family", 2nd Edition, PHI, 2000.
2. Rafiquzzaman.M. "Microprocessor Theory and Applications-Intel and Motorola", PHI, 2007.

09EC234 COMPUTER COMMUNICATION

Credits: 4:0:0

OBJECTIVE:

To introduce the concept, terminologies, and technologies used in modern data communication and computer networking.

OUTCOME

To introduce the students the functions of different layers.
To introduce IEEE standard employed in computer networking.
To make students to get familiarized with different protocols and network components.

UNIT I

Data Communications

Components – Direction of Data flow – networks – Components and Categories – types of Connections – Topologies –Protocols and Standards – ISO / OSI model – Transmission Media – Coaxial Cable – Fiber Optics – Line Coding – Modems – RS232 Interfacing sequences.

UNIT II

At Link Layer

Error – detection and correction – Parity – LRC – CRC – Hamming code – Flow Control and Error control: stop and wait – go back N ARQ – selective repeat ARQ- sliding window techniques – HDLC.
LAN: Ethernet IEEE 802.3, IEEE 802.4, and IEEE 802.5 – IEEE 802.11–FDDI, SONET – Bridges.

UNIT III
Network Layer
Internetworks - Packet Switching and Datagram approach – IP addressing methods – Subnetting – Routing – Distance Vector Routing – Link State Routing – Routers.

UNIT IV

Transport Layer

Duties of transport layer – Multiplexing – Demultiplexing – Sockets – User Datagram Protocol (UDP) – Transmission Control Protocol (TCP) – Congestion Control – Quality of services (QOS) – Integrated Services.

UNIT V

Application Layer

Domain Name Space (DNS) – SMTP, FDP, HTTP, WWW – Security – Cryptography.

TEXT BOOK
1. Behrouz A. Foruzan, "Data communication and Networking", Tata McGraw-Hill, 2004.

REFERENCE BOOKS
2. James .F. Kurouse & W. Rouse, "Computer Networking: A Top down Approach Featuring", Pearson Education, fourth edition 2008
3. Larry L.Peterson & Peter S. Davie, "Computer Networks", Harcourt Asia Pvt. Ltd., Third Edition,2007
4. Andrew S. Tannenbaum, "Computer Networks", PHI, Fourth Edition, 2003.
5. William Stallings, "Data and Computer Communication", Sixth Edition, Pearson Education, 2000.
6. Prakash C.Gupta," Data Communication and Computer Networks, PHI Learning Private Limited,2006

09EC235 ELECTRONICS AND MICROPROCESSORS

Credits: 4:0:0

Objective
To learn about various semiconductor devices, transducer And measuring Instruments and microprocessors applications.
Outcome
On successful completion of the subject, students will be able to analyse basic electronic circuits and write simple microprocessor based programs.

UNIT I

Review Of Semiconductor Devices-Electronics Circuits (Qualitative Study Only)
Circuitry and description of half wave and full wave rectifier – Capacitor and inductor filter – zener regulator-I.C. voltage regulators. Transistor Amplifiers:CB, CE, and CC configurations - Biasing Circuits RC coupled amplifier FET amplifiers - power amplifiers – Classification- class A and B Push Pull Configurations. Oscillators, Barkihausen criterion- Colpits-Wien bridge and phase shift oscillators-OP-amp comparators.

UNIT II
Transducer And Measuring Instruments (Qualitative Study Only)
Classification-working principle of potentimeter, strain gauges, piezoelectric crystals, thermistors, photodiodes, phototransistors- Study of working principle (using block diagram of multimeters, digital voltmeters, signal generators, CRO)

UNIT III
Digital Electronics
Comparison between analog and digital systems-Number representation–Logic gates-Flip-flops-Registers, Counters, Multiplexers, Decoders, and Encoders-Half and full adders, Half and full subtractor.

UNIT IV
Introduction to Microprocessor
Block diagram of Microcomputer - Architecture of Intel 8085 - Instruction formats, Addressing methods- types of Instruction - Intel 8085 - Instruction set - Development of simple assembly language programs and examples.

UNIT V
I/O Devices
Memory and I/O devices and interfacing RAM, ROM, EPROM - Printers-I/O ports-Key boards-Asynchronous and synchronous data transfer schemes-interrupt driven data transfer- DMA data transfer-Simple applications of Microprocessors.

TEXT BOOKS

1. *Albert Malvino, David A Bates, "Electronic Principles", Tata McGraw Hill, Seventh Edition, 2008.*
2. *Adithya P. Mathur, "Introduction to Microprocessor", Tata McGraw Hill, 6th Edition, 2002.*
3. *Morris Mano, "Digital logic and computer Design", 3rd edition Prentice Hall Of India, 2002.*

REFERENCE BOOK

1. *Kalsi H S "Electronics Instrumentation" ,Tata Mcgraw Hill, 2nd Edition reprint 2006*

09EC236 WORKSHOP PRACTICE ON PCB DESIGN

Credits: 0:0:2

List of experiments

1. Introduction to ORCAD tool
2. Design of circuit schematic & layout
3. Drilling
4. Etching
5. Soldering
6. Testing using CRO & Multimeter
7. Fitting of PCB board
8. Activity 1
9. Activity 2
10. Activity 3

09EC237 MICROWAVE AND OPTICAL COMMUNICATION LAB

Credits: 0:0:2

Any 10 experiments

1. Frequency And Wavelength Measurement
2. Impedance measurement
3. Mode characteristic of reflex klystron
4. Magic tee
5. Directional coupler
6. Characteristics of Gunn diode
7. Setting up of analog link
8. Setting up of digital link
9. Measurement of Numerical aperture of optical fiber
10. Study of losses in optical fiber
11. Characteristics of LED and PD
12. Time division multiplexing using optical link.

09EC238 ELECTRON DEVICES AND CIRCUITS LAB

Credits: 0:0:2

Any 12 experiments

1. Characteristic of PN diode
2. Characteristic of Zener diode
3. Characteristic of JFET
4. Characteristic of BJJ (CE configuration)
5. Characteristic of UJT
6. Design of HWR and FWR
7. Design of low pass & high pass circuit
8. Design of single state amplifier
9. Design of oscillator
10. Design of voltage regulator

11. Design of single tuned amplifier
12. Verification of KCL and KVL
13. Verification of superposition theorems
14. Verification of theverin theorem
15. Design of differential amplifier

09EC239 SOLID STATE CIRCUITS –I

Credits: 4: 0:0

Objective: To know about transistor And FET biasing, amplifiers ,oscillators and CMOS logic concepts

Outcome: Students can design amplifiers, filters and oscillators

UNIT I
Rectifier & Filters
Diode as Rectifiers – Half wave rectifier – Full wave rectifier – ripple factors – DC and AC components in rectifiers – Capacitor and inductor filters – Analysis and design of L section and Pi section filters – Regulators: Voltage and current regulators – Short circuit and over load protection.

UNIT II
Transistor And FET Biasing
Transistor Biasing: Location of the Q point – Fixed bias circuit – Collector to base circuit – Self bias circuit – Graphical DC bias analysis – Design of DC bias circuit. FET biasing: Self biasing – Voltage feedback biasing.

UNIT III
Amplifiers
Frequency response – RC coupled and Transformer coupled amplifiers – Single stage – Multistage amplifiers – Wideband amplifiers –Video amplifiers – Peaking circuits – Positive and Negative feedback – Current and Voltage feedback – Effect of feedback on gain – Input and Output impedance – Noise and Distortion.

UNIT IV
MOS Amplifier & Oscillators
Basic configuration of single stage MOS amplifier, MOS Cascode –MOS Power amplifiers : Class A, AB, B and class D amplifiers – Distortion – Push pull amplifiers – Complimentory symmetry. Oscillators And Tuned Amplifiers: Barkhausen criterion – RC and LC Oscillators – Crystal oscillators – Tuned amplifiers –Single tuned – Double tuned – Stagger tuned.

UNIT V
CMOS Logic concepts
Logic concepts – Inverter characteristic-MOS inverter circuits-CMOS inverter analysis-Static CMOS logic gates-Dynamic logic-Pass transistor logic-Transmission gates

TEXT BOOKS
1. Millman .J. & Halkias.C , "Electronic Devices And Circuits", Tata McGraw Hill, 2005

2. Roger T. Howe, Charles G. sodini " Microelectronics, An Integrated Approach" Pearson Education, 2004

REFERENCE BOOKS

1. Malvino A.P., "Electronic Principles", McGraw Hill International, 1998.
2. Boylestred R and Nashelsky, "Electronic Devices and Circuits Theory", PHI, 2006
3. Allen Moltershed, "Electronic Devices and Circuits", PHI, 1998.

M.TECH. PROGRAMME

09EC301 ADVANCED RADIATION SYSTEMS

Credits: 4:0:0

Objective:

To learn the fundamental of antenna radiation, different types of antenna and its design methodology.

Outcome:

Able to design any type of antenna

UNIT I

Concepts Of Radiation

Retarded vector potentials – Heuristic approach and Maxwell's equation approach. The Lorentz gauge condition. Vector potential in Phasor form. Fields radiated by an alternating current element. Total power radiated and radiation resistance. Radiation from Half wave dipole from assumed current distribution. Power radiated in the farfield. Electric vector potential F for a magnetic current source M. Far zone fields due to magnetic source M.

UNIT II

Antenna Arrays.

N element linear arrays – uniform amplitude and spacing. Phased arrays. Directivity of Broadside and End fire arrays. Three dimensional characteristics. Binomial arrays and Dolph-Tchebycheff arrays. Circular array. Antenna Synthesis- Line source and discretization of continuous sources. Schelkunoff polynomial method. Fourier transform method.

UNIT III

Aperture Antennas

Magnetic current – Duality. Electric and Magnetic current sheets as sources. Huyghens source. Radiation through an aperture in an absorbing screen. Fraunhoffer and Fresnel diffraction. Cornu Spiral. Complimentary screens and slot antennas. Slot and dipoles as dual antennas. Babinets principle. Fourier transform in aperture antenna theory.

UNIT IV

Horn , Microstrip , Reflector Antennas.

E and H plane sectoral Horns. Pyramidal horns. Conical and corrugated Horns. Multimode horns. Phase center.

Microstrip antennas – feeding methods. Rectangular patch- Transmission line model.

Parabolic Reflector antennas – Prime focus and cassegrain reflectors. Equivalent focal length of Cassegrain antennas. Spillover and taper efficiencies. Optimum illumination.

UNIT V

Antenna Polarization.

Simple relationship involving spherical triangles. Linear, Elliptical and circular polarization. Development of the Poincare sphere. Representation of the state of polarization in the Poincare sphere. Random polarization – Stokes parameters.

TEXT BOOK

1. *Balanis, C.A., "Antenna Theory" Wiley,2003*

REFERENCE BOOKS

1. *Jordan, E.C., " Electromagnetic waves and Radiating systems". PHI 2003*
2. *Krauss, J.D., " Radio Astronomy" McGraw-Hill 1966, for the last unit (reprints available)*
3. *Krauss, J.D.,, Fleisch,D.A., "Electromagnetics" McGraw-Hill,1999*

09EC302 MODERN DIGITAL COMMUNICATION TECHNIQUES

Credits: 4:0:0

OBJECTIVE

To learn the fundamental digital techniques for Communication

OUTCOME

Representation of Signal
Coding theory and Modulation
M ary signaling

UNIT I

Introduction

Functional architecture of coded and uncoded digital communication systems - Power bandwidth relation - Various bandwidth definitions - Link budget - Sample link analysis - Signal - Noise ratio as performance criterion. Shannon's capacity theorem - Signal space representation - M ary signals - Gram - Schmid orthogonalisation Procedure.

UNIT II

Modulation Techniques

Characterization of band limited Channel - ISI - Nyquist criterion for Zero ISI - Optimum pulse shape - Eye pattern - Communication System with duobinary encoding - Equalization techniques zero forcing, mean squared error linear equalizer - Decision feedback equalizer.

UNIT III

M' ARY Modulation

M'ARY modulation - M ary PSK, QAM, FSK, - Comparison Power spectra QPSK, MSK, M ary - Bandwidth efficiency.

UNIT IV

Trellis Coded Modulation

Block Interleaving - Convolutional Interleaving - Concept of Turbo code - Turbo Encoder - Feedback Decoder - Trellis coded modulation - TCM Encoding and decoding - TCM example - Reed Solomon code - Performance over Burst Noise - Reed Solomon Encoding and Decoding.

UNIT V

Synchronization

Synchronization Introduction Receiver Synchronization - Frequency and Phase synchronization - Performance in Noise - Non linear loop analysis - Suppressed Carrier loops - Symbol synchronization - Open loop and Closed loop - CPM synchronization - Frame synchronization - Network synchronization - Open loop and closed loop transmitter synchronization.

TEXT BOOKS

1. *Bernard Sklar, "Digital Communication, Fundamentals and Application", Pearson Education Asia, 2nd Edition, 2001*

2. *Simon, Hinedi, Lindsey, 'Digital Communication Techniques, Signal Design and Detection", Prentice Hall of India Private Limited, New Delhi - 11, 1999*
3.

REFERENCE BOOKS

1. *John .G.Proakis, "Digital Communication", McGraw Hill Inc 2001*
2. *Simon Haykin, "Digital Communications", John Wiley and Sons, 1998*
3. *B.P.Lathi, "Modern Digital and Analog and communication systems", 3rd Edition Oxford university press 1998*

09EC303 OPTICAL FIBER COMMUNICATION

Credits: 4:0:0
Objective:
To learn various types of optical fibers, transmitter and receiver section, and fiber amplifiers
Outcome:
Able to establish an efficient optical link.

UNIT I
Fiber Optic Guides
Light wave generation systems, system components, optical fibers, SI, GI fibers, modes, Dispersion in fibers, limitations due to dispersion, Fiber loss, non linear effects. Dispersion shifted and Dispersion flattened fibers

UNIT II
Optical Transmitters And Receivers
Basic concepts, LED's structures spectral distribution,semiconductor lasers, gain coefficients, modes, SLM and STM operation,Transmitter design, Reciever PIN and APD diodes design, noise sensititvity and degradation, Receiver amplifier design.

UNIT III
Light Wave System
Coherent, homodyne and heterodyne keying formats, BER in synchronous- and asynchronous-receivers, sensitivity degradation, system performance, Multichannel, WDM, multiple access networks, WDM components, TDM, Subcarrier and Code division multiplexing.

UNIT IV
Amplifiers
Basic concepts, Semiconductor laser amplifiers, Raman - and Brillouin - fiber amplifiers, Erbium doped – fiber amplifiers, pumping phenomenon, LAN and cascaded in-line amplifiers.

UNIT V
Dispersion Compensation
Limitations, Post-and Pre-compensation techniques, Equalizing filters, fiber based gratings, Broad band compersation, soliton communication system, fiber soliton, Soliton based communication system design, High capacity and WDM soliton system.

TEXT BOOK

1. G.Keiser, Optical fiber communication, Systems, McGraw-Hill, New York, 2000.

REFERENCE BOOKS

1. G.P. Agarwal, "Fiber optic communication systems" 2nd Edition, John Wiley & Sons, New York, 1997.
2. Franz and Jain, " Optical communication system ", Narosa Publications, New Delhi, 1995.
3.. Franz & Jain, "Optical comunication", Systems and components, Narosa Publications, New Delhi, 2000.

09EC304 COMMUNICATION NETWORK SECURITY

Credits: 4:0:0

Objective:
To learn about various network attacks.
To study about security mechanisms such as encryption algorithms and security services to recover the network from attacks.

Outcome:
The student learns to design a better internet security system to detect and correct security violations that involve in the transmission of information.

UNIT I
Conventional Encryption
Introduction, Conventional encryption model, Steganography, Data Encryption Standard, block cipher, Encryption algorithms, confidentiality, Key distribution.

UNIT II
Public Key Encryption And Hashing
Principles of public key cryptosystems, RSA algorithm, Diffie-Hellman Key Exchange. Elliptic curve cryptology, message authentification and Hash functions, Hash and Mac algorithms, Digital signatures.

UNIT III
IP Security
IP Security Overview, IP Security Architecture, Authentification Header, Security Payload, Security Associations, Key Management.

UNIT IV
Web Security
Web security requirement, secure sockets layer, transport layer security, secure electronic transaction, dual signature

UNIT V

System Security

Intruders, Viruses, Worms, firewall design, Trusted systems, antivirus techniques, digital Immune systems.

TEXT BOOKS:

1. *Stallings,W, "Cryptography and Network security", Principles and Practice, 3rd edition,PrenticeHall,2002.*

REFERENCE BOOKS

1.Baldwin.R and Rivest.R."TheRC5,RC5-CBC,TC5-CBC-PAD and RC5-CT5 Algorithms,RFC2040",October 1996.

09EC305 MULTIMEDIA COMPRESSION TECHNIQUES

Credits:4:0:0

Objective:

To learn about the various compression techniques for audio signals, video signals and text data.

Outcome:

Able to understand the concept of requirement for memory space reduction

Able to develop efficient algorithms for compression

UNIT I

Introduction

Special features of Multimedia – Graphics and Image Data Representations – Fundamental Concepts in Video and Digital Audio – Storage requirements for multimedia applications -Need for Compression - Taxonomy of compression techniques – Overview of source coding, source models, scalar and vector quantization theory – Evaluation techniques – Error analysis and methodologies

UNIT II

Text Compression

Compaction techniques – Huffmann coding – Adaptive Huffmann Coding – Arithmatic coding – Shannon-Fano coding – Dictionary techniques – LZW family algorithms.

UNIT III

Audio Compression

Audio compression techniques - μ- Law and A- Law companding. Frequency domain and filtering – Basic sub-band coding – Application to speech coding – G.722 – Application to audio coding – MPEG audio, progressive encoding for audio – Silence compression, speech compression techniques – Formant and CELP Vocoders

UNIT IV

Image Compression

Predictive techniques – DM, PCM, DPCM: Optimal Predictors and Optimal Quantization – Contour based compression – Transform Coding – JPEG Standard – Sub-band coding algorithms: Design of Filter banks – Wavelet based compression: Implementation using filters – EZW, SPIHT coders – JPEG 2000 standards - JBIG, JBIG2 standards.

UNIT V

Video Compression

Video compression techniques and standards – MPEG Video Coding I: MPEG – 1 and 2 – MPEG Video Coding II: MPEG – 4 and 7 – Motion estimation and compensation techniques – H.261 Standard – DVI technology – PLV performance – DVI real time compression – Packet Video.

TEXT BOOK

1. *Khalid Sayood: Introduction to Data Compression, Morgan Kauffman Harcourt India, 2nd Edition, 2000.*

REFERENCE BOOKS

1. *Peter Symes : Digital Video Compression, McGraw Hill Pub., 2004.*
2. *Mark Nelson : Data compression, BPB Publishers, New Delhi,1998.*
3. *Mark S.Drew, Ze-Nian Li : Fundamentals of Multimedia, PHI, 1st Edition, 2003*

09EC306 COMMUNICATION LAB-1

Credits: 0:0:2

LAB EXPERIMENTS

Any 12 Experiments

1. STATISTICAL DSP

(By using Software -MATLAB)

- Periodogram
- AR/MA/ARMA
- Kalman filter
- Adaptive filters(Noise, Echo chancellor)-LMS /RLS
- Wavelet

2. Multi Media Compression

(By using Software- Matlab)

- Text Compression
- Audio Compression
- Image Compression

3. Digital Communication

(By using Software -Matlab)

- Cyclic Codes
- Convolutional Codes
- Turbo Codes

Image Processing experiments in matlab

Signal Processing Using Processors

09EC307 MOBILE COMMUNICATION NETWORKS

Credits: 4:0:0

Objective :
To learn the fundamental concepts of mobile communication networks
Outcome**:**
Will be able to design simple communication network in mobile environment

UNIT I
Operation Of Mobile Communication Networks

Operation of first, second, and third generation wireless networks: cellular systems, medium access techniques, Mobile networks Elementary Principles of cellular Telephony Channel Division Techniques (TDMA, FDMA, CDMA) Cellular Coverage Methods Network Planning and Resource Allocation, Network Dimensioning ,Mobility Management Procedures

UNIT II
Propagation Models And Air Protocols

Radio propagation models, error control techniques, handoff, power control, Soft handover, Forward link ,Reverse link , common air protocols (AMPS, IS-95, IS-136, GSM, GPRS, EDGE, WCDMA, cdma2000, etc)

UNIT III
Mobile Network Architecture

General Architecture definition, Mobile Terminals (MT, SIM) Radio Section (BTS, BSC) Core Network (MSC, G-MSC, VLR, HLR, AuC) User and Control Plane Protocol Stack, MAP & SS#7, the Key Role of Signaling Interfaces and Network Entities Relation The Physical Channel, The Logical Channels Terminal, Call and Network Management Procedures, Network Planning.

UNIT IV
Wireless Local Area Networks

Wireless Local Area Networks , General Characteristics of the Hyper LAN System, 802.11 Standard, Basic DCF access scheme DCF Access Scheme with Handshaking, PCF Access Scheme, The 802.11a Standard, Mobile Ad Hoc Networks, Wireless Sensor Networks, Routing Energy Efficiency, Localization, Clustering.

UNIT V
Security Issues In Wireless Networks

Security in Wireless Networks, Secure routing, Key Pre-distribution and Management, Encryption and Authentication, Security in Group Communication, Trust Establishment and Management, Denial of Service Attacks, Energy-aware security mechanisms, Location verification, Security on Data fusion.

TEXT BOOK

1. *W. Stallings, "Wireless Communications and Networks", Prentice Hall, 2002.*

REFERENCE BOOKS

1. *T.S. Rappaport, "Wireless Communications: Principles & Practice", Second Edition, Prentice Hall, 2002.*
2. *J.Schiller,"Mobile Communications", Addison Wesley, 2000.*

09EC308 ERROR CONTROL CODING

Credits 3:1:0
Objective:
In order to transfer data without error from source to destination, focus must be made on coding. This syllabus is highly intended to emphasize bulk and burst error- correcting codes.
Outcome:
To understand life cyclic redundancy codes and convolution codes
To get a clear concept of different error correcting codes and convolution codes

UNIT I
Vector Algebra
Basics of vector algebra Galois Filed arithmetic in detail, Implementation of Galois Field Arthimetic

UNIT II
Basic Of Cyclic Codes
BCH Codes, Decoding of BCH Codes, implementation of error correction, Non binary BCH and Recd-Solomon Codes, error detection of binary BCH codes
UNIT III
Error Correcting Codes
Burst error correcting codes, decoding of single burst error correcting cyclic codes, Fire code interleaved codes, phased burst error correcting codes, Concatenated codes.

UNIT IV
Convolutional Codes
Covolutional codes, Maximum likelihood decoding of convolutional codes, sequential decoding convolutional codes - stack and fano algorithm Application of Viterbi decoding

UNIT V
Turbo Codes
Turbo codes - Coding - Performance - BCJR algorithm - Applications

TEXT BOOK
1. *Shu Lin & D.J. Costello - "Error Control Coding", 2nd edition ,PHI, 2004.*

REFERENCE BOOKS
1. *Shu Lin - "Application of error control", 1974*
2. *Simon Haykin, "Digital Communication", John Wiley and Sons, 1988*
3. *Bernard Sklar, Digital Communications, fundamentals and Applications, Pearson Education, 2001*

09EC309 HIGH PERFORMANCE COMMUNICATION NETWORKS

Credits 4:0:0

Objective

To study ISDN, Frame Relay, ATM and some advanced networks and to understand the module and protocols present in Bluetooth technology.

Outcome

It will be helpful to perform different operations in communication networks.

UNIT I

Packet Switched Networks

OSI and IP models, Ethernet (IEEE 802.3), Token ring (IEEE 802.5), Wireless LAN (IEEE 802.11) FDDI, DQDB, SMDS: Internetworking with SMDS

UNIT II

ISDN And Broadband ISDN

ISDN - overview, interfaces and functions, Layers and services - Signaling System 7 (SS7)- Broadband ISDN architecture and Protocols.

UNIT III

ATM And Frame Relay

ATM: Main features-addressing, signaling and routing, ATM header structure-adaptation layer, management and control, ATM switching and transmission.

Frame Relay: Protocols and services, Congestion control, Internetworking with ATM, Internet and ATM, Frame relay via ATM.

UNIT IV

Advanced Network Architecture

IP forwarding architectures overlay model, Multi Protocol Label Switching (MPLS), integrated services in the Internet, Resource Reservation Protocol (RSVP), Differentiated services

UNIT V

Blue Tooth Technology

The Blue tooth module-Protocol stack Part I: Antennas Radio interface, Base band, The Link controller, Audio, The Link Manager, The Host controller interface; The Blue tooth module-Protocol stack Part I: Logical link control and adaptation protocol, RFCOMM, Service discovery protocol, Wireless access protocol, Telephony control protocol.

TEXT BOOK

1. *William Stallings, "ISDN and Broadband ISDN with Frame Relay and ATM", 4th edition, Pearson education Asia, 2002.*

REFERENCE BOOKS

1. *Jennifer Bray and Charles F.Sturman,"Blue Tooth" Pearson education Asia, 2001.*
2. *Sumit Kasera, Pankaj Sethi, "ATM Networks ", Tata McGraw-Hill, New Delhi, 2000.*
3. *Rainer Handel, Manfred N.Huber and Stefan Schroder ,"ATM Networks",3rd edition, Pearson education asia,2002.*
4. *Jean Walrand and Pravin varaiya ,"High Performance Communication networks",2nd edition, Harcourt and Morgan Kauffman,London,2000.*

5. *Leon Gracia, Widjaja, "Communication networks ", Tata McGraw-Hill, New Delhi, 2000.*

09EC310 MICROWAVE INTEGRATED CIRCUITS

Credits: 4:0:0

Objective

To study the different technologies of microwave integrated circuits and to analyze the microstrip line.

Outcome

It will be helpful to design and fabricate different lumped elements and nonreciprocal components.

UNIT I

Technology Of Hybrid MICs

Dielectric substrates - thick film technology and materials - thin film technology and materials – methods of testing – encapsulation of devices for MICs – mounting of active devices.

UNIT II

Technology Of Monolithic MICs

Processes involved in fabrication – epitaxial growth of semiconductor layer – growth of dielectric layer – diffusion-ion implantation – electron beam technology.

UNIT III

Analysis Of Microstrip Line

Methods of conformal transformation – numerical method for analysis – hybrid mode analysis – coupled mode analysis- method of images – losses in miscrostrips.

UNIT IV

Coupled Microstrips, Slot Line And Coplanar Veguides

Coupled microstrips – even and odd mode analysis – microstrip directional couplers – branch line couplers – periodic branch line couplers – synchronous branch line couplers.

UNIT V

Lumped Elements And Non-Reciprocal Components

Design and fabrication using microstrips – flat resistors – flat inductors – interdigital capacitors – sandwich capacitors – ferromagnetic substrates for non-reciprocal devices – microstrip circulators – latching circulators – isolators – phase shifters.

TEXT BOOKS

1. *Annapurna Das, Sisir K. Das-"Microwave Engineering"– Tata McGraw-Hill,2000*
2. *Gupta,K.C, and Amarjit singh – "Microwave Integrated Circuits" – John Wiley and sons – Wiley Eastern Reprint, 1978.*

REFERENCE BOOK

1. *Hoffmann, R.K – "Handbook of Microwave Integrated Circuits" – Artec House, 1987.*

09EC311 SATELLITE COMMUNICATION

Credits: 4:0:0

Objective:
To learn about the science behind the orbiting satellites, various multiplexing schemes and earth station parameters used for satellite communication.

Outcome:
Able to make one global village.

UNIT I
Orbital Parameters
Orbital parameters, Orbital pertubations, Geo stationary orbits, Low Earth and Medium orbits. Frequency selection, Frequency co-ordination and regulatory services, Sun transit outages, Limits of visibility, Attitude and orientation control, Spin stabilisation techniques, Gimbal platform

UNIT II
Link Calculations
Space craft configuration, Payload and supporting subsystems, Satelite uplink -down link power budget, C/No, G/T, Noise temperature, System noise, Propagation actors, Rain and ice effects, Polarization calculations

UNIT III
Access Techniques
Modulation and Multiplexing: Voice, Data, Video, Analog and Digital transmission systems, multiple access techniques: FDMA, TDMA, T1-T2 carrier systems, SPADE, SS- TDMA, CDMA, Assignment Methods, Spread spectrum communication, Compression-Encryption and Decryption techniques

UNIT IV
Earth Station Parameters
Earth station location, propagation effects of ground, High power transmitters-Klystron Crossed field devices, Cassegrania feeds, Measurements on G/T and E_b/No

UNIT V
Satelite Applications
INTELSAT Series, INSAT, VSAT, Remotesensing, Mobile satellite service: GSM. GPS, INMARSAT, Satellite Navigation System, Direct to Home service(DTH), Special services, E-mail, Video conferencing and Internet connectivity

TEXT BOOKS
1. Dennis Rody," Satellite Communication", McGraw Hill, 2006.
2. Bruce R. Elbert, "The Satellite Communication Applications Hand Book" Artech House Boston,1997
3. Wilbur L. Pritchard, Hendri G.Suydarhood, Robert A. Nelson," Satellite Communication Systems Engineering", IIEdition,Prentice Hall,New Jersey.1993

REFERENCE BOOKS

1. Tri T.Ha,"Digital satellite communiocation",2nd Edition,McGraw Hill,New york.1990
2. K.Feher,Digital communication satellite / Earth Station Engineering, prentice Hall Inc,New Jersey,1983

09EC312 COMMUNICATION ENGINEERING LAB-2

Credits: 0:0:2

LAB EXPERIMENTS
Any 12 Experiments

1. HPCN

(By using Hardware)

- Wireless LAN (Ad-hoc –Wireless Access Point)
- Ethernet / token ring

2. MICROWAVE INTEGRATED CIRCUITS

(By Software SONNET or Microwave Office)

- Micro STRIPS – (Coupler / circulator / isolators/Phase Shifter)
- Slot line
- coplanar

3. Optical Communication

(By using Hardware)

- OTDR
- Splicing KIT

4. Mobile Communication

(By using Hardware)

- Mobile KIT

5. Satellite Communication

(By using Hardware)

- Satellite KIT
- GPS/GSM/GPRS

09EC313 ADVANCED DIGITAL SYSTEM DESIGN

Credits 4:0:0
Objective:
Advanced digital system concepts are introduced. Various PLD's are discussed
Outcome:
Good knowledge to design digital circuit. Architectures of various families of PLD's enables good understanding of FPGA

UNIT I
Advanced Topics in Boolean Algebra
Shannon's expansion theorem - Consensus theorem - Octal Designation - Run measure - INHIBIT / INCLUSION / AOI / Driver / Buffer Gates - Gate Expander - Reed Muller Expansion - Synthesis of multiple output combinational logic circuits by product map method - Design of static hazard free and dynamic hazard free logic circuits

UNIT II
Threshold Logic
Linear seperability – Unateness - Physical implementation - Dual comparability - Reduced functions - Various theorems in threshold logic - Synthesis of single gate and multigate threshold Network.

UNIT III
Sequential Logic Circuits
Mealy machine - Moore machine - Trivial / Reversible / Isomorphic sequential machines - State diagrams - State table minimization - Incompletely specified sequential machines - State assignments – Design - of synchronous and asynchronous sequential logic circuits working in the fundamental mode and pulse mode - Essential hazards Unger's theorem.

UNIT IV
Symmetric Functions
Elementary symmetric functions - partially symmetric and totally symmetric functions - Mc Cluskey de-composition method - Synthesis of symmetric function by contact networks.

UNIT V
Programmable Logic Devices
Anti fuse – static RAM -Basic concepts - Programming techniques - Programmable Logic Element (PLE) - Programmable Logic Array (PLA), Programmable Array Logic (PAL) Structure of Standard PLD's, Complex PLD's (CPLD) - Altera Max-7000 Series - Design of combination and sequential circuits using PLD's. Type of FPGA – Xilinx XC3000 Series – Logic Cell Array (LCA) – Configurable Logic Blocks (CLB) Input/Output Blocks (I/OB) – Programmable Interconnection Points (PIP) –Xilinx XC4000 families – Design examples.

TEXT BOOKS
1. *William I. Fletcher, "An Engineering Approach to Digital Design", Prentice Hall of India, 2004.*
2. *James E. Palmer, David E. Perlman, "Introduction to Digital Systems", TataMcGraw Hill, 1996.*

REFERENCE BOOKS
1. *N.N. Biswas, "Logic Design Theory", Prentice Hall of India, 2002.*
2. *Charles N. Roth, "Fundamentals of Logic Design", Pearson Education,2003.*
3. *Bhutiyani, "Digital Logic Design", Prentice Hall International, Simon & Schuster (Asia) Ptd., Ltd, 1996.*

09EC314 FPGA DESIGN USING VHDL & VERILOG

Credits 4:0:0
OBJECTIVE:
To know about the various flow of VHDL and verilog programming techniques
OUTCOME :
Knowledge in VHDL Programming and Verilog Programming and implementation of circuits in FPGA will be obtained

UNIT I

Introduction to VHDL & Dataflow modeling

VHDL Overview – FPGA Design flow Process – Software tools - Xilinx Tool Flow – Libraries – Data objects - Data types – Data operators – Entities – Architectures.

Basic Concurrent Statements – Signal assignment statements – Conditional Signal assignment – Selected signal assignment – Usage of Blocks in Dataflow modeling – Implementations of different digital circuits in Dataflow modeling

UNIT II

Behavioral Modeling & Packages

Process – Delays – Basic Sequential Statements – if, if else statements, case statements – Loops – for loop, while loop, next, exit, null statements – Usage of Variables inside the process – Implementation of digital circuits using Sequential statements – Multi Process statements – Generics – Operator Overloading – Conversion functions – Attributes – File Concepts - Packages – Functions & Procedures – Predefined & User defined library implementations.

UNIT III

Structural Modeling & FPGA Implementations

Component Declarations **–** Component Instantiation – Types of Component Instantiation - Examples – Packages with Components declaration & Instantiation – FSM implementation – Moore & Mealy Machines – Implementations of Basic digital circuit using structural modeling – Test benches – Combinational & Sequential Test benches – Examples – Traffic Light Controller – Toll both controller.

UNIT IV

Introduction to Verilog & Modeling

Design Methodology – Module – Ports – Basic concepts – Operators – Number specification – Data
types – Arrays – Parameters – Gate delays – Operator types – Conditional statements - Multiway branches - Loops - Switch – Modeling elements – Implementation of Basic circuit using Dataflow & Behavioral Modeling

UNIT V

Structural & Switch Level Modeling

Component Assignments – Switch level modeling – Applications of all dataflow, behavioral and Structural modeling in FPGA – FSM Implementation – Test Benches

TEXT BOOKS

1. *J. Bhaskar, "A VHDL Synthesis Primer", BS Publications, III Edition, 2004.*
2. *Samir Palnitkar, "Verilog HDL", Pearson Publication", II Edition. 2003.*

REFERENCE BOOK

1. *Navabi. Z, "VHDL: Analysis and Modeling of Digital Systems", Prentice Hall Inc.,2nd Edition, 1998.*

09EC315 CMOS VLSI DESIGN

Credits: 4:0:0

OBJECTIVE:

To study about basics in VLSI and various CMOS families and system designing and subsystem designing in CMOS.

OUTCOME:

Knowledge to design CMOS families and Subsystems in transistor and gate level.

Unit I

VLSI Fabrication Technology

Overview of wafer fabrication – wafer processing – oxidation – patterning – Diffusion – Ion implantation – Deposition – Silicon gate nMOS process – nwell CMOS process – pwell CMOS process – Twintub process – Silicon on insulator.

UNIT II

Introduction to CMOS Circuits

MOS Transistors - MOS Transistor Switches - CMOS Logic - Circuit and System Representations - MOS Transistor Theory - Introduction MOS Device Design Equations - The Complementary CMOS inverter - DC Characteristics - Static Load Inverters - The Differential Inverter - The Transmission Gate - The Tri state Inverter - Bipolar Devices.

Unit III

MOS and CMOS Circuit Design Process

MOS layers – Stick diagrams – nMOS design style – CMOS design style – Design rules and layout – Lambda based design rules – Contact cuts – Double metal MOS process rules – CMOS lambda based design rules – Sheet resistance – Inverter delay – Driving large capacitive loads – Wiring capacitance.

Unit IV

Subsystem Design

Switch logic – pass transistor and transmission gates – Gate logic – inverter – Two input NAND gate – NOR gate – other forms of CMOS logic – Dynamic CMOS logic – Clocked CMOS logic – CMOS domain logic – simple combinational logic design examples – Parity generator – Multiplexers.

Unit V

Sequential Circuits

Two phase clocking – Charge storage – Dynamic shift register – precharged bus – General arrangement of a 4 bit arithmetic processor – Design of a 4 bit shifter

TEXT BOOKS

1. E. Eshranghian, D.A. Pucknell and S. Eshraghian, "Essentials of VLSI circuits and systems", PHI, 2005.

2. Neil H.E. Weste, David Harris and Ayan Banerjee, "CMOS VLSI Design, A circuits and Systems Perspective", (3/e), Pearson, 2006.

REFERENCE BOOK

1. W. Wolf, "Modern VLSI Design", (3/e), Pearson, 2002.

09EC316 TESTING OF VLSI CIRCUITS

Credits: 4:0:0

OBJECTIVE:
To know about the various test Generation Algorithms and Fault Simulation Techniques.
OUTCOME:
Testing of various Memory Modules and Combinational logic Circuits.

Unit I
Introduction
Motivation for testing and design for testability – Faults in digital circuits - Modeling of faults - Logical Fault Models - Fault detection - Fault location - Fault dominance

UNIT II
CMOS Testing
Need for testing – Manufacturing test principles – Design Strategies for test – chip level test techniques - System level test techniques- Testability features for board test

UNIT III
Test Generation Algorithms and Fault Simulation Techniques
Introduction - Fault - Table, Boolean difference – Path sensitization, D algorithm –Sequential circuits – Random test vectors.
Serial, Single-fault propagation, Deductive, Parallel and Concurrent Simulation.

UNIT IV
Built In Self Test
Scan-in Scan-out design – Signature analysis - Built-In Self Test - Test pattern generation for BIST - Circular BIST – BIST Architectures - Testable Memory Design - Test algorithms - Test generation for Embedded RAMs

UNIT - V
Fault Diagnosis
Logic Level Diagnosis - Diagnosis by UUT reduction - Fault Diagnosis for Combinational Circuits - Self-checking design - System Level Diagnosis.

TEXT BOOK

1. *M. Abramovici M.A, Breuer and Ad Friedman, "Digital Systems Testing and Testable Design", Computer Sciences Press, 2002*

REFERENCE BOOKS

1. *P.K. Lala, "Digital Circuit Testing and Testability", Academic Press, 2002*
2. *Robert J.Feuguate, Jr. Steven M.Mcintyre, "Introduction to VLSI testing', Prentice Hall, Englewood Cliffs, 1998.*

09EC317 COMPUTER AIDED DESIGN FOR VLSI CIRCUITS

Credits 4:0:0

OBJECTIVE:

To study the Physical design cycle of VLSI

OUTCOME:

Knowledge of Placement, Routing ,Simulation ,Synthesis and MCMs is obtained

UNIT I

Introduction to VLSI Design

Introduction to VLSI Methodologies – Types of ASICs – Design flow -VLSI Physical Design Automation – Fabrication process and its impact on Physical Design.

UNIT II

Automation Tools and Algorithms

A quick tour of VLSI Design Automation Tools – Data structures and Basic Algorithms - Algorithmic graph theory and computational complexity – Tractable and Intractable problems.

UNIT III

Simulation and Synthesis

Simulation – Logic synthesis – Verification – High level synthesis – Compaction.

Unit IV

ASIC Construction, Floorplanning, Placement and Routing

Partitioning methods – floor planning – placement – global routing –detailed routing- circuit extraction –DRC.

UNIT V

Design Automation

Physical Design Automation of FPGAs – MCMS –Implementation of Simple Algorithms using VHDL & Verilog onto FPGA's.

TEXT BOOKS

1. N.A. Sherwari, "Algorithms for VLSI Physical Design Automation", John Wiley, 2003.

2 . Sabih H. **Gerez***," Algorithms for VLSI* **design automation***", John Wiley, 2004.*

REFERENCE BOOK

1. M.J.S.Smith, "Application – Specific Integrated Circuits", Addison, Wesly Longman Inc., 1997.

09EC 318 SIMULATION LAB

Credits: 0:0:2
LIST OF EXPERIMENTS
Any 10 experiments

EXPERIMENTS USING TANNER EDA

1 Design & Simulation of CMOS Inverter using Tanner EDA Tools
2. Design & Simulation of NAND & NOR using Tanner EDA Tools
3. Design & Simulation of Halfadder & full ader using Tanner EDA Tools.
4. Design & Simulation of CMOS Inverter using Tanner EDA Tools
5. Layout Design of CMOS Inverter using Tanner EDA Tools.

EXPERIMENTS USING MENTOR GRAPHICS

6. Simulation & Synthesis of Adders –Front End
7. Pre layout Simulation of adders using design architecture.
8. Simulation of inverter using Design Architecture.
9. Simulation of NAND & NOR circuits using Design Architecture.
10. Simulation of adders circuit using Design Architecture.
11. a) Design of Schematic Layout of current mirror and BICMOS Logic & generation of Symbol using IC Station in Mentor Graphics.
    b)Digital Simulation of Adders
12. Simulation of Subtractor circuit using Design Architecture.
13. Digital Simulation of Subtractors.
14. Design of Schematic Layout of NAND Gate using SDL Design Methodology and creating the hierarchical schematics for JK Flip flops
15. Design and Simulation of Sequence Detector using HDL Designer
16. Design of RTL using HDL Designer
17. Simulation and Synthesis of Inverter.
18. Automatic Layout Generation of Inverters.

09EC319 GENETIC PROGRAMMING AND PARTICLE SWARM OPTIMIZATION

Credits: 4:0:0

Objective
To learn the various concepts and techniques of optimization techniques

Outcome
Will be able to apply these algorithms to obtain optimal solutions in various applications.
Will be able to develop new hybrid algorithms.
Will be able to improve the performance of the existing artificial intelligence technique.

UNIT I
Evolutionary Computation
Genetic Algorithms – Evolution Strategy – Genetic Programming – Variants in Genetic Programming. Architecture of Gene Expression Programming – Chromosome Domains – Cells and creation. Evolving Intrusion detection systems – Intrusion Detection – Evolving IDS using Genetic Programming – Machine Learning Techniques.

UNIT II
Genetic Programming Applications
Evolutionary Pattern matching – Adaptive Pattern matching – Heuristics of good Traversal orders – Genetically Programmed Matching Automata – Genetic Programming in Data Modeling – Genetic Programming in mathematical modeling – Decision models for classification tasks – Genetic programming for Prediction task - Stock Market modeling using Genetic Programming ensembles – Modelling stock market Prediction – Intelligent Paradigms.

UNIT III
Swarm Intelligence
Foundations, Perspectives and Applications – Canonical Particle Swarm Optimization – Extended Models of PSO for Discrete problems – Applications of Particle Swarm Optimization – Ant Colony Optimization – Ant Colony Algorithms and its Applications.

UNIT IV
Swarm Intelligence – Searchers, Cleaners And Hunters
Dynamic Cooperative Definition – Cleaning Protocol – Dynamic Cooperative Cleaners – Cooperative hunters – Physical K-Clique – Physical graphs – Physical Clique finding Protocol – Exploration in Physical Environments.

UNIT V
Swarm Intelligence Applications
Ant Colony Optimization for Fast Modular Exponentiation using Sliding Window Method- Window based methods – Additional chains and additional sequences – Ant Systems and Algorithms – Chain Sequence Minimization using Ant System- Particle Swarm for Fuzzy Models Identification- Fuzzy models - Methodolgy for Fuzzy models Identification through PSO.

Text Books

1. Nadia Nedja, Ajith Abraham, Luiza de Macedo Mourelle ," Genetic Systems Programming" Springer Publication,Newyork, 2005.
2. Nadia Nedja , Luiza de Macedo Mourelle,"Swarm Intelligent systems" Springer,NewYork, 2006.

Reference Books.

1. David E. Goldberg, "Genetic algorithms in search, optimizing and machine learning", Addison Wesley, Boston, 1989.
2. Eric. Bonabeau, Marco Dorigo, and Guy Theraulaz ,"Swarm Intelligence: From Natural to Artificial Systems**"**, Oxford University Press, England, 1999.
3. Andries P.Engelbrecht ,"Fundamentals of computational swarm Intelligence", Wiley Publishers, New York, 2007.
4. Russell C. Eberhart , Yuhui Shi , James Kennedy ,"Swarm Intelligence", Kaufmann Publishers, San Francisco, 2001.

09EC320 ADVANCED DIGITAL IMAGE PROCESSING

Credits: 4:0:0

Objective

To learn the various advanced techniques of image processing with applications

Outcome

Will be used to develop hybrid techniques to solve the segmentation and classification problems
Will be able to apply these techniques for real time applications.
Will be able to form new image processing algorithms.

UNIT I

Image Enhancement

Fundamental steps in Digital Image Processing – Basic Gray Level Transformations – Histogram Equalization & Matching –Image Subtraction & Averaging - Introduction to Fourier Transform – Filtering In The Frequency Domain - Smoothing & Sharpening Frequency Domain filters, Homomorphic filtering.

UNIT II

Image Restoration

Model Of Image Degradation/Restoration Process - Noise Models – Filters for Restoration in the Presence of Noise, Periodic Noise Reduction by Frequency Domain Filtering - Inverse Filtering - Wiener Filtering - Constrained Least Square Filtering - Geometric Mean Filter.

UNIT III

Colour Image Processing & Wavelets & Multiresolution Processing.

Colour Models - Pseudo Colour Image Processing - Colour Transformation – Smoothing – Sharpening - Colour Segmentation & Noise in Colour Images - Image Pyramids - Subband Coding - Haar Transform - Multiresolution Expansion - Wavelet Transform in 1D and 2D - Fast Wavelet Transform & Wavelet Packets.

UNIT IV
Image Compression and Morphological Image Processing
Image Compression Models - Error Free Compression - Variable Length Coding - LZW Coding - Bit-Plane Coding - Lossless Predictive Coding – Lossy Compression – Lossy Predictive Coding – Transform Coding – Wavelet Coding - Morphological Operations - Dilation & Erosion - Hit or Miss Transformation - Morphological Algorithms and Extension to Gray Scale Images.

UNIT V
Image Segmentation & Description
Detection of Discontinuities - Edge Linking & Boundary Detection – Thresholding - Region Based Segmentation & Segmentation by Morphological Watersheds - Use of Motion in Segmentation - Representations- Boundary Descriptions - Regional Descriptions - Use of Principal Components for Description.

Text Books

1. Rafael.C. Gonzalez, Richard E.Woods, “Digital Image Processing”, 2nd Edition, Pearson Education Asia, 2002.
2. Anil.K.Jain, “Fundamentals Of Digital Image Processing”,PHI,India,1997,

Reference Books

1. S.Annadurai, R.Shanmugalakshmi, “ Fundamentals of Digital Image Processing”, Pearson Education ,New Delhi,2007.
2. B.Chanda, D Dutta Majumdar, “Digital Image Processing and Analysis”,Prentice Hall Edition, New Delhi,2000.
3. W. K. Pratt, ``Digital Image Processing,'' 2nd Edition, John Wiley and Sons, 1991

09EC321 NEURO-FUZZY MODELLING

Credits: 4:0:0

Objective
To learn the concepts and techniques of hybrid neuro fuzzy systems

Outcome
Will be able to develop new algorithms for real – time classification problems
Will be able to improve the performance of the existing techniques.
Will be able to design systems for practical applications.

UNIT I
Introduction to Neural Networks

Introduction - Action Potential - Biological Prototype - Artificial Neuron - Activation Functions - Single Layer Neural Network - Multi Layer Neural Network – Training - Supervised Methodology - Unsupervised Methodology - Back Propagation Neural Network – Architecture and Algorithm - Kohonen Neural Network – Architecture and Algorithm.

UNIT II
Adaptive Neuro-Fuzzy Inference Systems
Introduction - ANFIS Architecture - Hybrid Learning Algorithm - ANFIS as an Universal Approximator -CANFIS Framework - Neuron Functions for Adaptive Network - Neuro Fuzzy Spectrum - Analysis of Adaptive Learning Capability - Evolution of Antecedents - Evolution of Consequents - Evolving Partitions.

UNIT III
Classification and Regression Trees
Introduction – Decision Trees – CART Algorithm for Tree Induction – Tree Growing – Classification Trees – Regression Trees – Tree Pruning – CART Algorithm for Structure Identification in Adaptive Neuro Fuzzy Inference Systems.

UNIT IV
Data Clustering Algorithms
Introduction – Types of Clustering Algorithms – K-means Clustering Algorithm – Fuzzy C-Means Clustering Algorithm – Mountain Clustering Method – Subtractive Clustering – K-Nearest Neighbour Algorithm – Minimum Distance Classifier Algorithm.

UNIT V
Rule base Structure Identification
Introduction – Input Selection – Input Space Partitioning – Fuzzy Clustering Objective Functions – Flow Diagram of Structure Identification – Flow Diagram of Parameter Identification – Rule Base Organization – Binary Box Tree - Application of ANFIS for Printed Character Recognition.

Text Books

1. Rojer Jang, T.Sun and E.Mizutani, "Neuro-fuzzy and soft computing", Prentice Hall of India Private Limited, 2003.
2. L.Fausett, "Fundamentals of Neural Networks", Pearson Education, New Jersey, 2004.

Reference Books

1. P.D.Wasserman, "Neural Computing-Theory and Practice", Van Nostrand Reinhold, New York, 1989.
2. J.A.Freeman and D.M.Skapura, "Neural Algorithm Applications & Programming Techniques", Prentice Hall India, 2002.
3. Jacek M. Zurada, "Introduction to Artificial Neural Systems", Jaico Publication House, Mumbai,1995.

09EC322 PATTERN RECOGNITION

Credits : 4:0:0

Objective

To learn the fundamental pattern recognition techniques for image processing applications

Outcome

Will be able to apply these techniques to solve recognition problems in real-time applications
Will be able to form novel pattern recognition algorithm.
Will be able to analyse the pros and cons of existing algorithms.

UNIT I

Statistical Pattern Recognition

Overview of Pattern Recognition- Introduction to Statistical Pattern Recognition – Parametric Estimation and Supervised Learning – Approaches to Parameter Estimation – Maximum Likelihood Estimation – Formulation – Use of the Training Set – Bayesian Parameter Estimation Approach.

UNIT II

Non Parametric Approaches for Pattern Recognition

Introduction– Parzen Windows –Unit Step Function – Extension to Interpolation Functions – K–NN Nonparametric Estimation – Direct Estimation of Probabilities – Direct Classification using the Training Set –Nearest Neighbour Rule – NNR Approach.

UNIT III

Discrete and Binary Classification Problems

Introduction – Linear Discriminant Functions – Fisher's Linear Discriminant – Discrete and Binary Classification Problems – Techniques to directly obtain Linear Classifiers – Linear Separability – Design of Linear Classifiers-Introduction to Support Vector Machines.

UNIT IV

Neural Networks for Pattern Recognition

Introduction – Neural Network Structures for Pattern Recognition Applications – Neural Network Based Pattern Associator – Black Box Structure – Properties – Unsupervised Learning in Neural Pattern Recognition – Self Organizing Networks – Adaptive Resonance Theory Networks – Pattern Associator for Character Classification.

UNIT V

Image Analysis

Introduction – Scene Segmentation and Labelling – Region Labelling Algorithm - Counting Objects – Perimeter Measurement – Following and Representing Boundaries – Freeman Chain Code - Morphological Operations – Texture – Statistical Significance of Image Features.

Text Books

1. Robert Schalkoff, "Pattern Recognition-Statistical, Structural and Neural Approaches", John Wiley & sons, Inc, New York, 2005.

2. Earl Gose, R.Johnsonbaugh and Steve Jost, “Pattern Recognition and Image Analysis”, Prentice Hall of India Private Limited, 1999.

Reference Books

1. Rojer Jang, T.Sun and E.Mizutani, “Neuro-Fuzzy and Soft Computing”, Prentice Hall of India Private Limited, 2003.
2. Duda, R. O., Hart, P. E., and Stork, D. G,”*Pattern Classification”*, 2nd edition, John Wiley & Sons, NewYork,2001.
3. Tou and Gonzales,”Pattern Recognition Principles”, Wesley Publication Company,London,1974

09EC323 ARTIFICIAL NEURAL NETWORKS

Credits : 4: 0:0

Objective

To learn the various techniques and methodologies of artificial neural networks

Outcome

Will be able to develop hybrid methodologies for solving engineering applications
Will be able to develop hardware systems for Artificial Intelligence techniques.
Will be able to form new machine learning techniques.

UNIT I

Basic Concepts

Biological Neurons – Artificial Models – Neural Processing – Learning and Adaptation – Neural Network Learning Rules – Hebbian Rule – Perception Rule – Delta Learning Rule – Widrow – Hoff Rule – Winner -Takes – All Rule – Outstar Rule.

UNIT II

Perceptrons

Classification – Features – Decision Region – Discriminant Function – Linear Classifier – Minimum Distance Classification – Training and Classification using Discrete Perceptron – Single Layer Continuous Perceptron – Single Layer Multicategory Perceptron – Multi layer Feedforward Network – Linearity Non Seperable Classification – Feed Forward Recall and Error Back Propagation Training – Learning Factors – Network Architecture – Necessary Number of Hidden Nodes –Application to Character Recognition.

UNIT III

Feedback Networks

Dynamical Systems – Discrete Time Hopfield Networks – Gradient Type Hopfield Network – Solution of Optimisation Problems- Associative Memory – Linear Associator – Recurrent Auto Associative Memory – Bidirectional Associative Memory – Associative Memory of Spatio-temporal patterns.

UNIT IV

Self Organising Networks

Unsupervised Learning of Clusters – Hamming Net & MAX NET winner – take-All – Learning – Counter Propagation Network – Feature Mapping – Self Organising Feature Maps – Art Network Cognitron & Neo-Cognitron.

UNIT V

ANN Implementation

Neuro computing Hardware Requirements – IC Synaptic Connections – Analog Storage of Adjustable Weights – Digitally Programmable Weights.

Circuits for Neural Networks:

Invertor Based Neuron – Scalar Product & Averaging Circuits – Template Matching Circuit – Analog Multipliers with Weight Storage – Associative Memory Implementations.

Text Books

1. J. A.Freeman and D.M.Skapura, "Neural Algorithm Applications & Programming Techniques",Prentice Hall,New Delhi, 2002.
2. L.Fausett, "Fundamentals of Neural Networks", Pearson Education, New Jersey, 1994.

Reference Books

1. Jacek M. Zurada, "Introduction to Artificial Neural Systems", Jaico Publication House,Mumbai, 1995.
2. Robert Schalkoff, "Pattern Recognition-Statistical, Structural and Neural Approaches", John Wiley & sons, Inc,New York, 2005
3. P.D.Wasserman, "Neural Computing-Theory and Practice", Van Nostrand Reinhold, New York, 1989

ELECTRONICS AND COMMUNICATION ENGINEERING

ADDITIONAL SUBJECTS

Code	Subject Name	Credits
10EC201	Electron Devices	3:0:0
10EC202	Electric Circuit Analysis	3:1:0
10EC203	Embedded Systems	3:0:0
10EC204	Digital Communication	4:0:0
10EC205	VLSI Design	3:0:0
10EC206	Electron Devices Lab	0:0:2
10EC207	Electronics And Integrated Circuits Lab	0:0:2
10EC208	VLSI Design Lab	0:0:2
10EC209	Semiconductor Devices	4:0:0

10EC201 ELECTRON DEVICES

Credits: 3:0:0

Objective:

- To know about the internal function of Electron devices
- To know about the advanced semiconductor devices
- To know about the practical applications of devices.

Outcome:

- Able to design practical circuits and to analyse various components

Unit I
Electron Ballistics
Charged Particles – Constant electric Field – Two dimensional motions – Electrostatic Deflection in CRT – CRO – Force in magnetic Field – Motion in a magnetic field – Magnetic deflection in CRT – Combined electric and Magnetic Field.

Unit II
Theory of PN Junction
Mobility and conductivity – Drift and diffusion currents - Hall effect - Continuity equation – PN junction – Open circuit junction – Depletion Region – Barrier Potential. Transition and diffusion capacitance.

Unit III
Theory of semiconductor devices
Forward and Reverse characteristics of pn diode– Diode Equation– EberMoll equation – Transistor hybrid model - determination of hybrid parameters, measurement of hybrid parameters, Miller's theorem.

Unit IV
Special semiconductor diodes
SCR: Construction- Static- Characteristics - Zener diodes – Schotky Barrier diode – Tunnel diodes – DIAC – TRIAC – Gunn diodes - Varactor diode.

Unit V

Special Semiconductor Devices

Photo diodes –Photo transistors – LED – LCD – optocouplers –Digital electronic display-plasma display, nano crystal display.

Text Books

1. Jacob Millman, Christos C Halkias, Satyabrata Jit, "Electronic Devices & Circuits",Tata McGraw Hill, 2008.
2. Albert Malvino, David A Bates, "Electronic Principles", Tata McGraw Hill, Seventh Edition, 2008.

Reference Books

1. David.A.Bell, "Electronic Devices & Circuits ", PHI, 1998.
2. Robert Boylestad, "Electronic Devices & Circuit Theory", Sixth Edition, PHI, 2002.
3. Charles A Schuler, Roger L Tokheim, "Electronics Principles and Applications", Tata McGraw Hill, Sixth edition, 2003.

10EC202 ELECTRIC CIRCUIT ANALYSIS

Credits: 3:1:0

Objectives:

- To understand the basic concepts of electric circuits
- To study the various techniques which can be used to analyse electric circuits
- To understand the nature of the responses of electric circuits

Outcome:

- Make the students capable of applying the knowledge of circuit theory in other engineering subjects

Unit I

Basic Circuit Concepts

Kirchoffs Laws -VI relationships of R, L and C -independent sources - dependent sources – simple resistive circuits -network reduction, Series and parallel circuits reduction, Star delta transformation voltage division rule -current division rule -source transformation.

Unit II

Sinusoidal Steady State Analysis

Phasor- sinusoidal steady state response -concepts of impedance and admittance -analysis of simple circuits- power and power factor -series resonance and parallel resonance – bandwidth and Q factor. Solution of three-phase balanced circuits , Star connected load and delta connected load-power measurements by two wattmeter- solution of three phase unbalanced circuits, Star connected and delta connected load.

Unit III

Mesh-Current And Node-Voltage Methods

Formation of matrix equations and analysis of complex circuits using mesh-Super mesh analysis-nodevoltage analysis-Super node analysis- mutual inductance- coefficient of coupling -ideal transformer.

Unit IV

Network Theorems And Applications

Superposition theorem -reciprocity theorem –compensation theorem -substitution theorem -maximum power transfer theorem -Thevenin's theorem. -Norton's theorem and Millman's theorem with applications.

Unit V

Transient Analysis

Forced and free response of RL, RC and RLC circuits with D.C. and sinusoidal excitations-Forced and free response of RL, RC and RLC circuits with D.C. and sinusoidal excitations using Laplace transform technique.

Text Books

1. Paranjothi S.R., 'Electric Circuit Analysis', New Age International Ltd. , Delhi, 2nd Edition, 2000.
2. Sudhakar, A. and Shyam Mohan S.P., 'Circuits and Network Analysis and Synthesis' Tata McGraw Hill Publishing Company Limited, Third edition, 2007

Reference Book

1. Hyatt, W.H. Jr. and Kemmerly, J.E., 'Engineering Circuit Analysis', McGraw Hill International Editions, 1993.

10EC203 EMBEDDED SYSTEMS

Credits: 3: 0: 0

Objective

To learn about Real time Embedded system, Programming languages and tools

Out Come

To design Embedded Products based on various Operating Systems.

UNIT I

Introduction to Embedded Systems

Embedded System – Classification –Processor Embedded into a System – Embedded Hardware Units and Devices in a System – Embedded Software in System- Examples of Embedded Systems.

UNIT II

Embedded Linux System

Definitions -Real Life and Embedded Linux Systems -Design and Implementation Methodology-Basic Concepts: Types of Hosts- Types of Host/Target Development Setups- Development Tools: Using a Practical Project Workspace-GNU Cross-Platform Development Tool chain-C Library Alternatives-Java.

Unit III

Real Time Operating Systems

Task and Task States-Tasks and Data- Semaphores and Shared Data Operating system Services-Application of Semaphores -Message Queues-Timer Function-Events – Memory Management.

Unit IV

Embedded Software Development Process and Tools

Development Process and Hardware-Software-Software Tools-Source Code Engineering Tool-Host and Target machines –Linking and Locating Software-Integrated Development Environment (IDE)

Unit V

Programming Concepts and Embedded Programming in C and C++

Software programming in Assembly Language and in High level language – C Program Elements – Program Elements-Use of Data Structures: Queues – Stacks-Function Pointers-Function Queues and ISR Queues–Queuing of Functions on Interrupts- Object Oriented Programming-Embedded programming in C++-Optimization of Codes in Embedded C++.

Text Books

1. Raj Kammaal, "Embedded System Architecture, Programming and Design" McGraw Hill, 2nd Edition, 2008.
2. Karim Yaghmour, "Building Embedded Linux system", O'Reilly Media, 2003.

Reference Book

1. David E.Simon ," An Embedded Software Primer', Addison-Wesley Professional,2001

10EC204 DIGITAL COMMUNICATION

Credits: 4:0:0

Objectives:

- To equip the students with the basic concepts of digital modulation techniques.
- To understand the need and basics of error control coding.
- To understand the effect of noise in data reception..

Outcome:

- To make the students understand the recent technologies with the basics of digital communication and design receivers.

Unit I

Sampling And Bandlimited Signalling

Review of Sampling Theorem, PAM and TDMA Principles, Quantization, PCM, DPCM and Delta Modulation – International standard (CCCIT, CEPT) Power Spectra of PAM signals - Inter symbol Interference - Ideal Nyquist channel - Raised cosine channels – Correlative coding and precoding.

Unit II

Digital Modulation

Introduction - Binary phase shift keying - differential phase shift keying – differentially encoded PSK - Quadrature phase shift keying – M-ary PSK – quadrature amplitude shift keying - Binary frequency shift keying – similarity of BFSK and BPSK – M-ary FSK – Minimum shift keying – Duo binary encoding

.

Unit III

Data Transmission – Detection and Estimation

Base band signal receiver – Probability of error – Optimum filter – White noise: Matched filter – Probability of error of the matched filter – Coherent reception: Correlation – Phase- shift Keying – Non-coherent detection of FSK – Differential PSK – Four phase PSK (QPSK)

.

Unit IV

Information Theory and Coding

Discrete messages-amount of information-average information-entropy information rate-Shannon's theorem-capacity of gaussian channel-bandwidth-S/N trade off-coding-parity check bit coding-block codes coding and decoding probability of error with coding- - Convolution codes – Cyclic codes.

Unit V

Spread Spectrum Systems

Pseudo Noise sequences, generation and correlation properties - direct sequence spread spectrum systems - Frequency Hop systems - processing gain - antijam and multipath performance.

Text Books

1. Taub and Schilling – "Principles of Communication Systems", Mc Graw Hill, 2nd Edition, 25th Reprint, 2003

2. Simon Haykins, "Digital Communications", John Wiley, 1st edition, Reprinted, 2004.

Reference Books

1. Harold kolimbinis "Digital Communication Systems" Prentice Hall India, Indian print, 2001

2. John.G.Proakis, 'Digital Communication', McGraw-Hill Inc., 4th edition, Malaysia, 2000

3. M.K.Simen, 'Digital Communication Techniques, Signal Design & Detection', Prentice Hall of India,
Reprint, 2003

4. Leon.W.Couch II "Digital and Analog Communication", Pearson Education Asia, Indian print 2001.

10EC205 VLSI DESIGN

Credits: 3:0:0

Objective

The purpose of this course is to give an exposure to VLSI Design Process , Layout Design , CMOS logic Design styles and VHDL

Outcome

- Knowledge in VHDL Programming
- To Design various CMOS Design Styles

Unit I
Overview of VLSI Design Methodology
VLSI Design Process – Architectural Design – Logical Design – Physical Design – Layout Styles – Full Custom Semi Custom Approaches – Overview of wafer fabrication – Wafer Processing – Silicon Gate NMOS process – CMOS Process – N well – P well – Twin Tub – Silicon On Insulator

Unit II
Layout Design
MOS Transistor Structure – Depletion Mode Transistor-Enhancement Mode Transistor-Drain-to-source current versus Voltage Relationships - Stick Diagrams – NMOS/CMOS Design Style-Design Rules & layout - Mead Conway design rules for the Silicon gate NMOS process- CMOS N well / P well design rules-CMOS Inverter Characteristics.

Unit III
CMOS Design Styles
Sheet Resistance-Area Capacitances of layers-Standard Unit of Capacitance-Area Capacitance Calculations-CMOS Logic Design styles

Unit IV
Introduction to VHDL
Design Flow Process — Tutorial of VHDL – Basic Language Elements: Data Objects – Data Types – Data Operators – Entities and Architectures – Component Declaration and Instantiation

Unit V
Data Flow, Behavioral and Structural Modeling
Concurrent Signal Assignment – Conditional Signal Assignment – Selected Signal Assignment – Concurrent and Sequential Statements – Data Flow, Behavioral and Structural Modeling – Test Bench .

Text Books

1. Essentials of VLSI Circuits and Systems, K. Eshraghian Kamran PHI of India Ltd.,2008
2. CMOS VLSI Design : A Circuits and Systems Perspective, Neil H. E. Weste,David Harrisayan Banerjee ,Pearson Education India,3rd Edition ,2009.
3. Kevin Skahill ”VHDL for PROGRAMMABLE LOGIC” Pearson Publications,2004.

Reference Books

1. A VHDL Primer, J. Bhasker, Third Edition, Prentice Hall Publication, 2009
2. Douglas Perry, “VHDL”, 3rd Edition, McGraw Hill 2001.

10EC206 ELECTRON DEVICES LAB

Credits: 0:0:2

1. Study of CRO
2. Characteristics of PN Junction diode, Zener diode

3. Characteristics of Photo diode
4. Characteristics of BJT
5. Characteristics of Triac, SCR
6. DC Analysis of Electric Circuits
7. AC Analysis of Electric Circuits
8. Rectifiers
9. Characteristics of UJT, FET

Implementation of the above using PSPICE & Hardware

10EC207 ELECTRONICS AND INTEGRATED CIRCUITS LAB

Credits: 0:0:2

LIC Experiments

1. Design of Basic Operator circuits using op-amp
    a. Adder
    b. Subtractor
    c. Differentiator
    d. Integrator
2. Design of astable multivibrator and Schmitt trigger using 555 Timer
3. Design of active filters using op-amp
4. Design of Weinbridge Oscillator
5. Design of Digital Analog Converter
6. Precision rectifiers using op-amp

ELECTRONICS EXPERIMENTS

7. Half wave & Full wave Rectifiers
8. Voltage Regulator
9. Single stage amplifier
10. Single tuned Amplifier
11. RC Phase shift Oscillator
12. Differential Amplifier

10EC 208 VLSI DESIGN LAB

Credits 0:0:2

VHDL PROGRAMS

1. Design and Simulation Half adder and Full adder
2. Design & Simulation simple ALU
3. Design & Simulation of
   4x1 Multiplexer & Demultiplexer
4. Design & Simulation of Combinational Circuits
    - Magnitude Comparator
    - 3x8 Encoder
5. Design and Simulation of up-down counter
6. Design & Simulation of flip-flops.

- JK Flip-flop
- RS Flip-flop
- T Flip-flop
- D Flip-flop

7. Design and Simulation of Memory Module

SIMULATION PROGRAMS

8. Design & Simulation of CMOS Inverter/NAND & NOR.
9. Design & Simulation Half adder & Full adder
10. Design & Simulation of Transmission Gate and Multiplexer using TG
11. Design & Simulation of Boolean Expression & Bi CMOS Logic
12. Design & Simulation of different CMOS Design styles.

Required Software Tools:
Xilinx 9.1,Model Sim, Tanner EDA

10EC209 SEMICONDUCTOR DEVICES

Credits: 4:0:0

Objectives:

- To know about the internal function of Electron devices
- To know about the advanced semiconductor devices
- To know about the practical applications of devices.

Outcome:

- Able to design practical circuits and to analyze various components

Unit I
Electron Ballistics
Charged Particles – Constant electric Field – Two dimensional motions – Electrostatic Deflection in CRT – CRO – Force in magnetic Field – Motion in a magnetic field – Magnetic deflection in CRT – Combined electric and Magnetic Field.

Unit II
PN Diode and its Applications
Theory of PN junction – Open circuit junction –Diode resistance– Diode Equation–– Transition and diffusion capacitance- Applications: Half wave rectifier, full wave rectifier, Bridge rectifier, Clippers, Clampers

Unit III
Theory of Junction Transistors
Transistor action– Transistor current components –EberMoll equation – static characteristics of transistors (CE,CB,CC) –Transistor switching times, Maximum voltage rating- Avalanche Multiplication, reach-through

Unit IV

Theory of FET, UJT and SCR

Junction FET operation – Static characteristics – FET structure – Enhancement MOSFET, Depletion MOSFET – Comparison of JFET and MOSFET– Power MOSFET UJT :Operation, Static characteristics– SCR: Operation- Static- Characteristics

Unit V

Special Semiconductor Devices

Zener diodes – Schotky Barrier diode – Tunnel diodes – DIAC – TRIAC – Photo diodes –Photo transistors – LED – LCD – optocouplers – Gunn diodes - Varactor diode

Text Books

1. Jacob Millman, Christos C Halkias, Satyabrata Jit, "Electronic Devices & Circuits",Tata McGraw Hill, 2008.
2. Albert Malvino, David A Bates, “Electronic Principles”, Tata McGraw Hill, Seventh Edition, 2008.

Reference Books

1. David.A.Bell, "Electronic Devices & Circuits ", PHI, 1998.
2. Robert Boylestad, "Electronic Devices & Circuit Theory", Sixth Edition, PHI, 2002.
3. Charles A Schuler, Roger L Tokheim, “Electronics Principles and Applications”, Tata McGraw Hill, Sixth edition, 2003.

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

REVISED AND NEW SUBJECTS

Subject Code	Subject Name	Credits
10EC301	Statistical Digital Signal Processing	3:1:0
10EC302	Network Routing Algorithms	4:0:0
10EC303	Network Management	4:0:0
10EC304	Global Positioning system	4:0:0
10EC305	Digital communication receivers	4:0:0
10EC306	Optical Networks and photonic switching	4:0:0
10EC307	Digital Image Processing	3:0:0
10EC308	Wireless Sensor networks	4:0:0
10EC309	High Speed Switching Architecture	4:0:0
10EC310	CMOS VLSI Design	4:0:0
10EC311	VLSI Technology	4:0:0
10EC312	VLSI Digital Signal Processing	3:1:0
10EC313	Testing and Testability of Electronics Systems	3:0:0
10EC314	Low Power VLSI Design	3:0:0
10EC315	Hardware Description Languages	4:0:0
10EC316	Semiconductor Devices and Modeling	4:0:0
10EC317	HDL Laboratory	0:0:2
10EC318	ASIC Design Laboratory	0:0:2
10EC319	High Speed VLSI Design	4:0:0
10EC320	Mixed Signal Processing	4:0:0
10EC321	RF System Design	4:0:0
10EC322	Genetic Algorithm for VLSI Design	4:0:0
10EC323	MEMS and Micro Systems	4:0:0
10EC324	Nanoelectronics	4:0:0
10EC325	Advanced Semiconductor Memories	4:0:0
10EC326	Designing with PLDs and ASICs	4:0:0
10EC327	ASIC Design	4:0:0
10EC328	Digital Electronics And Microprocessors	4:0:0
10EC329	Digital Electronics And Microprocessor Lab	0:0:2
10EC330	Electronic Circuits	4:0:0
10EC331	Electron Devices Lab	0:0:2

10EC301 STATISTICAL DIGITAL SIGNAL PROCESSING

Credits: 3:1:0

Objective:
To learn the concepts of signal processing and analyze the statistical properties of signals

Outcome:
Will be able to solve the practical signal applications.

Unit I : Discrete Random Signal Processing
Discrete Random Processes - Expectations – Variance - Co-Variance - Scalar Product - Energy of Discrete Signals - Parseval's Theorem - Wiener Khintchine Relation-Power Spectral Density - Periodogram - Sample Autocorrelation - Sum Decomposition Theorem - Spectral Factorization Theorem - Discrete Random Signal Processing by Linear Systems-Simulation of White Noise - Low pass Filtering of White Noise.

Unit II : Spectrum Estimation
Non-Parametric Methods-Correlation Method-Co-Variance Estimator-Performance Analysis of Estimators - Unbiased - Consistent Estimators - Periodogram Estimators - Barlett Spectrum Estimation - Welch Estimation - Model based Approach - AR - MA - ARMA Signal Modeling-Parameter Estimation using Yule - Walker Method.

Unit III : Linear Estimation And Prediction
Maximum likelihood criterion - Efficiency of estimator - Least mean squared error criterion-Wiener filter - Discrete Wiener Hoff equations - Recursive estimators - Kalman filter - Linear Prediction - Prediction Error - Whitening filter - Inverse filter - Levinson recursion - Lattice realization and Levinson Recursion algorithm for solving Toeplitz System of equations.

Unit IV : Adaptive Filters
FIR adaptive filters - Newton's steepest descent method - Adaptive filter based on steepest descent method - Windrow Hoff LMS adaptive algorithm - Adaptive channel equalization - Adaptive echo chancellor - Adaptive noise cancellation - RLS adaptive filters - Exponentially Weighted RLS - Sliding window RLS - Simplified IIR LMS Adaptive filter.

Unit V: Multirate Digital Signal Processing
Mathematical description of change of sampling rate-Interpolation and Decimation-continuous time model - Direct digital domain approach - Decimation by an integer factor - Interpolation by an integer factor - Single and multistage realization - Poly phase realization - Application to sub band coding - Wavelet transform and filter bank implementation of wavelet expansion of signals.

Text Book

1. Monson H.Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley and Sons Inc., New York, Reprint 2008

Reference Books

1. John G.Proakis, Dimitris G.Manolakis, "Digital Signal Processing", Prentice Hall of India, 4th Edition 2007
2. P.P Vaithyanathan, "Multirate systems and filter Banks", Prentice Hall of India 1993

10EC302 NETWORK ROUTING ALGORITHMS

Credits: 4:0:0

Objectives

- To review the routing concept in circuit switching & packet switching networks in general and high speed networks in particular
- To study the routing algorithms of mobile networks in detail

Outcome

- To explore the functionalities of routing algorithms of Wired and Wireless Networks.

Unit I : Multi Access Communication

Basic classifications of routing, Routing in circuit switching networks - Dynamic Non - Hierarchical Routing and Dynamic Alternative Routing - Routing in packet switching networks - characteristics and design elements, Routing strategies - Routing in ATM networks - Self and Table Controlled routing.

Unit II : **Single User Matched Filter**

Distance Vector Routing - Routing Information Protocol - Link State Routing - Open Shortest Path First Protocol - Inter Domain Routing - EGP, BGP and IDRP Protocols - Apple Talk Routing

Unit III : **Optimum Multi User Detection**

Routing based taxonomy of optical networks, Deflection routing algorithm, Routing in PlaNET - modes, options, packet and call level routing

Unit IV : **Non De-Correlating Linear Multi User Detection**

Mobility management in Internet - Mobile IP - Routing in cellular networks - hand off and roaming - Introduction to packet radio networks - Routing in small and large sized packet radio networks - Tier and hierarchical routing - Applications and other issues of Mobile Adhoc Networks

Unit V : **Decision - Driven Multiuser Detectors**

Table driven and On-demand routing protocols, Desitination Sequenced Distance Vector protocol, Clusterhead Gateway Switch Routing protocol, Wireless Routing Protocol - Adhoc On-demand Distance Vector protocol, Dynamic Source Routing protocol - Multicast routing - Link reversal routing - Temporally Ordered Routing Algorithm - Associativity Based Routing protocol, Signal Stability Routing protocol - Comparison.

Text Books

1. M C.E. Perkins, "AdHoc Networking", Addison - Wesley Publication, Singapore, 2001
2. S. Keshav, "An Engineering Approach to Computer Networking", Addison - Wesley, New Delhi, 2001

Reference Books

1. Steen Strub, "Routing in Communication Networks", Prentice Hall International, New York, 1995
2. A.S. Tanenbaum, " Computer Networks", PHI, New Delhi, 2003
3. William Stallings, "Data and Computer Communications", 6th Edition, Pearson Education, 2002

10EC303 NETWORK MANAGEMENT

Credits: 4:0:0

Objectives

Understand the fundamental concepts of network management
Exposure to network security aspects

Outcome

Network Management is a course designed to familiarize the student with the design, analysis operation and management of modern data communications networks. The course will provide the student with a working knowledge of the types of communications network management systems and their strengths and weaknesses in solving various information network management problems

Unit I : **OSI Network Management**

OSI Network management model-Organizational model-Information model, Communication model. Abstract Syntax Notation - Encoding Structure, Macros Functional Model CMIP/ CMIS

Unit II : Internet Management (Snmp)

SNMP-organizational model-system overview, The information model, communication model-Functional model. SNMP proxy server, Management information, Protocol remote monitoring

Unit III : **Broadband Network Management**

Broadband networks and services, ATM Technology - VP, VC, ATM Packet, Integrated service, ATMLAN emulation, Virtual Lan, ATM Network Management - ATM Network reference model, Integrated local Management Interface. ATM Management Information base, Role of SNMD and II. MIin ATM Management, M1, M2, M3, M4 interface. ATM Digital Exchange Interface Management

Unit IV : Network Management Protocols

HTTP-History and standards development-HTTP Session-Request message-Request methods-Status Codes- persistent connections-Secure HTTP-POP4-SDPS-server implementations-SMTP-mail processing model-protocol review-outgoing mail SMTP server-FTP/IP-IMAP-orginal-imap2-imap4-advantages over POP-disadvantages of IMAP

Unit V : **Network Management Applications**

Configuration management, Fault management, performance management, Event Corelation Techniques security management, Accounting management, Report Management, Policy Based Management Services Level Management

Text Books

1. Mani Subramanian, "Network Management Principles and Practice", Addison Wisely, New York, 2000
2. W. Richard Stevens, TCP/IP Illustrated Volume-I,the protocols,Pearson Education,2000.

Reference Books

1. Salah aiidarons, Thomas Plevayk, "Telecommunications Network Technologies and Implementations", Eastern Economy Edition IEEE press, New Delhi, 1998
2. Lakshmi G Raman, "Fundamentals of Telecommunication Network Management", Eastern Economy Edition IEEE Press, New Delhi,1999

10EC304 GLOBAL POSITIONING SYSTEM

Credits: 4:0:0

Objectives

At the end of this course students will gain knowledge in the topics such as

- Introduction to global positioning
- Types of signals used in the GPS systems and accuracy limits
- Latest versions of GPS and its application

Outcome

The purpose of this course is to develop a strong foundation in the field of Global Positioning Systems. The subject gives the students an in-depth knowledge about working of Global positioning receivers. Students are exposed to various errors occurring in GPS and latest variant DGPS receivers and GPS applications.

Unit I : Introduction

GPS and GLONASS Overview - Satellite Navigation -Time and GPS - User position and velocity calculations - GPS - Satellite Constellation - Operation Segment - User receiving Equipment - Space Segment Phased development

Unit II : **Signal Characteristics**

GPS signal components - purpose, properties and power level - signal acquisition and tracking - Navigation information extraction - pseudorange estimation - frequency estimation - GPS satellite position calculation

Unit III : **GPS Receivers & Data Errors**

Receiver Architecture - receiver design options - Antenna design - SA errors - propagation errors - Methods of multipath mitigation - Ephemeris data errors - clock errors

Unit IV : Differential Gps

Introduction - LADGPS - WADGPS, Wide Area Augmentation systems - GEO Uplink subsystem - GEO downlink systems - Geo Orbit determination - Geometric analysis - covariance analysis - GPS /INS Integration Architectures

Unit V : **GPS Applications**

GPS in surveying, Mapping and Navigation - Precision approach Aircraft landing system - Military and Space application - Intelligent transportation system

Text Book

1. Mohinder S.Grewal , Lawrence R.Weill, Angus P.Andrews, "Global positioning systems - Inertial Navigation and Integration", John wiely & sons , 2002

Reference Book

1. E.D.Kaplan, ""Global positioning systems - Inertial Navigation and Integration", John wiely & sons , 2001

10EC305 DIGITAL COMMUNICATION RECEIVERS

Credits: 4:0:0

Objectives:

To learn about base band and band pass communication.
To study the different types of receivers used in Additive white Gaussian noise channels and Fading channels.
To study the extraction methods of the signal from AWGN and Fading channel.

Outcome:

The student learns to design a receiver for any given communication channel.

Unit I : Review of Digital Communication Techniques

Base band and band pass communication, signal space representation, linear and nonlinear modulation techniques, and Spectral characteristics of digital modulation.

Unit II : Optimum Receivers for Awgm Channel

Correlation demodulator matched filter, maximum likelihood sequence detector, optimum receiver for CPM signals, M-ary orthogonal signals, envelope detectors for M-ary and correlated binary signals.

Unit III : Receivers For Fading Channels

Characterization of fading multiple channels, statistical models, slow fading, frequency selective fading,, diversity technique, RAKE demodulator, coded waveform for fading channel.

Unit IV : Synchronization Techniques

Carrier and signal synchronization, carrier phase estimation-PLL, Decision directed loops, symbol timing estimation, maximum likelihood and non-decision directed timing estimation, joint estimation.

Unit V : Adaptive Equalization

Zero forcing algorithm, LMS algorithm, adaptive decision-feedback equalizer and Equalization of Trellis-coded signals. Kalman algorithm, blind equalizers and stochastic gradient algorithm. Echo cancellation

Text Book:

1. John.G.Proakis, " Digital communication " 4th Edition, McGraw-Hill, New York, 2001.

Reference Books

1. Simon Marvin, " Digital communication over fading channel; An unified approach to performanceAnalysis ", John Wiley, New York, 2000.
2. Heinrich Meyer, Mare Moeneclacy, Stefan.A.Fechtel, " Digital communication recievers ",Vol I & Vol II, John Wiley, New York, 1997.
3. E.A.Lee and D.G.Messerschmitt, " Digital communication ", 2nd Edition, Allied Publishers, New Delhi, 1994.

10EC306 OPTICAL NETWORKS & PHOTONIC SWITCHING

Credits: 4:0:0

Objectives

To learn about

- Various components of optical networks
- First generation and broadcast optical network
- Wavelength routed optical networks also various photonic switches

Outcome

The main purpose of this course is to introduce students the important areas of communication networks, mainly optical networks and photonic switching. This will enable the students to acquire a solid understanding of foundations of optical networks technologies, systems, networks issues as well as economic deployment considerations and also photonic switching

Unit I : Networks

Introduction : first and second generation optical networks : system network evaluation

Unit II : **Technology**

Propagation of light energy in optical fibers dispersion and non linear effects; components - couplers, isolators, circulators, multiplexers, filters and optical amplifiers; switches and wavelength converters.

Unit III : **First Generation Optical Networks**

SONET / SDH, MAN layered architecture, broadcast and select networks MAC protocols, test beds, wavelength routing networks

Unit IV : **Control and Management**

Configuration, performance and fault management, optical safety, service interface; testbeds; access networks - HFC, FTTC, architecture

Unit V : **Photonic Packet Switching**

OTDM, MUX & DEMUX synchronization; broadcast OTDM networks, switch - ban networks: OTDM testbeds

Text Book

1. Rajiv Ramaswamy, "Optical Networks", Harcourt Asia Private Limited, Singapore, 2001

Reference Books

1. D.W.Smith, Ed., Optical Network Technology, Chapman and Hall, London, 1995
2. Biswanath Mukherjee, "Optical Communication Networks", McGraw-Hill,1997

10EC307 DIGITAL IMAGE PROCESSING

Credits: 3:0:0

Objective:
To study the fundamental concepts, algorithms and techniques of digital image processing

Outcome:
Will be able to develop new techniques for image enhancement, segmentation, compression, etc.

Unit I : Fundamentals of Image Processing
Elements of visual perception - Image sensing and acquisition – Sampling and Quantization – Pixel relationships - Color fundamentals and models – Separable image transforms – DFT, DCT - Walsh, Hadamard, Haar – Karhunen Loeve and SVD

Unit II : Image Enhancement and Restoration
Histogram equalization & matching - Image smoothening and sharpening (spatial & frequency domain) - Homomorphic filtering - Model of image degradation/restoration process – Noise models – Inverse filtering - Least mean square filtering – Constrained least mean square filtering –Pseudo inverse – Kalman filtering.

Unit III : Image Segmentation and Feature Analysis
Edge detection – Edge linking and boundary Detection – Intensity and histogram based image segmentation - Region based segmentations – Contour based segmentation - Motion segmentation - Feature analysis and extraction – spatial techniques for shape and texture feature extraction.

Unit IV : Multi Resolution Analysis and Compressions
Image Pyramids – Multi resolution expansion – Wavelet transforms - Lossless compression: Variable length coding – LZW coding – Bit plane coding - predictive coding - Lossy Compression: Transform coding – Wavelet coding – Basics of image compression standards: JPEG, MPEG, Basics of Vector quantization.

Unit V : Applications of Image Processing
Image classification – Image recognition – Image understanding – Image fusion – Image registration - Steganography – Digital compositing – Mosaics – Content based image retrieval - Color image processing –Video motion analysis

Text Book

1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing – Pearson Education, 2nd Edition, 2003.

Reference Books

1. A.K. Jain, Fundamentals of Digital Image Processing, Pearson Education, 2003.
2. William K. Pratt, Digital Image Processing, John Willey 2001.
3. Chanda Dutta Magundar, Digital Image Processing and Applications, Prentice Hall of India,2000
4. Millman Sonka, Vaclav hlavac, Roger Boyle, Image Processing Analysis and Machine Vision, – Broos/colic, Thompson Learniy1999.

10EC308 WIRELESS SENSOR NETWORKS

Credits: 4:0:0

Objectives:

- To introduce the basic concepts of Sensor Networks.
- To introduce the overview of communication Protocols
- To introduce the Energy management and Security.

Outcome:

Students will be able to understand the concepts of sensor networks, applications and different types of protocols in WSN.

Unit I : Basics Concepts about Sensor Networks

Introduction –Difference between sensor networks and traditional networks-Need for sensor network programmability- Functional architecture of sensor networks—Individual components of WSN-Sensor network node--Applications-Habitat monitoring-Tracking chemical plumps-Smart transportation.

Unit II : Communication Protocols

Time synchronization protocols-Transport Layer protocol-Network layer protocol-Data link protocol-medium access control-The S-MAC protocol-IEEE 802.15.4 standard and Zigbee -Error Control

Unit III : Tracking Technologies

Tracking scenario –Problem formulation –Sensing model-Fundamentals-ToA, TDoA, and AoA-Positioning by signal strength-positioning ang location tracking algorithms-Trilateration-Multilateration-Pattern matching-Nearest neighbor algorithms-probability based algorithms-location tracking-network based tracking

Unit IV : Sensor Network Data Bases

Sensor data base chalanges- Queying the physical environment-High level data base organization-Data aggregation-types of aggregation-Packet level aggregation-total aggregation-Geographic aggregation-selection of the best aggregation points-Problem with high data rate

Unit V : Energy Management And Security

Idle power manage ment-Active power management-Design challenges in energy efficient medium access control –IEEE 802.11-operation-power saving mode –merrits-drawbacks-implications in WSN.
Blue tooth –operation-Merits-im plecations. Security: Security architecture-Cell based WSNs-Privacy of local information

Text Book:

1. Mohammad Ilyas and Imad Mahgoub, "Handbook of Sensor Networks: Compact Wireless and Wired Sensing Systems" CRC Press 2009.

Reference Books:

1. Feng Zhao, Leonidas J. Guibas, Wireless Sensor Networks: An Information Processing Approach" Morgan Kaufmann Publishers 2004.
2. Michel Banatre, Pedro Jose Marron, Anibal Ollero and Adam Wolisz,"Cooperating Embedded Systems and Wireless Sensor Networks", ISTE Ltd,2008.

10EC309 HIGH SPEED SWITCHING ARCHITECTURE

Credits: 4:0:0

Objective

To understand the types of switch fabrics for high-speed applications. To get a clear idea about the traffic and Queuing systems

Outcome

Speed is one of the demand put forth by the users of communication resources. So focus must be made on the switch architectures suitable for high speed application. This syllabus has been framed based on the above requirements

Unit I : LAN Switching Technology

Switch Forwarding Techniques, Switch Path Control, LAN Switching, Cut through Forwarding, Store and forward, and Virtual LANs

Unit II : Architectures

Switching architectures - Issues and performance analysis - Banyan and knockout switches - Single & Multistage networks - Shuffle switch tandem banyan...

Unit III : Packet Switching Architectures

Architectures of Internet Switches and Routers- Bufferless and buffered Crossbar switches, Multi-stage switching, Optical Packet switching; Switching fabric on a chip; Internally buffered Crossbars.

Unit IV : **Signaling Standards and Queueing Concepts**

Signaling - SS7 Signaling - Traffic and queuing models - Performance analysis of Input, Output & Multiple shared Queuing.

Unit V : **IP Switching**

Addressing Model, IP switching types, Flow driven and topology driven solutions, IP over ATM, Address and next hop resolution, Multicasting, IP v6 over ATM

Text Books

1. Achille Pattavina, Switching Theory Architectures and performance in Broadband ATM networks, John wiley & sons Ltd. New York, 1998
2. Elhanany M. Hamdi, "High Performance Packet Switching architectures", Springer Publications, 2007.

Reference Books

1. Ranier Handel. Manfred N Huber, Stefab Schrodder, ATM Networks - Concepts, Protocols, Applications, 3rd edition, Adisson Wesley, New York 1999
2. Thiggarajan Viswanathan, "Tele Communication Switching System and Networks", Prentice Hall of India, Pvt.Ltd., New Delhi, 1995
3. Christopher Y Metz, Switching protocols & Architectures, McGraw Hill Professional Publishing, New York, 1998

10EC310 CMOS VLSI DESIGN

Credits: 4:0:0

Objective:

To study the basic concepts of MOS transistor, circuit design processes, Combinational Logic Circuits,, Sequential Logic Circuits, Arithmetic Building Blocks, Memory and Array Structures and BiCMOS Logic Circuits.

Outcome:

To gain knowledge in designing circuits using various design styles.

Unit I :Logic Design with MOSFETS and MOS Transistor Theory

MOSFETs as Switches – Basic Logic Gates in CMOS – Complex Logic Gates in CMOS – Transmission Gate Circuits – Clocking and Dataflow Control – The MOS Structure – The MOS System under External Bias – Structure and Operation of MOS Transistor (MOSFET) – I_{ds} Versus V_{ds} Relationships –MOSFET Scaling and Small-Geometry Effects – MOSFET Capacitances – CMOS Inverter Characteristics.

Unit II : Circuit design processes and characterization

Stick diagrams – Design rules and layout – Layout planning using Euler path – Delay approach estimation – Logical Effort and Transistor Sizing – Power Dissipation – Design Margin Interconnect – Scaling.

Unit III : Designing Combinational Logic and Sequential Logic Circuits

Static CMOS Design – Dynamic CMOS Design – Static Latches and Registers – Dynamic Latches and Registers – Alternative Register Styles – Pipelining.

Unit IV : Designing Arithmetic Building Blocks, Memory and Array Structures

Adders – Multipliers – Shifters – Memory Core – Memory Peripheral Circuitry – Programmable Logic Arrays.

Unit V : BiCMOS Logic Circuits and Chip Input & Output (I/O) Circuits
Bipolar Junction Transistor (BJT): Structure and Operation, Dynamic Behavior of BJTs, Basic BICMOS Circuits: Static Behavior, Switching Delay in BiCMOS Logic Circuits, BiCMOS Applications, ESD Protection, Input Circuits, Output Circuits and L(*di/dt*) Noise, On-Chip Clock Generation and Distribution, Latch-Up and its Prevention.

Text Books

1. Kang & Leblebigi "CMOS Digital IC Circuit Analysis & Design"- McGraw Hill, 2003.
2. Jan.M.Rabaey, Anantha ChandraKasan and **Borivoje Nikolic, "**Digital Integrated Circuits – A Design Perspective", Pearson Education, 2nd Edition 2003.

Reference Books:

1. Neil H.E. Weste, David Harris and Ayan Banerjee, "A Ciruits and Systems Perspective", Pearson Education India, 3rd Edition, 2006.
2. Kamran Eshraghian, Douplas A.Pucknell and Sholeh Eshraghian, "Essentials of VLSI Circuits and Systems", Eastern Economy Prentice Hall of India New Delhi, 2005.

10EC311 VLSI TECHNOLOGY

Credits: 4:0:0

Objective:
To learn in detail about the fabrication of BJT and MOSFET transistors. All the unit process steps involved in planar process starting from silicon crystal growth to packaging of circuits has to be dealt in depth.

Outcome:
Students are expected to design VLSI circuits by keeping technological process constraints in mind.

Unit I : Introduction
Introduction to VLSI fabrication – BJT and CMOS Fabrication Process a Brief Overview – Unit Process Steps in Planar Process. Environment for VLSI Technology: Clean Room and Safety Requirements. Wafer Cleaning Processes and Wet Chemical Etching Techniques, Silicon Crystal Growth, Epitaxy – VPE and MBE.

Unit II : Oxidation and Diffusion
Oxidation: Kinetics of Silicon Dioxide Growth for Thick and Thin Films – Oxidation Rate Constants- Dopant Redistribution and Oxide Charges - Characterization of Oxide Films - Impurity Diffusion: Solid State Diffusion Modelling and Technology - Characterization of Impurity Profiles- Diffusion Systems - Ion Implantation Modeling and Technology - Damage Annealing – Masking during Implantation.

Unit III : Lithography and Etching

Basic Process Explaining Lithography – Positive and Negative Resist and their Comparison – Light Sources – Mask Making Process – Layout Generation using Software Tools – Optical Lithography - Issues in Optical Lithography – X-ray Lithography – E-beam Lithography. Wet Chemical Etching- Dry Etching, Plasma Etching System – Etching of Various Materials Used in VLSI Fabrication.

Unit IV : Deposition Techniques
Physical Vapor Deposition – Thermal Evaporation and Sputtering – Metallization –Failure Mechanisms in Metal Interconnects - Silicides and Copper Metallization, Chemical Vapor Deposition Techniques: CVD Techniques for Deposition of Polysilicon, Silicon Dioxide, Silicon Nitride and Metal Films – Comparison of CVD techniques.

Unit V : Integrated Device Fabrication
BJT fabrication – Isolation techniques; Junction Isolation, LOCOS, Trench Isolation – Realization of ECL and I^2L Circuits. MOSFET fabrication – Metal Gate to Self-Aligned Poly-Gate – Tailoring of Device Parameters – CMOS Fabrication – Latch-up in CMOS – Bi-CMOS Technology – MESFET Technology,VLSI Assembly And Packaging.

Text Book

1. S. A. Campbell, "The Science and Engineering of Microelectronic Fabrication", 2^{nd} Edition, Oxford University Press, 2001.

Reference Books

1. G. S. May and S. M. Sze, " Fundamentals of Semiconductor Fabrication", John Wiley Inc., 2004.
2. C.Y. Chang and S.M.Sze (Ed), "ULSI Technology", McGraw Hill Companies Inc, 1996.
3. S.M. Sze (Ed), "VLSI Technology", 2^{nd} Edition, McGraw Hill, 1988.
4. S.K. Ghandhi, "VLSI Fabrication Principles", 2^{nd} Edition, John Wiley Inc., New York,Reprint 2004.

10EC312 VLSI DIGITAL SIGNAL PROCESSING

Credits 3:1:0

Objective
This paper integrates VLSI architecture theory and algorithms, addresses various architectures at the implementation level, and presents several approaches to analysis, estimation, and reduction of power consumption.
Explains how to design high-speed, low-area, and low-power VLSI systems for a broad range of DSP applications

Outcome
The students will be able to apply several optimization techniques to improve implementations of several DSP algorithms, using digital signal processors.

Unit I : Iteration Bound & Pipelining / Parallel Processing.
Introduction to DSP systems- representations of DSP Algorithms- loop bound and iteration bound- algorithms for computing iteration bound- iteration bound for MRDFG- pipelining and parallel processing of FIR filters- pipelining and parallel processing for low power applications.

Unit II : Retiming & Unfolding
Definition and properties of retiming -solving system inequalities- retiming techniques-algorithm and properties of unfolding -applications-Algorithmic strength reduction in filters and transforms- parallel FIR filters- fast FIR algorithms.

Unit III : Systolic Array & Fast Convolution Algorithm
Design Methodology- FIR systolic Arrays- Selection of Scheduling Vector- Cook-Toom Algorithm-Winograd Algorithm- Iterated Convolution – Cyclic Convolution-

Unit IV : Scaling And Round Off Noise
State Variable Description of digital filters- Scaling and roundoff noise computation- Bit level arithmetic architectures- parallel multipliers- bit serial multipliers- Canonic Signed Digit Arithmetic- distributed arithmetic

Unit V : Numerical Strength Reducing Techniques
Redundant Arithmetic- Redundant Number Representations- Carry Free Radix-2 Addition And Subtraction-Hybrid Radix 4 Addition- Data Format Conversion- Redundant To Nonredundant Converter- Subexpression Elimination- Multiple Constant Multiplication- Subexpression Sharing In Digital Filters- Additive and Multiplicative Number Splitting- Synchronous Pipeling And Clocking Styles-Wave Pipelining- Asynchronous Pipeling- Signal Transition Graphs.

Text Book
1. Keshab K.Parhi, “VLSI Digital Signal Processing Systems, Design and implementation”, Wiley, Inter Science, 1999.

Reference Books

1. Mohammed Isamail and Terri Fiez, “Analog VLSI Signal and Information Processing”, McGraw Hill, 1994
2. Jose E. France, Yannis Tsividis,“Design of Analog-Digital VLSI Circuits for Telecommunication and Signal Processing”, Prentice Hall, 1994.

10EC313 TESTING AND TESTABILITY OF ELECTRONICS SYSTEMS

Credits: 3:0:0

Objective:
To know about various Faults, Fault Models, Test Generation Algorithms, Fault Simulation Techniques and Design for Testability.

Outcome:
Testing of various Combinational & Sequential logic Circuits.

Unit I : Introduction

Introduction to Testing – Testing at Different Levels of Abstraction – Fault Modeling - Logical Fault Models - Fault Detection & Redundancy- Fault Equivalence & Fault location

Unit II : Test Generation for Combinational and Sequential Logic Circuits

Introduction - Fault - Table, Boolean difference – Path sensitization, D algorithm –PODEM Test Generation for Sequential Circuits – State Table Verification -Random Testing.

Unit III : Fault Simulation Techniques

Simulation for Design Verification-Algorithms for Fault Simulation-Serial Fault Simulation-Parallel Fault Simulation-Deductive Fault Simulation -Concurrent Fault Simulation

Unit IV : Design for Testability

Testability - Ad-hoc design for Testability Techniques - Generic Scan based Designs - Classical Scan based Design – Board-Level and System level DFT Approaches-Boundary Scan Standards.

Unit V : Built-In Self Test

Introduction to Built-In Self Test Concepts - Test Pattern Generation for BIST –Exhaustive Testing-Pseudorandom Testing- Specific BIST Architectures -CSBL-BEST-LOCST-STUMPS-CBIST-SST-BILBO.

Text Books:

1. M. Abramovici M.A, Breuer and A.d Friedman, “Digital Systems Testing and Testable Design”, Computer Sciences Press, 2008.
2. M.L. Bushnell and V.D. Agarwal, "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits", Kluwer Academic Publishers, 2002.

Reference Book:

1. Parag K. Lala, "Fault Tolerant and Fault Teastable Hardware Hardware Design", BS Publications, 2008.

10EC314 LOW POWER VLSI DESIGN

Credits: 3:0:0

Objective:

To study the concepts on different levels of power estimation and optimization techniques.

Outcome:

Students gain knowledge in designing low power circuits on various levels by applying different optimization techniques.

Unit I : Simulation Power Analysis

Need for Low Power VLSI chips – Charging and Discharging Capacitance – Short circuit Current – Leakage Current – Static Current – Basic Principles of Low Power Design – Gate Level Logic Simulation – Architecture Level Analysis.

Unit II : Circuit and Logic Level Power Estimation
Transistor and Gate Sizing – Equivalent Pin Ordering – Network Restructuring andReorganization– Gate reorganization – Signal Gating –Logic Encoding – State Machine Encoding – Pre-Computation Logic – Power Reduction in Clock Networks – CMOS Floating Node – Low Power Bus – Delay Balancing.

Unit III : Power Estimation
Modeling of Signals – Signal Probability Calculation – Probabilistic Techniques for Signal Activity Estimation – Statistical Techniques – Estimation of Glitching Power.

Unit IV : Circuit Design Techniques and SRAM Architecture
Circuit Design style – Leakage Current in Deep sub-Micrometer Transistors – Deep Sub micrometer Device Design Issues – Low Voltage Circuit Design Techniques – Multiple Supply Voltages-MOS Static RAM- Memory Cell – Banked SRAM – Reducing Voltage Swing on Bit Lines– Reducing Power in the Write Driver and Sense Amplifier Circuits.

Unit V : Energy Recovery and Low Power Latches and Flip flops
Energy Recovery Circuit Design – Design with Partially Reversible Logic – Need for Low power Latches and Flip flops – Evolution of Latches and Flip flops – Quality Measures for Latches and Flip flops.

Text Books:

1. Gary Yeap, “Practical Low Power Digital VLSI Design”, Kluver Academic Publishers, 2001.
2. Kaushik Roy and Sharat Prasad, “Low Power CMOS VLSI Circuit Design”, John Wiley & Sons Inc., 2000.

Reference Books:

1. Anatha Chandrakasan and Robert Broderson, “Low Power CMOS Design”,Standard Publishers, 2000.
2. Kiat-Seng Yeo/Samir S.Rofail/Wang-Ling Goh, ”CMOS/BiCMOS ULSI Low Voltage, Low Power”,Pearson Edition, Second Indian Reprint 2003.

10EC315 HARDWARE DESCRIPTION LANGUAGES

Credits: 4:0:0

Objective:
To know about the various flow of VHDL and Verilog programming techniques and synthesis

Outcome:
Knowledge in VHDL Programming and Verilog Programming

Knowledge in synthesizing circuits using HDL

Unit I : Introduction To VHDL Data Flow And Structural Modeling
VHDL Overview – FPGA Design Flow Process – Software Tools - Xilinx Tool Flow – Libraries – Data Objects - Data Types – Data Operators – Entities – Architectures. Basic Concurrent Statements – Signal Assignment Statements – Conditional Signal Assignment – Selected Signal Assignment – Usage of Blocks In Dataflow Modeling. Component Declarations – Component Instantiation – Types of Component Instantiation- Test Benches – Combinational & Sequential Test Benches.

Unit II : Behavioral Modeling & Packages
Process – Delays – Basic Sequential Statements – If, If Else Statements, Case Statements – Loops – For Loop, While Loop, Next, Exit, Null Statements – Usage of Variables Inside The Process –Multi Process Statements – Generics – Operator Overloading – Conversion Functions – Attributes – File Concepts - Packages – Functions & Procedures – Predefined & User Defined Library Implementations.

Unit III : Introduction to Verilog HDL
Design Methodology – Module – Ports – Basic Concepts – Operators – Nos. Specification – Data Types – Arrays – Parameters – Gate Delays – Operator Types – Conditional Statements – Multiway Branches - Loops - Switch – Modeling Elements -Dataflow Modeling- Continuous Assignment. Delays, Expression, Operators and Operands.

Unit IV : Modeling With Verilog HDL
Behavioral Modeling-Procedural Assignments, Timing Controls, Loops- Implementation of Basic Circuit Using Dataflow & Behavioral Modeling. Switch Level Modeling. Applications of all Dataflow, Behavioral and Structural Modeling in FPGA – FSM Implementation – Test Benches.

Unit V : HDL Synthesis
VHDL Synthesis: Synthesis basics-modeling a wire- modeling combinational logic- modeling sequential logic- Modeling Flip-flop-Flip-flop with Synchronous Preset and clear- Flip-flop with Asynchronous Preset and clear-Modeling a latch. Verilog Synthesis: Synthesis of combinational logic-synthesis of sequential logic with latches and flip flops- synthesis of explicit and implicit state machines- Synthesis of gated clocks and clock enables synthesis of Loops.

Text Books:
1. M.D. Ciletti, "Advanced Digital Design with the VERILOG HDL" PHI.2008
2. J. Bhaskar, "A VHDL Synthesis Primer", BS Publications, II Edition, 2001.

Reference Books:
1. Kevin Skahill "VHDL for PROGRAMMABLE LOGIC" Pearson Publications,2004.
2. SamirPalnitkar, "Verilog HDL", Pearson Publication, II Edition. 2003.
3. Douglas Perry, "VHDL", 3rd Edition, McGraw Hill 2001.

10EC316 SEMICONDUCTOR DEVICES AND MODELING

Credits: 4:0:0

Objective:
To learn the physics behind the semiconductor devices and study the various models. To understand the BJT, MOSFET and other semiconductor devices from the device perspective.

Outcome:
Clear understanding of semiconductor devices which will help the students in learning the advanced semiconductor devices.

Unit I : Semiconductor Physics
Semiconductor Materials and Structures- Band Structures – Electron-Hole Statistics – Carrier Mobility and Conductivity– Carrier Diffusion, Generation/Recombination – Avalanche Multiplication – Hall Effect, P-N Junction Theory – Built-In Potential – P-N Electrostatics – Abrupt And Linearly Graded P-N Junction Depletion Layers – Current-Voltage Relation In P-N Junction – Generation/Recombination Current – Diffusion Capacitance – Diode Equivalent Circuit – Breakdown Voltage – Junction Curvature Effect – Transient Behavior – Noise. Tunnel Diode – Metal-Semiconductor Junctions – Schottky Diode and Ohmic Contact – Hetero-Junctions.

Unit II : BJT Device Analysis
BJT Current- Voltage Relation – Current Gain – Band Gap Narrowing – Auger Recombination – Early Effect – Punch-Through In BJT – Breakdown Voltage In BJT – Small Signal Equivalent Circuit – Cut-Off Frequency – Switching Behavior – HBT.

Unit III : BJT Models
Basic Ebers-Moll Model – Basic Gummel-Poon Model – Model Derivation – Moll-Ross Equation – High Injection Effect – Knee Current – Early Effect – Base Widening Effects.

Unit IV : MOSFET Device Analysis
Basic Concepts Of MOSFET – Capacitance-Voltage Characteristics – Threshold Voltage Of MOS Capacitor – Flat-Band Voltage – Gate Oxide Charges And Transport Through Gate Oxide – Current-Voltage Relation of Long Channel MOSFETS – Drain Conductance – Trans conductance – Drain Current Saturation – Body Effect – Drift- Diffusion Model – Sub-Threshold Conduction, Slope And Mobility Models in MOSFETS – Temperature Effect – Equivalent Circuit Of MOSFETS. Tailoring Of MOSFET Parameters – Scaling of MOSFETs and Short-Channel Effects – Charge Sharing Model – Narrow Width Effect – Channel Length Modulation – Hot Carrier Effects. LDD MOSFET – VMOS, FAMOS – MESFET – MODFET.

Unit V : MOSFET models
Level-1 model of MOSFET – Level-2 model of MOSFET: Mobility modeling, Sub-threshold current, Channel length modulation, Short channel effect, Velocity saturation, Narrow width effect, Gate capacitance, Junction capacitances – Level-3 model of MOSFET: Slope discontinuity, Gate capacitances, BSIM model.

Text Book

1. S.M. Sze, K. N. Kwok, “Physics of Semiconductor Devices”, 3rd Edition, John Wiley & Sons, 2008.

Reference Books

1. S. M. Sze, “Semiconductor Devices: Pioneering Papers”, World Scientific Publishing Company, 2004.
2. D. P. Foty, “MOSFET Modeling with SPICE, Principles and Practices”, Prentice Hall PTR, 1997.
3. H. C. deGraff and F. M. Klaassen, “Compact Transistor Modelling for Circuit Design”, Springer-Verlog Wein, New York, 1990.
4. E. Getreu, “Modeling the Bipolar Transistor”, Elsevier Scientific Publishing Company, 1978.
5. P.E. Gray et al., “Physical Electronics and Circuit Models for Transistors”, John Wiley & Sons, 1964.

10EC317 HDL LABORATORY

Credits 0:0:2

10 Experiments will be notified by the HOD from time to time.

10EC318 ASIC DESIGN LABORATORY

Credits: 0:0:2

10 Experiments will be notified by the HOD from time to time.

10EC319 HIGH SPEED VLSI DESIGN

Credits: 4:0:0

Objective

To learn in detail about Non clocked and Clocked Logic Styles, Latching Strategies and Asynchronous Clocking Techniques.

Outcome

Design of various High speed VLSI Circuits.

Unit I : Non-Clocked and Clocked Logic Styles

Static CMOS Structure – DCVS Logic – Non-Clocked Pass-Gate Families – Single Rail Domino Logic Styles – Alternating-Polarity Domino Approaches – Dual-Rail Domino Structures – Latched Domino Structures – Clocked Pass-Gate Logic.

Unit II : Circuit Design Margin and Design Variability

Process Induced Variation – Design Induced Variation – Application Induced variation – Noise.

Unit III : Latching Strategies
Basic Latch Design – Latching Single-Ended Logic – Latching Differential Logic – Race Free Latches for Precharged Logic – Asynchronous Latch Techniques.

Unit IV : Interface Techniques
Signaling Standards – Chip-to-chip Communication Networks – ESD Protection – Driver Design Techniques – Receiver Design Techniques.

Unit V : Clocking Styles
Clock Jitter and Skew – Clock Generation – Clock Distribution – Single Phase Clocking – Multi-Phase Clocking – Asynchronous Techniques.

Text Book:
1. Kerry Bernstein & et.al, "High Speed CMOS Design Styles", Kluwer Academic Publishers, 2001.

Reference Book:
1. Evan Sutherland, Bob Stroll, David Harris, "Logical Efforts, Designing Fast CMOS Circuits", Kluwer Academic Publishers, 1999.

10EC320 MIXED SIGNAL PROCESSING

Credits: 4:0:0

Objective:
To know about the various analog and mixed signal concepts and Behavioral Generic Model of Operational amplifiers.

Outcomes:
Knowledge in Analog and Mixed Signal Extensions to VHDL and VERILOG HDL
Knowledge in Behavioral Generic Model of Operational amplifiers.

Unit I : Introduction
Introduction – Modeling Basic Analog Concepts – Analog Circuit Analysis – Network Independent- Dependent Data Sampled Analog Systems, Loading Effects.

Unit II : Analog and Mixed Signal Extensions To VHDL
Introduction – Language Design Objectives – Theory of Differential Algebraic Equation – The 1076.1 Language – Tolerance Groups – Conservative Systems – Time and The Simulation Cycle – A/D And D/A Interaction – Quiescent Point – Frequency Domain Modeling and Examples.
Unit III : Analog Extensions to Verilog
Introduction – Equation Construction – Solution – Waveform Filter Functions – Simulator – Control Analysis – Multi Disciplinary Model.

Unit IV

Behavioral Generic Model of Operational amplifiers
Introduction – Description of Generic Opamp Model – Structure – Configuration – Functional Specification – Auxillary Block – Conflict Resolution – Application Examples.

Unit V : Non-Linear State Space Averaged Modeling of 3-State Digital Phase – Frequency Detector
Introduction – Model – Resetable Integrator – AC Analysis – Sample Application.

Text Book:

1. Alain Vachoux, Jean – Michael Bergi, "Analog and Mixed signal Hardware Description Language", Kluwer Academic publishers, 2007.

Reference Books:

1. Philip E. Allen, "CMOS Analog Circuit Design", Oxford University Press, New Delhi 2009.
2. Behzad Razavi, "Design of Analog CMOS Integrated Circuits", Tata McGraw Hill Edition 14th reprint 2008.

10EC321 RF SYSTEM DESIGN

Credits: 4:0:0

Objective:
To know about the RF issues, RF components and applications.

Outcomes:
Knowledge in RF Filter Design and RF Amplifier Design
Knowledge in High frequency Oscillator configuration, Mixers and Phase Locked Loops.

Unit I : RF Issues
Importance of RF Design – Electromagnetic Spectrum – RF Behavior of Passive Components – Chip Components and Circuit Board Considerations – Scattering Parameters – Smith Chart And Applications.

Unit II: RF Filter Design
Overview – Basic Resonator and Filter Configuration – Special Filter Realizations – Filter Implementations – Coupled Filter.

Unit III : Active RF Components & Applications
RF Diodes – BJT – RF FETs – High Electron Mobility Transistors – Matching and Biasing Networks – Impedance Matching Using Discrete Components – Microstripline- Matching Networks – Amplifier Classes of Operation and Biasing Networks.

Unit IV : RF Amplifier Designs
Characteristics – Amplifier Power Relations – Stability Considerations – Constant Gain Circles – Constant VSWR Circles – Low Noise Circuits – Broadband – High Power and Multistage

Amplifiers.

Unit V : Oscillators, Mixers & Applications
Basic Oscillator Model – High Frequency Oscillator Configuration – Basic Characteristics of Mixers – Phase Locked Loops – RF Directional Couplers and Hybrid Couplers – Detector and Demodulator Circuits – Microwave Integrated Circuits.

Text Book

1. Reinhold Ludwig and Powel Bretchko, RF Circuit Design – Theory and Applications, Pearson Education Asia, Mc Graw Hill Publishers 5^{th} edition 2003.

Reference Books:

1. Reinhold Ludwig and Powel Bretchko, RF Circuit Design – Theory and Applications, Pearson Education Asia, Mc Graw Hill Publishers 5^{th} edition 2003.
2. Joseph. J. Carr, Secrets of RF Circuit Design, Mc Graw Hill Publishers, Third Edition 2000.
3. Matthew M. Radmanesh, Radio Frequency & Microwave Electronics, Pearson Education Asia, Second Edition, 2002.

10EC322 GENETIC ALGORITHM FOR VLSI DESIGN

Credits: 4:0:0

Objective

To study about Implementation of VLSI Design in GA.

Outcome

Design of GA Based Design and Testing.

Unit I
Introduction, GA Technology-Steady State Algorithm-Fitness Scaling-Inversion

Unit II
GA for VLSI Design, Layout and Test automation- partitioning-Automatic Placement, Routing Technology, Mapping for FPGA- Automatic Test Generation- Partitioning Algorithm Taxonomy-Multiway Partitioning

Unit III
Hybrid genetic – Genetic Encoding-Local Improvement-WDFR-Comparison Of GAS - Standard Cell Placement-GASP Algorithm-Unified Algorithm.

Unit IV
Global routing-FPGA technology mapping-Circuit Generation-Test Generation in A GA Frame Work-Test Generation Procedures.

Unit V

Power estimation-application of GA-Standard cell placement-GA for ATG-problem encoding-fitness function-GA vs. Conventional algorithm.

Text Book:

1. Pinaki Mazumder, E.M Rudnick,"Genetic Algorithm for VLSI Design, Layout and Test Automation", Pearson Education, 2007.

Reference Books:

1. Ricardo Sal Zebulum, Macro Aurelio Pacheco, Marley Maria B.R. Vellasco, Marley Maria Bernard Vellasco "Evolution Electronics: Automatic Design of electronic Circuits and Systems Genetic Algorithms", CRC press, 1st Edition Dec 2001.
2. Melanie Mitchell, "An Introduction to Genetic Algorithms" Prentice Hall India, 2002.
3. John R.Koza, Forrest H.Bennett III, David Andre , Morgan Kufmann, "Genetic Programming Automatic programming and Automatic Circuit Synthesis", 1st Edition May 1999.

10EC323 MEMS AND MICRO SYSTEMS

Credits: 4:0:0

Objective:

To learn about the emerging field of MEMS and Microsystems and understand the concepts involved in realizing various types of Microsensors and actuators using MEMS technology.

Outcome:

Students are expected to learn physical principles involved in micro sensors and design a suitable sensor for a given application.

Unit I : Introduction to MEMS and Microsystems

Introduction to MEMS and Microsystems-Evolution of MEMS- Market survey – Applications of MEMS and various types of MEMS devices – MEMS materials and properties.

Unit II : Microelectronic Technology Applicable to MEMS

Oxidation – Diffusion- Ion-Implantation - Physical Vapor Deposition- Chemical Vapor Deposition-Lithography- Etching, Difference Between Microelectronic Fabrication And MEMS Fabrication, Wafer Bonding, Electroplating, MEMS Packaging, Micromachining.

Unit III :Bulk Micromachining and Surface Micromachining

Bulk Micromachining: Crystal Silicon Properties- Wet Etching- Isotropic And Anisotropic Etching- Issues In Wet Anisotropic Etching- Corner Undercutting Problem And Compensation Structures-Real Estate Consumption Issue - Dry Etching. Surface Micromachining: Sacrificial Layer Process, Surface Micromachining Requirements, Polysilicon Surface Micromachining, Other Compatible Materials, Silicon Dioxide, Silicon Nitride, Piezoelectric Materials, Surface Micro Machined Systems : Micro Motors, Gear Trains, Mechanisms - Introduction To LIGA.

Unit IV : Scaling and Power in Miniaturized Systems

Scaling of Length, Surface Area and Volume – Scaling and Diffusion – Scaling and Surface Tension – Scaling in Flying and Swimming- Scaling in Electrochemistry- Scaling of Minimal Analytical Sample Size- Scaling In Optics MEMS Batteries And Capacitors- Beam Energy To MEMS- Heat-Powered MEMS- Kinetic Energy Driven MEMS- Combustion Engines In MEMS.

Unit V : MEMS devices

Physical Properties Used For Sensing- Thermal Sensors, Electrical Sensors, Mechanical Sensors, Chemical And Bio-Sensors - **Case Study:** Pressure And Acceleration Sensors Based On Piezoresistive And Capacitive Sensing Techniques. Micro Actuators: Electromagnetic And Thermal Micro Actuation, Mechanical Design Of Micro Actuators, Micro Actuator Examples, Micro Valves, Micro Pumps, Micromotors - Microactuator Systems: Ink-Jet Printer Heads, Micro-Mirror , TV Projector.

Text Book

1. Marc Madou, "Fundamentals of Microfabrication: The Science of Miniaturization" CRC Press, 2002.

Reference Books

1. Stephen Beeby, Graham Ensell, Michael Kraft and Neil White, "MEMS Mechanical Sensors", Artech House Inc.,London, 2004.
2. Nadim Maluf and Kirt Williams, "An Introduction to Microelectromechanical Systems Engineering", 2nd Edition, Artech House, 2004.
2. Mohamed Gad-el-Hak, "The MEMS Handbook-MEMS Introduction and Fundamentals",2nd Edition, CRC Press, 2006.
3. Stephen D. Senturia, "Microsystem Design", Kluwer Academic Publishers, 2001.
4. M.-H. Bao, "Micromechanical Transducers: Pressure sensors, accelerometers and gyroscopes", Elsevier, New York, 2000.

10EC324 NANOELECTRONICS

Credits: 4:0:0

Objective:

To Learn About The Various Aspects Of Nanoelectronics. To Understand The Journey From Microelectronics To Nanoelectronics, Various Approaches Of Achieving Nano-Scale Devices.

Outcome:

Students Are Expected To Understand The Physics Behind Nano-Scale Devices And Various Approaches Of Realizing Nanoscale Devices.

Unit I :Introduction to Nanoelectronics

Basics Of Nanoelectronics – Capabilities Of Nanoelectronics – Physical Fundamentals of Nano-Electronics – Microelectronic Circuits – MOSFET Characteristics – Advantages And Issues With MOSFET Scaling – Microelectronics To Nanoelectronics.

Unit II : Shrink-Down Approaches

CMOS Scaling – Traditional Scaling And Equivalent Scaling – The Nanoscale MOSFET, Vertical MOSFETs –Limits To Traditional Scaling: Technological Limits; Issues In Optical, X-Ray And E- Beam Lithography, Emerging Lithographic Techniques For Nanoscale Fabrication , Device Limits ; Leakage Current, Floating Body, Parasitic Signals, Mobility, Equivalent Scaling – High-K Materials – Strained Silicon – FinFETs.

Unit III : Nanoelectronics with Tunneling Devices And Superconducting Device
Tunnel Effect And Tunneling Elements – Tunneling Diode – Resonant Tunneling Diode – Three Terminal RTD – Technology Of RTD – Digital Circuit Design Based On RTD Super Conducting Switching Devices – Cryotron – The Josephson Tunneling Device.

Unit IV : Molecular Electronics and Single Electron Transistor
Molecular Electronics Overview – Switches Based On Nanotubes, Polymer Electronics, Self-Assembling Circuits, Single Electron Devices And Their Applications – The Coulomb Blockade – Performance Of Single-Electron Transistor – SET Circuit Design – Fabrication Challenges In SET.

Unit V : Nano-Memory Architectures
Single Electron Memory for Terabit Storage – Single Island And Multiple Island Memories – FeRAM – MRAM – NOVORAM.

Text Books

1. Karl Goser, Peter Glosekotter, Jan Dienstuhl., “Nanoelectronics and Nanosystems” , Springer, 2004.
2. A.M. Ionescu and K. Banerjee (ed.), “Emerging Nanoelectronics, Life with and after CMOS”, Kluwer Academic Publishers, 2004.

Reference Books

1. Rainer Waser (ed.) , “Nanoelectronics and Information Technology : Advanced Electronic Materials and Novel Devices” ,2nd Edition, Wiley VCH Verlag Weiheim, 2005.
2. Mick Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons and Burkhard Raguse, “Nanotechnology: Basic Science and Emerging Technologies”,Overseas Press, 2005.

10EC325 ADVANCED SEMICONDUCTOR MEMORIES

Credits: 4:0:0

Objective
This subject deals with the study of recent developments in advanced semiconductor memories like (BSRAM, TSRAM, SDRAM, EDRAM, Floating gate, FRAM, MRAM, Single-electron memory)

Outcome

This subject will help in doing research in advanced memories and its designs

Unit I : Introduction to Advanced Semiconductor Memories
Semiconductor Memories Overview- Advanced Semiconductor Memories Development- Future Memory Direction- **Static Random Access Memory Technologies:** Basic SRAM Architecture And Cell Structures-SRAM Selection Considerations-High Performance Srams-Advanced SRAM Architectures-Low Voltage SRAM-Bicmos Technology SRAMS-SOI SRAMS-Specialty SRAMs.

Unit II : High-Performance Dynamic Random Access Memories
Dram Technology Evolution And Trends-DRAM Timing Specifications And Operations Extended Data-Out Drams-Enhanced DRAM(EDRAM)-Enhanced Synchronous Drams-Cache DRAM-Virtual Channel Memory (VCM)DRAM-Multilevel Storage Drams.

Unit III : Application-Specific DRAM Architectures And Designs
Video Rams (VRAM)-Synchronous Graphic RAMS (SGRAMS)-Synchronous Link DRAMS- 3-D Rams-Memory Design Considerations.

Unit IV : Advanced Non-Volatile Memory Designs And Technologies
Non-Volatile Memory Advances- Floating Gate Cell Theory-Flash Memory Architectures-Flash Memory Reliability Issues-Ferroelectric Memories- Magneto Resistive Random Access Memories-Resonant Tunneling Diode-Based Memories-Single-Electron Memories -Phase-Change Non-Volatile Memories-Miscellaneous Memory Technology Development.

Unit V : Embedded Memories Designs And Its Applications
Embedded Memory Developments- Cache Memory Designs-Embedded SRAM/DRAM Designs-DRAM Process With Embedded Logic Architectures-Embedded EEPROM And Flash Memories-Memory Cards And Multimedia Applications.

Text Book

1. Ashok K.Sharma, “Advanced Semiconductor Memories Architectures, Designs and Applications", Wiley Interscience, 2003.

Reference Books

1. Ashok K.Sharma, “Advanced Semiconductor Memories Architectures, Designs and Applications", Wiley Interscience, 2003.
2. Ashok K.Sharma, " Semiconductor Memories Technology, Testing and Reliability ", Prentice-Hall of India Private Limited, New Delhi, 1997.
3. Tegze P.Haraszti, “CMOS Memory Circuits”, Kluwer Academic publishers, 2001.
4. Betty Prince, “Emerging Memories: Technologies and Trends”, Kluwer Academic publishers, 2002.

10EC326 DESIGNING WITH PLDS AND ASICS

CREDITS: 4:0:0

Objective
To know about different types of PLDs ,various families of Xilinx and Physical design of ASICs.
Outcome
Design of Xilinx Series, Application Specific Devices and State Machines

Unit I : Hardware and Mixed Logic Convention:
Gate Hardware – mixed logic as design tools and descriptive convention – Uses of mixed logic in trouble shooting
MSI & LSI Elements Multiplexes – Decoders and demultiplexers – ROM

Unit II : Timing Diagram
Introduction – micro timing diagrams – Hazards – macro timing diagrams- timing simulations - Feedback in combinational circuits

Unit III : PLDs
Introduction – Programmable Logic – Programmable Logic –Programmable Logic Device - Simple PLDs – CPLD – FPGA – PREP Benchmarks – Future Direction of Programmable Logic

Unit IV : Designing with Field Programmable Gate Arrays
Implementing Functions in FPGAs – Implementing Functions Using Shannon's Decomposition – Carry Chains in FPGAs – Cascade Chains in FPGAs – Examples of Logic Blocks in Commercial FPGAs – Dedicated Memory in FPGAs – Dedicated Multipliers in FPGAs – Cost of Programmability – FPGAs and One –Hot State Assignment – FPGA Capacity: Maximum Gates Versus Usable Gates – Design Translation (Synthesis) – Mapping, Placement and Routing.

Unit V : State Charts and Microprogramming
State Machine Charts – Derivation of SM Charts – Realization of SM Charts – Implementation of the Dice Game – Microprogramming - Linked State Machines

Text Book:
1. James E. Palmer, David E Perlman, " Introduction to digital systems", Tata Mcgraw Hill,2004

Reference Books:
1. Kevin Skahill, "VHDL for Programmable Logic", Pearson Education, First Indian Reprint, 2004.
2. Roth John, " Principles of Digital Systems Design Using VHDL", India Edition, Second Indian Reprint, 2009.

10EC327 ASIC DESIGN

Credits: 4:0:0

Objective:
To study types of programmable ASICs ,ASIC interconnects and Physical design of ASICs.

Outcome:
Knowledge in the complete design flow of ASICs.

Unit I : Introduction to ASICS,CMOS Logic and ASIC Library Design
Types of ASICs – Economics of ASICs – ASIC Cell Libraries - Design flow – Combinational Logic Cell – Sequential logic cell – Data path logic cell – I/O Cells – Cell Compilers – Logical effort.

Unit II : Programmable ASICS, Programmable ASIC Logic Cells And Programmable ASIC I/O Cells
Anti fuse – static RAM – EPROM and EEPROM technology – PREP Benchmarks – Actel ACT – Xilinx LCA – Altera FLEX –Altera MAX – DC Output – AC Output –DC Input –AC Input – Clock Input – Power Input -Xilinx I/Oblocks

Unit III : Programmble ASIC Interconnect, Programmable ASIC Design Software and Low Level Design Entry
Actel ACT – Xilinx LCA – Xilinx EPLD – Altera MAX 5000 and 7000 – Altera MAX 9000 – Altera FLEX – Schematic entry - Low level design language – PLA tools – EDIF – CFI design representation**.**

Unit IV : Simulation and ASIC Construction
Types of simulation – Switch Level Simulation – Transistor Level Simulation – Physical Design – CAD Tools – System Partitioning – FPGA Partitioning – Partitioning Methods.

Unit V : Floorplanning, Placement and Routing
Floor Planning – Placement – Global Routing –Detailed Routing- Circuit Extraction –DRC.

Text Book:

1. M.J.S.Smith, "Application – Specific Integrated Circuits", Addison, Wesly Longman Inc., 2006.

Reference Book

1. S.D. Brown R.J. Francis, J.Rox, Z.G. Urumesic, "Field Programmable Gate Arrays", Kluwer Academic Publishers, 2007.

10EC328 DIGITAL ELECTRONICS AND MICROPROCESSORS

Credits: 4:0:0

Objectives:
To understand the concepts of digital circuits
To understand the architecture of microprocessors and methodology of programming

Outcome:
Will be able to design digital circuits and Programming in Microprocessors.

Unit I : Number Systems & Boolean Algebra
Number systems – conversions- BCD-ASCII-EBCDIC-Excess 3 codes-gray code- Logic gates- implementation of logic functions -SOP and POS- canonical forms- Boolean Algebra: Postulates & theorems of Boolean Algebra- simplification of logic functions using karnaugh map- Quine Mcclausky method.

Unit II : Combinational Logic Design
half adder, full adder- half subtractor& full subtractor- parallel adder- multiplexers & demultiplexers- implementation of logical functions using multiplexers-encoders & decoders- code converters- parity generator/checker

Unit III : Sequential Logic Design
RS, JK, D&T flip flops- truth table and excitation table of flip flops- shift register- asynchronous & synchronous counters – modulus counters

Unit IV : Microprocessor 8086
Architecture of 8086 – Addressing modes of 8086 – Instruction set - Simple programs

Unit V : Interfacing Techniques
Memory interfacing – I/O interfacing keyboard – Display – Programmable peripheral Interface 8255- Modes of Operation.

Text Books
1. Morris Mano, "Digital Logic And Computer Design", 3rd Edition, Prentice Hall Of India, 2002.
2. D.V Hall "Microprocessor and digital system" Mc graw Hill Publication company 2004.

Reference Books
1. Floyd T.L., "Digital Fundamentals ", Prentice Hall, 9th edition, 2006
2. Ramesh S Gaonkar "Microprocessor architecture, Programming and applications with 8085" Penram International, 2006

10EC329 DIGITAL ELECTRONICS AND MICROPROCESSOR LAB

Credits: 0:0:2

10 Experiments will be notified by the HOD from time to time.

10EC330 ELECTRONIC CIRCUITS

Credits: 4:0:0

Objectives:
- The students will be learn the basics of designing a power supply, amplifiers and oscillators

- They will also learn the operation and characters of FET

Outcome:

They will be able to design small circuits such as power supplies, radio circuits etc.

Unit I : Rectifiers and Filters

Diode as Rectifiers – Half wave rectifier – Full wave rectifier – ripple factors – DC and AC components in rectifiers – Capacitor and inductor filters – Analysis and design of L section and Pi section filters – Regulators: Voltage and current regulators – Short circuit and over load protection.

Unit II : Transistor Biasing and amplifiers

Transistor Biasing: Location of the Q point – Fixed bias circuit – Collector to base circuit – Self bias circuit - Frequency response – RC coupled and Transformer coupled amplifiers – Single stage –Multistage amplifiers – Power amplifiers : Class A, AB, B and class D amplifiers– Push pull amplifiers

Unit III : Feedback and tuned amplifier

Positive and Negative feedback – Current and Voltage feedback – Effect of feedback on gain – Input and Output impedance – Noise and Distortion.-Tuned amplifiers –Single tuned – Double tuned – tagger tuned.

Unit IV : JFET and MOSFET Characteristics

JFET operation - V-I characteristics, transfer characteristics, DC analysis - JFET biasing. Small signal JFET model- Constructional details - Operation of Enhancement and Depletion type MOSFETs , V-I characteristics, Transfer characteristics, analytic expression for drain current, Comparison of PMOS and NMOS devices - MOSFET biasing, MOSFET as a switch, resistor and amplifier, Introduction to CMOS devices.

Unit V : Oscillators and Multivibrators

Oscillators – Barkhausen criteria – RC Phase Shift oscillators, Hartley and Colpitt's oscillators, Frequency stability of oscillators. Crystal Oscillators, Non-sinusoidal oscillators –Bistable, Monostable and Astable Multivibrators and Schmitt Trigger using BJT.

Text Books

1. Millman J and Grabiel A, "Microelectronics", Tata McGraw-Hill Publishing Company Limited, New Delhi, 3rd Edition, 2000.
2. Boylestead L R and Nashelsky L, "Electronic Devices and Circuit Theory",Pearson Education India Series, New Delhi, 9th Edition, 2006.

Reference Books

1. Adel S Sedra and Kenneth C Smith, "Microelectronic Circuits", Oxford University Press, London, 4th Edition, 1998.
2. Thomas L. Floyd, "Electronic Devices", Pearson Education India Series, New Delhi,7th Edition, 2007.

3. David A Bell, “Electronic Devices and Circuits”, Prentice Hall of India, New Delhi,4th Edition 2000.

10EC331 ELECTRON DEVICES LAB

Credits: 0:0:2

10 Experiments will be notified by the HOD from time to time.

SCHOOL OF ELECTRICAL SCIENCES

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

ADDITIONAL SUBJECTS

Subject Code	Subject Name	Credit
10EC401	MEMS and Microsensor Technology	4:0:0
10EC402	Integrated A/D and D/A Converters	4:0:0
10EC403	VLSI Architectures for Image and Video Processing	4:0:0

10EC401 MEMS AND MICROSENSOR TECHNOLOGY

Credit: 4:0:0

Objective:
To learn about the emerging field of MEMS and Microsystems and understand the concepts and technological issues involved in realizing various types of Microsensors and actuators using MEMS technology.

Outcome:
Students are expected to learn physical principles involved in micro sensors and design a suitable sensor for a given application.

Unit-I: Introduction to MEMS and Microsystems
Introduction to MEMS and Microsystems – Evolution of MEMS – Market survey – Applications of MEMS and various types of MEMS devices.
MEMS materials and properties – Silicon as a substrate material – Crystal structure – Miller Indices – Mechanical properties of silicon – Silicon Compounds – Piezoresistive property in silicon – Piezoelectric property - Polymers

Unit-II: Microelectronic Technology-I Oxidation, Diffusion and Deposition
Clean room requirements – Wafer cleaning - Oxidation – Diffusion- Ion-implantation - Physical vapor deposition – Thermal evaporation and sputtering – Metallization –Failure mechanisms in metal interconnects - Chemical vapor deposition techniques: CVD techniques for deposition of polysilicon, silicon dioxide, silicon nitride and metal films – Comparison of CVD techniques.

Unit-III: Microelectronic Technology-II Lithography and Etching
Basic process explaining lithography – Positive and negative resist and their comparison – Light sources – Mask making process – Layout generation using software tools – Optical lithography - Issues in optical lithography – X-ray lithography – E-beam lithography. Wet chemical etching- Dry etching, plasma etching system – Etching of various materials used in MEMS fabrication.

Unit-IV: Bulk Micromachining and Surface Micromachining
Bulk micromachining: Crystal silicon properties- Wet etching- Isotropic and Anisotropic etching- Issues in wet anisotropic etching- Corner undercutting problem and compensation structures-Real estate consumption issue - Dry etching.
Surface micromachining: Sacrificial layer process, Surface micromachining requirements, Polysilicon surface micromachining, Other compatible materials, Silicon dioxide, Silicon nitride,

Piezoelectric materials, Surface micro machined Systems : Micro motors, Gear trains, Mechanisms - Introduction to LIGA.

Unit-V: MEMS Devices
Case Study: Piezoresistive Pressure Sensor, Wheatstone bridge connection – Capacitive Pressure Sensors – Piezoresistive Accelerometer – Different structures – Single beam, Two beam, Guad beam, Five beam twin mass structures – Capacitive accelerometer.

Text Book

1. Marc Madou, “Fundamentals of Microfabrication: The Science of Miniaturization” by, CRC Press, 2002.

Reference Books

1. Stephen Beeby, Graham Ensell, Michael Kraft and Neil White, “MEMS Mechanical Sensors”, Artech House Inc.,London, 2004.
2. Nadim Maluf and Kirt Williams, “An Introduction to Microelectromechanical Systems Engineering”, 2nd Edition, Artech House, 2004.
3. Mohamed Gad-el-Hak, “The MEMS Handbook-MEMS Introduction and Fundamentals”,2nd Edition, CRC Press, 2006.
4. Stephen D. Senturia, "Microsystem Design" by, Kluwer Academic Publishers, 2001.
5. M.-H. Bao, “Micromechanical Transducers: Pressure sensors, accelerometers and gyroscopes” by Elsevier, New York, 2000.

10EC402 INTEGRATED A/D AND D/A CONVERTERS

Credit 4:0:0

Objective:
To learn the various techniques& architectures of D/A & A/D Converters

Outcome:
Will be used to develop low power, low voltage, high speed A/D & D/A Converters

Unit I : Data Converter Fundamentals & Specifications of Converters
Analog Versus Discrete Time Signals-Converting Analog Signals to Digital Signals-Sample –and –Hold(S/H) Characteristics-Digital data coding-Digital coding schemes-Ideal and Non-ideal converters-DC specifications-Dynamic specifications-Figure of Merit

Unit II : High Speed A/D Converters & D/A converters
Design problems in high-speed converters- Full-flash converters-Interpolation-Averaging-Two-step flash converters-Pipeline converter architecture-Folding converter system- High speed D/A converter architecture- Voltage weighting based architecture- High speed segmented converter architecture

Unit III : High Resolution A/D & D/A converters
Introduction-Single slope A/D converter system-Dual-slope A/D converter system-Dual ramp single-slope A/D converter system-Algorithmic A/D converter-Cyclic redundant signed digit

A/D converter-Self-calibrating capacitor A/D converter- Pulse width modulation D/A converters- Integrating D/A converters- Current weighting using ladder networks- Self calibrating D/A converter system- Current calibration principle

Unit IV : Sample –and –hold amplifiers
Introduction-Basic sample –and –hold configuration-Signal bandwidth –Acquisition time-Aperture time accuracy-Sampling moment distortion calculation-Differential sample-and –hold circuit-Types of Bootstrapping system- Generalized non-inverting configurations-Inverting sample -and -hold circuit-Operational range of simple sample –and –hold amplifiers

Unit V: Sigma-delta A/D conversion & Testing of D/A and A/D converters
General form of Sigma-delta A/D converters-General filter architectures-Discussion of basic converter architectures-Multi stage sigma-delta converter (MASH)-Nth order sigma delta architecture- Sigma-delta digital voltmeter- DC testing of D/A converters - Dynamic testing of A/D converters- Testing very high-speed A/D converters

Text Book:

1. Rudy van de Plassche, *CMOS Integrated Analog-to-Digital and Digital-to-Analog Converters*, Springer International Edition, Second Edition, 2007.

Reference Book:

1. Jacob Baker. R, Harry W. Li, David E. Boyce, *CMOS Circuit Design, Layout and Simulation*, IEEE Press, Fifth Edition, 2003.

10EC403 VLSI ARCHITECTURES FOR IMAGE AND VIDEO PROCESSING

Credit: 4:0:0

Objective:
To learn about the image and video compression algorithms and their hardware implementation in VLSI.

Outcome:
Will be able to design practically feasible VLSI chips for image and video algorithms.

Unit I: Fundamentals of Image and Video:
Light and Spectra-Human Vision-Image Formation-Camera Systems- Block diagram of Digital Image Processing – Image Data Types and Image Formats - Chromaticity Diagram-Color Models in Images-Color Models in Video- Types of Video Signals – Video Standards – Coding Techniques for Images and Videos : Huffman Coding, Arithmetic Coding & Dictionary Techniques

Unit II:Spatio- Temporal Video Sampling and Two-dimensional Motion Estimation
Digital Video Concepts- Sampling Structures for Digital Video – Two- Dimensional Rectangular Sampling - Two- Dimensional Periodic Sampling - Sampling on 3-D Structures -Reconstruction

from Samples - Sampling Structure Conversion-Two-dimensional Motion Estimation-Optical Flow Methods - Block-based Methods -Pixel-based Methods -Bayesian and Mesh Based Methods .

Unit III: VLSI Architecture for DWT & JPEG 2000

VLSI Architecture for Convolution Approach- Mapping the DWT in a Semi-Systolic Architecture- JPEG 2000 Architecture for VLSI Implementation – VLSI Architecture for EBCOT- VLSI Architecture for Binary Arithmetic Coding- MQ-Coder –Decoder Architecture for JPEG 2000.

Unit IV: Motion Estimation Algorithms and Analysis of Fast Motion Estimation Algorithms.

VLSI Design Methodology for MPEG-4 , MPEG – 4 Motion Estimation , Rate/distortion – Optimized Motion Estimation, Fast Motion Estimation Algorithms- Fast Motion Estimation for MPEG -4 - Analysıs of PSNR/bit rate and Complexity.

Unit V: Design Space Motion Estimation Architectures and VLSI Implementation.

Introduction- General Design Space Evaluation - Design Space Motion Estimation Architectures - Motion Estimation Architecture for MPEG-4 —VLSI Architecture Search Engine I – Algorithm Architecture Mapping - Processor Element Array – Result Analysis – VLSI Architecture Search Engine II – Algorithm Architecture Mapping – Memory Configurations – Result Analysis.

Text Book

1. Peter Kuhn, “Algorithms, Complexity Analysis and VLSI Architectures for MPEG-4 Motion Estimation”, Kluwer Academic Publishers-1999.

Reference Books

1. Watkinson J. “The MPEG Handbook – MPEG-1, MPEG-2, MPEG-4,” Oxford, UK: Focal Press, II Edition, 2005.
2. Wang Y., Ostermann J.and.Zhang Y.Q., “Digital video processing and communications”, Prentice-Hall, 2002.
3. Richardson I.E.G.,”H.264 and MPEG-4 video compression”, Hoboken, NJ: Wiley, 2003.
4. Khalid Sayood, “Introduction to Data Compression”, Morgan Kaufmann Publishers, Third Edition, 2006.
5. Ze-Nian Li & Mark S.Drew, “Fundamentals of multimedia”, Prentice-Hall of India, 2004.
6. Tinku Acharya, Ping-Sing Tsai,”JPEG 2000 Standard for Image Compression: Concepts, Algorithms and VLSI Architectures, John Wiley Publishers, 2005.

SCHOOL OF ELECTRICAL SCIENCES

ADDITIONAL SUBJECTS

Sub Code	Name of the Subject	Credits
11EC201	SOLID STATE CIRCUITS	3:1:0
11EC202	NETWORK ANALYSIS AND SYNTHESIS	3:1:0
11EC203	SIGNALS AND SYSTEMS	3:1:0
11EC204	DIGITAL ELECTRONICS	3:1:0
11EC205	DIGITAL COMMUNICATION	4:0:0
11EC206	COMMUNICATION THEORY AND SYSTEMS	4:0:0
11EC207	C++ AND DATA STRUCTURES	3:0:0
11EC208	LINEAR INTEGRATED CIRCUITS AND APPLICATIONS	3:0:0
11EC209	C++ AND DATA STRUCTURES LABORATORY	0:0:2
11EC210	PULSE AND WAVE SHAPING CIRCUITS	4:0:0
11EC211	ANTENNAS AND WAVE PROPAGATION	3:1:0
11EC212	TRANSMISSION LINES AND WAVE GUIDES	4:0:0
11EC301	CMOS DIGITAL INTEGRATED CIRCUIT DESIGN	4:0:0
11EC302	MODERN DIGITAL COMMUNICATION TECHNIQUES	4:0:0
11EC303	SOFT COMPUTING	4:0:0
11EC304	DIGITAL IMAGE PROCESSING	4:0:0
11EC305	APPLIED ELECTRONICS LAB – I	0:0:2
11EC306	APPLIED ELECTRONICS LAB - II	0:0:2
11EC307	ANALYSIS AND DESIGN OF ANALOG INTEGRATED CIRCUITS	4:0:0
11EC308	ANALOG VLSI DESIGN	4:0:0
11EC309	CMOS VLSI DESIGN	4:0:0
11EC310	LOW POWER VLSI DESIGN	4:0:0
11EC311	OPTICAL FIBER COMMUNICATION	4:0:0
11EC312	MULTIMEDIA COMPRESSION TECHNIQUES	4:0:0
11EC313	MICROWAVE INTEGRATED CIRCUITS	4:0:0
11EC314	COMMUNICATION LAB-1	0:0:2
11EC315	COMMUNICATION LAB-II	0:0:2
11EC316	ADVANCED SEMICONDUCTOR MEMORIES	4:0:0
11EC317	HIGH SPEED SEMICONDUCTOR DEVICES	4:0:0
11EC318	NANO CMOS DEVICE ARCHITECTURE	4:0:0

11EC319	EMBEDDED SYSTEM DESIGN	4:0:0
11EC320	MEMS AND NANO TECHNOLOGY	4:0:0
11EC321	INTEGRATED A/D AND D/A CONVERTERS	4:0:0
11EC322	VLSI ARCHITECTURES FOR IMAGE AND VIDEO PROCESSING	4:0:0

11EC201 SOLID STATE CIRCUITS

Credits: 3:1:0
OBJECTIVE
To understand the basic concepts of electronic circuits
OUTCOME
Students will be able to design electronic circuits for various applications

UNIT I
Regulated Power Supplies
Diode as Rectifiers – Half wave rectifier – Full wave rectifier – Ripple factors – DC and AC components in rectifiers – Capacitor and inductor filters – Analysis and design of L section and π section filter– Regulators-series and shunt type- problems. Voltage and Current regulators – Short circuit and over load protection.

UNIT II
Transistor and FET Biasing
Transistor Biasing: Location of the Q point – Fixed bias circuit – Collector to base circuit – Self bias circuit – Graphical DC bias analysis – Design of DC bias circuit- problems . FET biasing - Self biasing – Voltage feedback biasing- Problems

UNIT III
Amplifiers
Frequency response – Single stage Amplifier- Multistage amplifiers - RC coupled and Transformer coupled amplifiers Power amplifiers: Class A, AB, B and D amplifiers – Distortion – Push pull amplifiers – Complementary symmetry amplifier. Problems Wideband amplifiers – Video amplifiers – Peaking circuits

UNIT IV
Feedback Amplifiers & DC Amplifiers
Positive and Negative feedback – Current and Voltage feedback – Effect of feedback on gain – Input and Output impedance – Noise and Distortion. DC amplifiers: Drift in amplifiers – Differential amplifiers.

UNIT V
Oscillators And Tuned Amplifiers
Barkhausen criterion – RC and LC Oscillators – Crystal oscillators – Tuned amplifiers – Single tuned – Double tuned – Stagger tuned.

TEXT BOOKS

1. Millman .J. & Halkias.C , "Electronic Devices And Circuits", Tata McGraw Hill, 2007.
2. Mathur S.P,m Kulshrestha D.C., Chanda P.R., “Electronic Devices Applications and Integrated Circuits, Umesh Publications, 2004.

REFERENCE BOOKS

1. Malvino A.P., “Electronic Principles”, McGraw Hill International, 2005.
2. Boylestred R and Nashelsky, “Electronic Devices and Circuits Theory”, PHI, 2005.

11EC202 NETWORK ANALYSIS AND SYNTHESIS

Credits 3:1:0

OBJECTIVES

To make the students capable of analyzing any given electrical network
To make the students learn how to synthesize an electrical network from a given impedance/admittance function

OUTCOMES

Students will be able to analyze the various electrical and electronic networks using the techniques they learn
Students will be able to construct a circuit to suit the need

UNIT I
S-Domain Analysis

Network functions for the one port and two port networks – Driving point and transfer functions – Properties of driving point and transfer functions - Poles and zeros of Network Functions – Significance of poles and zeros -Time domain response from pole zero plots.

UNIT II
Frequency Domain Analysis

Amplitude and phase response from pole zero plots – Stability criterion for active networks – Routh Criteria - Magnitude and phase plots for RL and RC networks – Complex loci for RL, RC and RLC networks - Plots based on S- Plane Phasors.

UNIT III
Network Topology

Network graph, Tree, Incidence matrix - Fundamental cutsets and fundamental loops – Tie set and cut set schedules – V shift and I shift – Formulation of equilibrium equation on loop basis and node basis, Formulation of equilibrium equation in matrix form – Duality, Construction of dual of a network.

UNIT IV
Two Port Networks & Filters

Characterization of two port networks in terms of Z, Y, h, g, T and inverse T parameters – Relations between the network parameters - Network equivalents – Analysis of T, π , ladder and lattice networks - Transfer function of terminated two port networks.
Filters- Design of constant K, m derived and composite filters

UNIT V
Elements of Network Synthesis
Realisability of one port network – Hurwitz polynomials and properties – Positive real functions and its properties – Synthesis of RL, RC and LC one port networks.

TEXT BOOKS

1. W.H Hayt, JE Kemmerly, SM Durbin, "Engineering Circuit Analysis", Tata McGraw Hill Publishing Company Limited, ND, 6th Edition, 2006.
2. Sudhakar A. Shyammohan, "Circuits and Networks Analysis and Synthesis" Tata Mc Graw Hill Publishing company limited, New Delhi, 3rd edition, 2007.

REFERENCE BOOKS

1. Umesh Sinha, "Network Analysis And Synthesis,"Sathya Prakasan Publishers Limited, New Delhi, Fifth edition, 1992.
2. Allan H. Robbins, Wilheln C Miller, "Circuit Analysis, Principles of Applications" First Indian reprint 2008.
3. Paranjothi S.R., "Electric Circuit Analysis", New age International Publishers Limited, New Delhi, 2nd edition 2000.

11EC203 SIGNALS AND SYSTEMS

Credit: 3:1:0

OBJECTIVE
To get an in-depth knowledge about signals, systems and the analysis of the same using various transforms

OUTCOME
Students will be able to apply the knowledge obtained to prepare for future developments in the chosen fields

UNIT I
Introduction
Continuous Time (CT) signals – CT signal operations – Discrete Time(DT) signals – Representation of DT signals by impulses – DT signal operations – CT and DT systems – Properties of the systems – Linear Time Invariant(LTI) and Linear Shift Invariant(LSI) Systems

UNIT II
LTI Systems
Continuous and Discrete Convolutions –CT system representations by Differential equations – DT System representations by difference equations.Z transforms– System function algebra and Block Diagram representations –The unilateral Z-transform

UNIT III
Fourier Analysis of CT Signals and Systems

Fourier series representation of periodic signals – Properties – Harmonic analysis of LTI systems – Convergence of Fourier series – Representation of A Periodic signals by Continuous Time Fourier Transform (CTFT) – Properties – Frequency response of systems characterized by Differential Equations – Power and Energy Spectral Density–Parseval's Relation.

UNIT IV
Sampling and Laplace Transform
Representation of CT signals by samples – Sampling Theorem – Sampling Methods – Impulse, Zero – order hold method – Reconstruction of CT signal from its samples – Effect of under sampling – Aliasing Error – Discrete Time processing of CT signals. Analysis and characterization of LTI system using the Laplace Transform, System function algebra and Block Diagram representation – Unilateral Laplace Transform

UNIT V
Fourier Analysis of DT Signals and Systems
Discrete Time Fourier series representation of DT periodic signals – Properties – Representation of DT Aperiodic signals by Discrete Time Fourier Transform(DTFT) – Properties – Frequency response of systems characterized by Difference Equations – Power and Energy Spectral Density concepts related to DT signals – Parseval's Relation.

TEXT BOOKS

1. Alan V Oppenheim, Alan S Wilsky and Hamid Nawab S, "Signals & Systems", II Edition, PHI, New Delhi, Reprint 2009.
2. Simon Haykin and Barry Van Veen, "Signals & Systems", Second Edition, John Wiley and Sons Inc., 2005

REFERENCE BOOKS

1. Samir S Solimon and Srinath M.D., "Continuous and Discrete Signals and Systems", II-Edition, PHI, 2003.
2. Rodger E Zaimer and William H Tranter, "Signals & Systems – Continuous and Discrete", McMillan Publishing Company, Fourth edition, III Reprint, 2002.

11EC204 DIGITAL ELECTRONICS

Credits: 3:1:0

OBJECTIVES
To learn about number systems, binary codes basic postulates of Boolean algebra, methods for simplifying Boolean expressions, the formal procedures for the analysis and design of combinational circuits and sequential circuits and the concept of programmable logic devices and logic families.

OUTCOMES
The student will be able to do number conversions and various simplification techniques.

They will be able to design various combinational and sequential circuits and combinational circuit using PLDs

UNIT I

Number Systems & Boolean Algebra

Review of Binary, Octal, & Hexadecimal Number Systems-Representation of Signed Numbers - Floating point number representation-BCD-ASCII-EBCDIC-Excess 3 codes-Gray code-error detecting & correcting codes. Boolean Algebra:Postulates & Theorems of Boolean Algebra – Canonical Forms –Simplification of Logic Functions using Karnaugh map - Quine Mcclusky method.

UNIT II

Combinational Logic Design

Logic gates –Implementation of Combinational Logic Functions – Encoders & Decoders – Multiplexers & Demultiplexers –Code Converters – Comparator - Half Adder and Full Adder – Parallel Adder/Binary Adder – Parity Generator/Checker – Implementation of Logical Functions using Multiplexers.

UNIT III

Flip flops & Synchronous Sequential Logic Design

Level triggering clock and edge triggering clock-RS, JK, D&T flip flops – JK Master–slave flip flop –Excitation tables – Basic models of sequential machines – Concept of State Table – State diagram – State Reduction through Partitioning - Implementation of Synchronous Sequential Circuits- Sequence Detector –Sequence Generator.

UNIT IV

Counters &Registers

Asynchronous Counters- Modulus Counters - Timing Waveforms-Counter Applications.- Synchronous Counters–Synchronous Modulus Counters-Shift Register –Johnson Counter- Ring Counter

UNIT V

Digital Logic Families

Basic structure of PLDS: PAL-PLA-PROM

Implementation of simple combinational circuits using PLDS

LOGIC FAMILIES: TTL families, Schottky Clamped TTL- Emitter Coupled (ECL)- MOS inverter- CMOS Logic Gates -Comparison of performance of various logic families.

TEXT BOOKS

1. Morris Mano,"Digital logic and computer Design", 3rd edition Prentice Hall Of India, 2002.
2. V.K. Puri, "Digital Electronics: Circuits and Systems", Tata Mc Graw Hill, First Edition, 2006.

REFERENCE BOOKS

1. Jain R.P, "Modern Digital Electronics", Third edition, Tata Mcgraw Hill,2003
2. Floyd T.L., "Digital Fundamentals ", Prentice Hall, 9th edition, 2006

3. Alan B Marcovitz, "Introduction to Logic and Computer Design", Tata McGrawHill, 2003.

11EC205 DIGITAL COMMUNICATION

Credit:4:0:0

OBJECTIVE
To learn the fundamental digital modulation techniques and coding schemes for communication

OUTCOME
Knowledge gained will help the student to design an efficient communication system

UNIT I
Fundamental limits on digital communication
Sources and Signals- Model of Digital Communication System-Basic Signal Processing Operations in Digital Communications-Channels for Digital Communication- Uncertainty-Information- Entropy- Source Coding Theorem- Huffman Coding- Discrete Memoryless Channel- Mutual Information-Channel Capacity Theorem–Channel Coding Theorem-Differential Entropy and Mutual Information for Continuous Ensembles.

UNIT II
Detection and Estimation techniques
Gram-Schmidt Orthogonalization Procedure-Geometric Interpretation of Signals-Response of Bank of Correlators to Noisy Input- Detection of Known Signals in Noise-Maximum Likelihood Detector- Probability of Error- Correlation Receiver- Matched Filter Receiver –Detection of Signals with Unknown Phase in Noise.

UNIT III
Digital Modulation Schemes
Sampling –Impulse Sampling-Natural Sampling-Quantization-Uniform Quantization-Non Uniform Quantization-Midtread, Midriser, Biased Quantization-PCM-ADPCM-DM-ADM - Binary Phase Shift Keying - Differential PSK – Differentially Encoded PSK - QPSK– M-ary PSK – Quadrature Amplitude Shift Keying - Binary Frequency Shift Keying – M-ary FSK – Minimum Shift Keying –Duo Binary Encoding.

UNIT IV
Error control coding
Rationale for Coding- Types of Coding-Linear Block Codes-Syndrome Decoding-Minimum Distance Considerations- Cyclic Codes-Generator Polynomial-Parity Check Polynomial-Encoder Design -Convolution Codes –Maximum Likelihood Decoding of Convolutional Codes-Sequential Decoding of Convolutional Codes.

UNIT V
Spread Spectrum Systems
Pseudo Noise –Sequence Generation and Correlation Properties - Direct Sequence Spread Spectrum- Rake Receiver- Frequency Hopping Systems–Fast Hopping-Slow Hopping Techniques- Continuous Phase Modulation- Space Time Communication - Space Time Channel

Modeling-Information Theoretic Limits -Spatial Multiplexing-Space Time Coding-Transit Beam Forming.

TEXT BOOKS

1. Taub and Schilling “Principles of Communication Systems”, Mc Graw Hill, 2nd Edition, 25th Reprint, 2003
2. Simon Haykins, “Digital Communications”, John Wiley, 1st edition, Reprinted, 2004.

REFERENCE BOOKS

1. Upamanyu Madhow, “Fundamentals of Digital Communication”,Cambridge University Press,1st South Asian edition,2009.
2. Amitabha Battacharya, “Digital Communication”, Mc Graw Hill, Fourth reprint 2008.

11EC206 COMMUNICATION THEORY AND SYSTEMS

Credits: 4:0:0

OBJECTIVE
To impart the basic concepts of communication systems, transmitter and receiver, analog modulation, demodulation techniques and the effect of noise on signals

OUTCOME
This will enable the student to select the efficient technique to design a communication system

UNIT I
Base Band Signals and Amplitude modulation
Introduction, Definition of communication - Allocation of frequency for various services-Communication system block diagram – Need for wireless communication – Need for modulation – Amplitude Modulation: Introduction – Theory of Amplitude Modulation – AM power calculations – AM with a complex wave – Need for suppression of carriers – Suppressed carrier systems (DSB, SC, SSB & VSB systems). Generation of AM signal – low level and high level modulation – Square law diode modulation – AM in amplifier circuits – Suppressed carrier AM generation (Balanced Modulator, Ring Modulator, Product Modulator)

UNIT II
Analog Modulation & Demodulation Techniques
AM Demodulation: Square law detector, envelope (or) diode detector – distortion in
Diode detectors – synchronous demodulation - Angle Modulation: Theory of Frequency modulation, Mathematical analysis of FM and representation of FM – Spectra of FM signals – Narrow band FM and wide band FM - Comparison of AM & FM.
Frequency Modulation: Generation - FM signal by Direct method (Varactor diode modulator) – Indirect generation of FM (Armstrong method, RC phase shift method) -FM Demodulation: Direct methods frequency demodulation (Travis detector, Balanced slope detector, Foster Seeley discriminator, Ratio detector, Limiters) Indirect methods (Detection using PLL, Zero crossing detector)

UNIT III
AM Transmitters and Receivers
AM Transmitter and Receiver: AM transmitters block schematic- high level and low level transmitters-SSB transmitters- ISB transmitters - Tuned radio frequency receivers – Super heterodyne receiver- Basic elements of AM super heterodyne receiver: - Image frequency rejection – frequency conversion – IF amplifier –Tracking and alignment – Merits and demerits of different receivers - Characteristics of Receivers.

UNIT IV
FM Transmitters and Receivers
FM Transmitter and Receivers: Block diagram of FM transmitter and methods of frequency stabilization – Armstrong FM transmitter system – Pre-emphasis. Block diagram of FM receiver – De-emphasis - Noise and Interference-Thermal and Shot noise-Signal to Noise ratio - Noise figure – Noise temperature - Noise in AM and FM – SSB SC - calculation of output signal to noise ratio - DSBS Calculation of output signal to noise ratio Figure of merit

UNIT V
Multi Access Communication
Digital Communication Techniques- ASK-FSK-PSK. Theory of PM-PDM-PPM-PM obtained from FM-FM obtained from PM- Multiplexing- demultiplexing -SDMA-FDMA-TDMA-CDMA.

TEXT BOOKS

1. Anokh Singh, "Principles of Communication Engineering" S.Chand Co., 2001
2. Roody , Coolen, "Electronic Communication", PHI, 4th Edition, 2003

REFERENCE BOOKS

1. Taub and Schilling, "Principles of Communication Systems", Mc Graw Hill, 2nd Edition, 25th Reprint, 2003
2. G.Kennedy, "Electronic Communication Systems", Mc Graw Hill, 4th Edition, 8th Reprint, 2003

11EC207 C++ AND DATA STRUCTURES

Credits: 3:0:0

OBJECTIVES
To learn the C++ programming language fundamentals: its syntax, properties and styles
To learn object oriented programming concepts
To learn the data structures in c++

OUTCOME
The students will be trained to write their own programs using object oriented programming and data structures.

UNIT I

Objects and Classes

A Simple Class C++ Objects as Physical Objects - C++ Objects as Data Types - Object as function argument Constructors - Copy Constructors, Returning Objects from functions - Structures and Classes - Arrays and Strings.

UNIT II

Operator Overloading

Overloading Unary and Binary Operator - Data Type Conversion and its Pitfalls, Inheritance: Derived Class and Base Class - Derived Class Constructors, Overloading Member Functions-Class Hierarchies - Public and Private Inheritance - Levels of Inheritance - Multiple Inheritance. Pointers: Address and Pointers - Pointers and Arrays - New and Delete Operator - Pointer to Pointer.

UNIT III

Virtual Functions

Virtual Functions- and Polymorphism - Friend Functions Static Functions - this Pointer - Streams and Files: Stream Classes - Stream Errors - Disk File I/O with Streams - File Pointers. Templates and Exception: Function Templates - Class Templates - Exceptions.

UNIT IV

Linked list

Linked List Introduction-Implementation of Linked Lists Using Arrays-Linear Linked List-Basic Operations on linear linked List-Searching-Reversing-Concatenating-Disposing on linear linked Lists- Doubly linked List- Basic Operations on Doubly Linked List- Circular Linked List- Basic Operations on Circular Linked List.

UNIT V

Sorting and Searching Techniques

Sorting - Bubble Sort, Insertion Sort, Selection Sort, Quick Sort, Heap Sort, Merge Sort. Searching- Linear Search, Binary Search.

TEXT BOOKS

1. Robert Lafore, "Object Oriented Programming in C++", Third Edition, Galgotia Publishers, Pune, Reprint, 2006.
2. Abhishek Daya Sagar,"Expert Data Structures using C/C++", BPB Publications, New Delhi 2004.

REFERENCE BOOKS

1. Herbert Schmidt, " C++, The Complete Reference" , Mc Graw-Hill Publishing Company Limited, New Delhi, 3rd Edition, 2002
2. Owen L. Astrachan, "Programming with C++ - A Computer Science Tapestry", Special Indian edition 2007, Tata McGraw-Hill, Second reprint, 2008.

11EC208 LINEAR INTEGRATED CIRCUITS AND APPLICATIONS

Credits: 3:0:0

OBJECTIVE
To get knowledge about IC fabrication and applications

OUTCOME
Students will be able to design circuits using ICs

UNIT I
Integrated Circuit Technology
Fabrication of Bipolar Junction Transistor, FET's – CMOS Technology – Monolithic diodes – Metal –Semiconductor contact – Integrated Circuit Resistors – Integrated Circuit Capacitors – Integrated Circuit Packaging – Characteristics of Integrated Circuit Components.

UNIT II
OP-AMP Applications
Rectifiers- Clipper- Clamper- Peak detector- Differentiator and Integrator – Sample & Hold circuit-Log and antilog amplifiers - Multiplier and divider - Instrumentation amplifier, Comparators - Regenerative Comparators - Input output characteristics.

UNIT III
Signal Generators & Voltage Regulator
Astable multivibrator -Monostable multivibrator - Triangular wave generators – RC phase shift oscillator -Wein's bridge oscillator. Series op amp regulator - IC voltage regulator -723 general purpose regulator - Switching Regulator.

UNIT IV
Active Filters, Timers And Multipliers
Low pass - High pass - Band pass and Band Reject filters – Butterworth - Chebychev filters – first and second order filters-Switched capacitor filters.555 Timer functional diagram, Monostable and Astable operation - multiplier -applications.

UNIT V
PLL, ADC And DAC
PLL- basic block diagram and operation - capture range and lock range simple applications of PLL - AM detection - FM detection and FSK demodulation. Weighted resistor DAC, R-2R and inverted R- 2R DAC, monolithic DAC - Flash ADC - counter type ADC - successive approximation ADC – dual slope ADC - conversion times of typical ADC.

TEXT BOOKS

1. Roy Choudhury.D., Shail Jain, "Linear Integrated Circuits", New Age International Publications, Third Edition, 2007.
2. Gayakwad.A.R., "Op-Amps & Linear IC's", PHI, fourth edition,2004

REFERENCE BOOKS

1. Robert F. Coughlin, Frederick F. Driscoll, "Operational Amplifiers & Linear Integrated Circuits", PHI 6th Edition 2001.
2. Franco,"Design With Operational Amplifier and Analog Integrated Circuits", TMH, 2002.

11EC209 C++ AND DATA STRUCTURES LABORATORY

Credit: 0:0:2

OBJECTIVE
To learn object oriented programming and data structure programming

OUTCOMES
The students will be able to write the algorithm and flowchart for any object oriented programs
The students will be able to design any object oriented program using data structures

1. Classes and objects
2. Constructors and destructors
3. Operator overloading
4. Data type conversion
5. Inheritance
6. Pointers
7. Virtual functions and polymorphism
8. Friend functions
9. Files
10. Linked list
11. Sorting techniques
12. Searching techniques

11EC210 PULSE AND WAVE SHAPING CIRCUITS

Credits: 4:0:0

OBJECTIVE
To understand the concepts of wave shaping and to design various circuits for any application

OUTCOMES
Will be able design linear and non-linear wave shaping circuits
To apply the fundamental concepts of wave shaping for various switching and signal generating circuits

UNIT I
Linear Wave Shaping Circuits
High pass and low pass RC circuits – response for step, pulse, square wave, ramp and exponential signals as input – High pass circuit as a differentiator – low pass circuit as an integrator – attenuators. Non Linear Wave Shaping Circuits: Diode and transistor - clippers – Clamping Circuits – clamping theorem – practical clamping circuits.

UNIT II

Bistable And Schmitt Trigger Circuits
Fixed and self bias bistable circuits – Loading – Commutating capacitors – Triggering methods – Design of bistable circuits – Schmitt Trigger circuit, critical voltages, Design example – Applications: Comparator, Sine wave to square wave converter.

UNIT III
Monostable And Astable Circuits
Collector and emitter coupled monostable circuits – Waveforms – equation for delay – collector coupled, emitter coupled astable circuits – VCO – Design examples for monostable and astable circuits.

UNIT IV
Voltage And Current Time Base Generators
General feature of a time base signal – exponential sweep circuit – A transistor constant current sweep – Miller and Bootstrap time base generators – General considerations – Current time base generator: A simple current sweep – A transistor current time base generator – Transistor Television sweep circuit.

UNIT V
Blocking Oscillator Circuits And Sampling Gates
Blocking oscillators – Triggering Transistor blocking oscillators – Base and emitter timings – Triggering circuits – Astable blocking oscillators – Sampling gates: Unidirectional and bidirectional sampling gates using Diodes and Transistors.

TEXT BOOKS
1. Millman & Taub “Pulse Digital and Switching Waveforms”, McGraw Hill, Second Edition 2007.
2. Suryaprakash Rao Mothiki, “Pulse and Digital Circuits”, MC Graw Hill, 2nd Reprint 2009.

REFERENCE BOOKS
1. Ronald Tocci, “Fundamentals of Pulse and Digital Circuits”, Merrill Publishing Company, Third Edition, 1997.
2. David A Bell, “Solid State Pulse Circuits”, Prentice Hall Inc, Fourth Edition, 2005.

11EC211 ANTENNAS AND WAVE PROPAGATION

Credits 3:1:0

OBJECTIVE
To understand the applications of the electromagnetic waves in free space

OUTCOME
The students will be able to apply the fundamentals to design different types of auntennas

UNIT I
Radiation Fields of Wire Antennas
Concept of Vector Potential-Modification of time varying retarded case. Fields associated with Hertizian dipole-Radiation power, Resistance and Gain of current element- Radiation resistance of elementary dipole with linear current distribution- Radiation from half wave dipole and

quarter wave monopole-Assumed current distribution for wire antennas-Use of Capacitance hat and loading coil for short antennas

UNIT II
Antenna Fundamentals and Antenna Arrays
Definitions: Radiation Intensity-Directive Gain-Directivity-Power gain-Beam width-Band width. Radiation resistance - Gain of half wave dipole - Folded dipole-Reciprocity principle-Effective length and effective area - Relation between gain effective length and radiation resistance
Loop Antennas: Radiation from small loop and its radiation resistance- Radiation from loop with circumference equal to wavelength and resultant circular polarization on axis
Helical Antennas: Normal and axial mode of operation
Antenna Arrays: Expression for electric field from two or three element arrays-Uniform linear array-Method of Pattern multiplication-Binomial array-Image method

UNIT III
Travelling Wave Antennas
Radiation from a Traveling wave on a wire
Rhombic Antenna: Analysis and design
Coupled Antennas: Self and mutual impedence-2 and 3 element Yagi antennas-Log periodic antennas-feeding and transposing of lines- effects of decreasing α.

UNIT IV
Aperture and Lens Antennas
Radiation from Huygen's source- Radiation from the open end of a coaxial line- Radiation from a rectangular aperture treated as an array of Huygen's source-Equivalence of fields of Slot and complementary dipole- Relation between dipole and slot impedances. Feeding of slot antennas-Thin slot in an infinite cylinder-Field on E plane horn-Radiation from circular aperture-Beam width and effective area Reflector antennas-Lens antennas-Spherical waves and Biconical antennas

UNIT V
Propagation
Sky wave propagation: Structure of Ionosphere-Effective dielectric constant of ionized region-Refraction-Refractive index-Critical frequency-Skip distance-Effect of earth's magnetic field-collisions-Max usable frequency-Fading-diversity reception
Space wave propagation: Reflection of polarized waves-Reflection characteristics of earth-Resultant of direct and reflected wave at the receiver-Duct propagation
Ground wave propagation: Attenuation characteristics-Calculation of field strength

TEXT BOOKS

1. John D Kraus and Ronalatory Marhefka "Antennas" Tata Mc Graw Hill 2002
2. Jordan and Balmain, "Electromagnetic waves and radiating systems", PHI, 1968, Reprint 2003

REFERENCE BOOKS

1. R.E. Collins "Antennas and Radio wave propagation" Mc Graw Hill 1987
2. Balanis, C.S "Antenna Theory Analysis and Design" John Wiley & Sons, II Edition 2003.

11EC212 TRANSMISSION LINES AND WAVEGUIDES

Credits 4:0:0

OBJECTIVES

To study the fundamental concepts of transmission lines at higher frequencies and also exposé the learner to waveguides their types and modes of transmissions

OUTCOME

At the end of the course, the students would be aware of the different parameters and constraints in high frequency transmission of information.

UNIT I

Transmission Line Theory

Different types of transmission lines – Characteristic impedance – The transmission line as a cascade of T-Sections - Propagation Constant - General Solution of the transmission line – The two standard forms for voltage and current of a line terminated by an impedance – physical significance of the equation and the infinite line – The two standard forms for the input impedance of a transmission line terminated by an impedance – reflection coefficient – wavelength and velocity of propagation. Waveform distortion – distortion less transmission line – The telephone cable – Inductance loading of telephone cables - Input impedance of lossless lines – Reflection on a line not terminated by characteristic impedance - Transfer impedance – reflection factor and reflection loss – T and Π Section equivalent to lines.

UNIT II

The Line at Radio Frequencies

Standing waves and standing wave ratio on a line – One eighth wave line – The Quarter wave line and impedance matching – the Half wave line. The circle diagram for the dissipationless line – The Smith Chart – Application of the Smith Chart – Conversion from impedance to reflection coefficient and vice-versa - Impedance to Admittance conversion and viceversa – Input impedance of a lossless line terminated by an impedance – Single stub matching and double stub matching.

UNIT III

GuidedWaves

Waves between parallel planes of perfect conductors – Transverse electric and transverse magnetic waves – characteristics of TE and TM Waves – Transverse Electromagnetic waves – Velocities of propagation – component uniform plane waves between parallel planes – Attenuation of TE and TM waves in parallel plane guides – Wave impedances.

UNIT IV

Rectangular Waveguides

Transverse Magnetic Waves in Rectangular Wave guides – Transverse Electric Waves in Rectangular Waveguides – Characteristics of TE and TM Waves – Cutoff wavelength and Phase velocity – Impossibility of TEM waves in waveguides – Dominant mode in rectangular waveguide – Attenuation of TE and TM modes in rectangular waveguides – Wave impedances – Characteristic impedance – Excitation of modes.

UNIT V

CircularWave Guides and Resonators

Bessel functions – Solution of field equations in cylindrical co-ordinates – TM and TE waves in circular guides – wave impedances and characteristic impedance – Dominant mode in circular waveguide – excitation of modes – Microwave cavities, Rectangular cavity resonators, circular cavity resonator, semicircular cavity resonator - Q factor of a cavity resonator for TE101 mode.

TEXT BOOKS

1. J.D.Ryder, "Networks, Lines and Fields", PHI, New Delhi, 2003. (Unit I & II)
2. E.C. Jordan and K.G.Balmain "Electro Magnetic Waves and Radiating System, PHI, New Delhi, 2003. (Unit III, IV & V)

REFERENCE BOOKS

1. Ramo, Whineery and Van Duzer "Fields and Waves in Communication Electronics" John Wiley, 2003.
2. David M.Pozar "Microwave Engineering", 2nd Edition, John Wiley.
3. David K.Cheng, "Field and Waves in Electromagnetism", Pearson Education, 1989.

11EC301 CMOS DIGITAL INTEGRATED CIRCUIT DESIGN

CREDITS: 4:0:0

OBJECTIVE

To study the basic concepts of MOS transistors, circuit characterization and performance estimation, CMOS circuit and logic design, Systems design and design methods and CMOS sub system design

OUTCOME

Good understanding of CMOS VLSI design concepts. Ultimately, it is hoped that the course would help to arouse student's interest in the area of VLSI design.

UNIT I

Introduction to CMOS circuits

MOS Transistors, MOS Transistor Switches -CMOS Logic - Circuit and System Representations - MOS Transistor Theory - MOS Device Design Equations - Complementary CMOS Inverter - DC Characteristics - Static Load MOS Inverters - Differential Inverter- Transmission Gate - Tri State Inverter - Bipolar Devices.

UNIT II

Circuit characterization and performance estimation

Introduction, Estimation of Resistance - Capacitance and Inductance, Switching - Characteristics –MOS Gate Transistor Sizing - Power Dissipation - Routing Conductors - Charge Sharing - Design Margining – Reliability - Scaling of MOS transistor dimensions.

UNIT III

CMOS circuit and logic design

CMOS Logic Gate Design - Basic Physical Design of Simple Gate - CMOS Logic Structures - Clocking Strategies, I/O Structures - Low Power Design.

UNIT IV

Systems design and design method

Design Strategies - CMOS Chip Design Options - Design Methods - Design Capture Tools- Design Verification Tools- Design Economics- Data Sheets- CMOS Testing - Manufacturing Test Principles- Design Strategies for Test- Chip Level Test Techniques- System Level Test Techniques- Layout Design for Improved Testability.

UNIT V

CMOS sub system design

Data Path Operations-Addition/Subtraction- Parity Generators- Comparators- Zero/One Detectors- Binary Counters- ALUs- Multiplication- Shifters- Memory Elements- Control-FSM-Control Logic Implementation.

TEXTS BOOK

1. N. Weste and K. Eshranghian "Principles of CMOS VLSI Design: A Systems Perspective", Pearson Education India- 2008.

REFERENCE BOOKS

1. Jacob Backer, Harry W.Li and David E.Boyce, "CMOS Circuit Design- Layout and Simulation", John Wiley & Sons, 2008.
2. S. M. Kang, Y. Lablebici, "CMOS Digital Integrated Circuits Analysis & Design", McGraw Hill, 2003.

11EC302 MODERN DIGITAL COMMUNICATION TECHNIQUES

CREDITS: 4:0:0

OBJECTIVE

To understand the various digital communication concepts like coherent and non-coherent- band limited channels- block coded and convolution code and spread spectrum signals.

OUTCOME

Understanding of various digital communication techniques. Ultimately it is hoped that the course would help to arouse student's interest in the area of digital communication.

UNIT I

Coherent and Non-Coherent Communication

Coherent receivers – Optimum receivers in WGN – IQ modulation & demodulation – Noncoherent receivers in random phase channels; M-FSK receivers – Rayleigh and Rician channels – Partially coherent receivers – DPSK; M-PSK; M-DPSK--BER Performance Analysis.

UNIT II

Bandlimited Channels and Digital Modulations

Eye pattern; demodulation in the presence of ISI and AWGN; Equalization techniques – IQ modulations; QPSK; QAM; QBOM; -BER Performance Analysis. – Continuous phase modulation; CPFM, CPFSK, MSK-OFDM. Matched filter

UNIT III

Block Coded Digital Communication

Architecture and performance – Binary block codes; Orthogonal; Biorthogonal; Transorthogonal – Shannon's channel coding theorem; Channel capacity theorem - Coded BPSK and DPSK demodulators – Linear block codes; Hamming- Cyclic codes- Golay codes- Cyclic BCH - Reed – Solomon codes.

UNIT IV

Convolutional Coded Digital Communication

Representation of codes using Polynomial- State diagram- Tree diagram- and Trellis diagram – Decoding techniques Maximum likelihood- Viterbi algorithm- Sequential decoding; Turbo Coding-BCJR algorithm.

UNIT V

Spread Spectrum Signals for Digital Communication

Model of spread Spectrum Digital Communication System-Direct Sequence Spread Spectrum Signals- Error rate performance of the coder- Generation of PN Sequences and its properties -Frequency Hopped Spread Spectrum Signals- Performance of FH Spread Spectrum Signals in an AWGN Channel- Synchronization of Spread Spectrum Systems.

TEXT BOOKS

1. M.K.Simon, S.M.Hinedi and W.C.Lindsey, "Digital communication techniques; Signaling and detection; Prentice Hall India, New Delhi, 1995.
2. Bernad Sklar, "Digital Communication – Fundamentals and Applications", Pearson Education, India, 2001.

REFERENCE BOOKS

1. Simon Haykin, "Digital communications", John Wiley and sons, 1998
2. B.P.Lathi, "Modern digital and analog communication systems", 3rd Edition, Oxford University press, 1998.
3. John G. Proakis, "Digital Communications" 4th Edition, McGraw-Hill, New York, 2003

11EC303 SOFT COMPUTING

CREDITS: 4:0:0

OBJECTIVE

To learn Artificial neural networks- Fuzzy sytems- Neuro Fuzzy modeling and Genetic Algorithm

OUTCOME

To understand the concepts of soft computational techniques. The course would help to arouse student's interest in the application of soft computational techniques to solve various problems.

UNIT I

Artificial Neural Networks

Basic concepts-single layer perceptron-Multi layer perceptron-Adaline-Madaline-Learning rules-Supervised learning-Back propagation networks-Training algorithm- Practical difficulties-Advanced algorithms-Adaptive network- Radial basis network-modular network-Applications

UNIT II
Unsupervised Networks

Introduction- unsupervised learning -Competitive learning networks-Kohonen self organising networks- Learning vector Quantisation - Hebbian learning - Hopfield network-Content addressable nature- Binary Hopfield network- Continuous Hopfield network Traveling Salesperson problem - Adaptive resonance theory –Bidirectional Associative Memory-Principle component Analysis

UNIT III
Fuzzy Systems

Fuzzy sets-Fuzzy rules: Extension principle- Fuzzy relation- Fuzzy reasoning – Fuzzy inference systems: Mamdani model- Sugeno model. Tsukamoto model -Fuzzy decision making-Multiobjective Decision Making--Fuzzy classification-Fuzzy control methods –Application

UNIT IV
Neuro-Fuzzy Modeling

Adaptive Neuro Fuzzy based inference systems – classification and regression trees: decision tress- CART algorithm – Data clustering algorithms: K means clustering- Fuzzy C means clustering- Mountain clustering- Subtractive clustering – rule base structure identification – Neuro fuzzy control: Feedback Control Systems- Expert Control- Inverse Learning- Specialized Learning- Back propagation through Real Time Recurrent Learning.

UNIT V
Genetic Algorithm

Fundamentals of genetic algorithm-Mathematical foundations-Genetic modeling-Survival of the fittest - crossover- Inversion and Deletion-mutation-reproduction-Generational cycle-rank method-rank space method- Other derivative free optimization-simulated annealing- Random search- Downhill simplex search- Application

TEXT BOOK

1. R. A. Aliev and R. R. Aliev, “Soft Computing and its Applications”, World Scientific Publishing, Singapore, 2001

REFERENCE BOOKS

1. Jang J.S.R., Sun C.T and Mizutani E, “Neuro Fuzzy and Soft Computing: A Computational Approach to Learning Machine Intelligence”, Prentice Hall, 1997
2. Laurene Fausett,”Fundamentals of Neural Networks: Architectures, Algorithms and Applications ”, Pearson Education India, 2006
3. S.N. Sivanandam, S.N. Deepa, “Introduction to Genetic Algorithm”, Springer, 2008

11EC304 DIGITAL IMAGE PROCESSING

CREDITS: 4:0:0

OBJECTIVE:
To study the basics and techniques of digital image processing
OUTCOME:
Students will be able to apply and develop new techniques in the areas of image enhancement- restoration- segmentation- wavelet processing and image morphology.

UNIT I
Fundamentals of Image Processing
Elements of visual perception - Image sensing and acquisition – Sampling and Quantization – Pixel relationships - Color fundamentals and models – Separable image transforms – DFT- DCT - Walsh- Hadamard- Haar – Karhunen Loeve and SVD

UNIT II
Image Enhancement and Restoration
Histogram equalization & matching - Image smoothening and sharpening (spatial & frequency domain) - Homomorphic filtering - Model of image degradation/restoration process – Noise models – Inverse filtering - Least mean square filtering – Constrained least mean square filtering –Pseudo inverse – Kalman filtering.

UNIT III
Image Segmentation and Feature Analysis
Edge detection – Edge linking and boundary Detection – Intensity and histogram based image segmentation - Region based segmentations – Contour based segmentation - Motion segmentation - Feature analysis and extraction – spatial techniques for shape and texture feature extraction.

UNIT IV
Multi Resolution- Wavelets and Morphological Processing
Image Pyramids – Sub-band coding - Multi resolution expansion – Wavelet transforms in two dimensions – Wavelet Packets – Dilation and Erosion – Opening and Closing – Hit-or-Miss transformations - Morphological Algorithms

UNIT V
Applications of Image Processing
Image classification – Image recognition – Image understanding – Image fusion – Image registration - Steganography – Digital compositing – Mosaics – Content based image retrieval - Color image processing –Video motion analysis

TEXT BOOK

1. Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", Pearson Education, 2nd Edition, 2003.

REFERENCE BOOKS

1. A.K. Jain, "Fundamentals of Digital Image Processing", Pearson Education, 2003.
2. William K. Pratt, "Digital Image Processing", John Willey 2001.
3. B. Chanda, D. Dutta Majumder, "Digital Image Processing and Analysis", Prentice Hall of India,2000
4. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing Analysis and Machine Vision", Thompson Learning, 2008.

11EC305 APPLIED ELECTRONICS LAB – I

Credits: 0:0:2

(Experiments related to signal processing- communication and digital system design. Using Matlab- Xilinx and ModelSim softwares)

1. Digital Modulation Techniques
2. Spread spectrum estimation
3. Multirate signal processing
4. Power spectrum analysis
5. LMS Algorithm
6. Design of FIR filter
7. Design of combinational circuits inVHDL using packages
8. Design of Counters and shift registers inVHDL using packages
9. Design of ALU inVHDL using packages
10. Design of 4 bit adder using Verilog
11. Design of state diagram using Verilog
12. Design of combinational and sequential circuits using Verilog

11EC306 APPLIED ELECTRONICS LAB - II

Credits: 0:0:2

(Experiments related to image processing and Embedded system. Using Matlab- ARM processor - LINUX platform)

1. Image enhancement in spatial domain
2. Image enhancement in frequency domain
3. Image restoration
4. Edge based segmentation
5. Region based segmentation
6. Wavelet processing
7. Image compression
8. Addition and Subtraction of two Hexadecimal numbers.
9. Multiplication and division of two Hexadecimal numbers.
10. Logical Operations and swapping.
11. ARM-THUMB Interworking.
12. Software Interrupt handler.

11EC307 ANALYSIS AND DESIGN OF ANALOG INTEGRATED CIRCUITS

Credit: 4:0:0

Objective:

To learn about Integrated Circuit Active Devices -opamps-analog multipliers -PLL and Analog Design with MOS Technology.

Outcome:

Students will be able to understand the concepts of active devices and to design various analog circuits.

UNIT I

Analysis of Integrated Circuit Active Devices

Depletion Region Of A PN Junction – Large Signal Behaviour Of Bipolar Transistors- Small Signal Model Of Bipolar Transistor- Large Signal Behaviour Of MOSFET- Small Signal Model Of The MOS Transistors- Short Channel Effects In MOS Transistors – Weak Inversion In MOS Transistors- Substrate Current Flow In MOS Transistor.

UNIT II

Circuit Configuration for Linear IC

Analysis Of Difference Amplifiers With Active Load Using FET Supply And Temperature Independent Biasing Techniques- Voltage References- Output Stages: Emitter Follower- Source Follower- CMOS Class B And Class AB Push Pull Output Stages.

UNIT III

Operational Amplifiers

Analysis Of Operational Amplifiers Circuit- Slew Rate Model And High Frequency Analysis- Frequency Response Of Integrated Circuits: Single Stage Amplifier And Multistage Amplifiers Using ZVT And SCT

UNIT IV

Analog Multiplier and PLL

Analysis Of Four Quadrant And Variable Trans Conductance Multiplier- Voltage Controlled Oscillator- Closed Loop Analysis Of PLL- Monolithic PLL Design In Integrated Circuits: Sources Of Noise- Noise Models Of Integrated-Circuit Components – Circuit Noise Calculations – Noise Bandwidth – Noise Figure And Noise Temperature

UNIT V

Analog Design with MOS Technology

MOS Current Mirrors – Simple- Cascode- Current sources: Wilson and Widlar current source – Two stage MOS Operational Amplifiers- with Cascode- MOS Telescopic-Cascode Operational Amplifier – MOS Folded Cascode and MOS Active Cascode Operational Amplifiers

TEXT BOOKS

1. Gray, Meyer, Lewis, Hurst, “Analysis and design of Analog IC’s”, 4^{th} Edition,Wiley International, 2002.
2. Behzad Razavi, “Design of Analog CMOS Integrated Circuits”, S.Chand and company ltd, 2000

REFERENCE BOOKS

1. Nandita Dasgupata, Amitava Dasgupta,"Semiconductor Devices,Modelling and Technology", Prentice Hall of India Pvt.ltd,2004.
2. Grebene, Bipolar and MOS Analog Integrated circuit design", John Wiley & sons,Inc.,2003.
3. Phillip E.Allen Douglas R. Holberg, "CMOS Analog Circuit Design", Second Edition, Oxford University Press, 2003

11EC308 ANALOG VLSI DESIGN

Credit: 4:0:0

Objective:
To learn about Device Modeling- Various types of analog systems- CMOS amplifiers and Comparators.

Outcome:
Students will be able to understand the concepts of analog design and to design various analog systems including data converters- CMOS amplifiers- Comparators and Switched Capacitor Circuits.

UNIT I
Device Modeling
Analog Integrated Circuit Design-Analog Signal Processing-Example of Analog VLSI Mixed – Signal Circuit Design- Modeling-MOS Models: DC- Small Signal and High Frequency Model- Measurement of MOSFET Parameters- Diode Models: DC- Small Signal And High Frequency Diode Model – Bipolar Models: DC- Small Signal and High Frequency BJT Model- Measurement of BJT Model Parameters.

UNIT II
Analog Systems
Analog Signal Processing-Digital-to- Analog Converters; Current Scaling- Voltage Scaling And Charge Scaling-Serial D/A Converters-Analog-To Digital Converters: Serial A/D Converters- Successive Approximation A/D –Parallel-High Performance A/D Converters – Continuous Time Filters: Low Pass Filters- High Pass Filters- Band Pass Filters.

UNIT III
CMOS Amplifiers
Inverters-Differential Amplifiers-Cascode Amplifiers-Current Amplifiers-Output Amplifiers- High-Gain Amplifier Architectures.

UNIT IV
Comparators
Characterization of a Comparator-Two Stage- Open-Loop Comparators-Other Open-Loop Comparators-Improving the Performance of Open-Loop Comparators –Discrete Time Comparators- High –Speed Comparators.

UNIT V
Switched Capacitor Circuits
Switched Capacitor Circuits- Switched Capacitor Amplifiers- Switched Capacitor Integrators-z-Domain Models of Two-Phase Switched Capacitor Circuits-First-Order Switched Capacitor Circuits- Second-Order Switched Capacitor Circuits- Switched Capacitor Filters.

TEXT BOOK

1. Philip E. Allen, Douglas R. Halberg, “CMOS Analog Circuit Design”, Oxford University Press, II Edition, 2003.

REFERENCE BOOKS

1. Randall L.Geiger, Philip E.Allen, Noel K.Strader, “VLSI Design Techniques for Analog and Digital Circuits”, McGraw Hill International Co, 1990.
2. YannisTsividis, “Mixed Analog – Digital VLSI Device and Technology” World scientific publishing Co. Pvt. Ltd., 2002

11EC309 CMOS VLSI DESIGN

Credits: 4:0:0

Objective

To study the basic concepts of MOS transistor- circuit design processes- Combinational Logic Circuits-- Sequential Logic Circuits- Arithmetic Building Blocks- Memory and Array Structures and BiCMOS Logic Circuits.

Outcome

Students are expected to design circuits using different CMOS styles and also to do analysis on CMOS structures.

UNIT I

MOS Transistor Theory

The MOS Structure – The MOS System under External Bias – Structure and Operation of MOS Transistor (MOSFET) – I_{ds} Versus V_{ds} Relationships –MOSFET Scaling and Small-Geometry Effects – MOSFET Capacitances-CMOS Inverter Characteristics.

UNIT II

Circuit design processes and characterization

Stick Diagrams – Design Rules and Layout – Delay Approach Estimation – Logical Effort and Transistor Sizing – Power Dissipation – Design Margin –Interconnect.

UNIT III

Combinational Logic Design

Static CMOS Design –Complementary CMOS-Ratioed Logic-Pass Transistor Logic- Dynamic CMOS Design –Basic Principles-Speed and Power Dissipation of Dynamic Logic-Signal Integrity Issues in Dynamic Design-Cascading Dynamic Gates.

UNIT IV

Sequential Logic Design

Static Latches and Registers – Multiplexer based Latches-Master –Slave Edge Triggered Register-Low voltage Static Latches- Dynamic Latches and Registers –Dynamic Transmission Gate Edge-triggered Registers-C^2MOS-A clock skew Insensitive Approach-True Single Phase Clocked Register-Pulse Registers-Sense Amplifier based Registers –Pipelining.

UNIT V

Arithmetic Building Blocks and Memory Design
Binary Adder-Full Adder Circuit Design Considerations-Binary Adder: Logic Design Considerations-Array Multipliers – Carry Save Multipliers-Tree Multipliers-Barrel Shifters – Read –Only Memories- EPROM - E^2 PROM-Flash Memory- SRAM Operation-Dynamic RAM Operation –Contents-Addressable Memory.

TEXT BOOKS

1. Kang ,Leblebigi “CMOS Digital IC Circuit Analysis & Design”, McGraw Hill, 2003.
2. Jan.M.Rabaey, Anantha Chandrakasan, Borivoje Nikolic, “Digital Integrated Circuits - A Design Perspective”, Pearson Education, 2nd Edition 2003.

REFERENCES BOOKS

1. Neil H.E. Weste, David Harris, Ayan Banerjee, “A Ciruits and Systems Perspective”, Pearson Education India, 3rd Edition, 2006.
2. Kamran Eshraghian, Douglas A.Pucknell, Sholeh Eshraghian, “Essentials of VLSI Circuits and Systems”, Eastern Economy Prentice Hall of India, New Delhi, 2005.

11EC310 LOW POWER VLSI DESIGN

Credits 4:0:0
Objective
To study the concepts on different levels of power estimation and optimization techniques.

Outcome
To design chips used for battery-powered systems and high-performance circuits not exceeding power limits.

UNIT I
Simulation Power Analysis
Need For Low Power VLSI Chips- Charging And Discharging Capacitance- Short Circuit Current- Leakage Current- Static Current- Basic Principles of Low Power Design- Gate Level Logic Simulation- Architectural Level Analysis

UNIT II
Circuit and logic level power Estimation
Transistor and Gate Sizing- Equivalent Pin Ordering- Network Reconstructing and Reorganization- Gate Reorganization- Signal Gating- Logic Encoding- State Machine Encoding-Pre-Computation Logic- Power Reduction in Clock Networks- CMOS Floating Node- Low Power Bus- Delay Balancing

UNIT III
Power Estimation
Architecture and System- Power and Performance Management- Switching Activity Reduction-Parallel Architecture- Flow Graph Transformation. Modeling of Signals- Signal Probability Calculation- Probabilistic Techniques for Signal Activity Estimation- Statistical Techniques-Estimation of Glitching Power

UNIT IV
Circuit Design techniques and SRAM Architecture
Circuit Design Style- Leakage Current in Deep Sub-Micrometer Transistors- Deep Sub-Micrometer Device Design Issues- Low Voltage Circuit Design Techniques- Multiple Supply Voltages- MOS Static RAM- Memory Cell- Banked SRAM- Reducing Voltage Swing on Bit Lines- Reducing Power in the Write Driver and Sense Amplifier Circuits

UNIT V
Energy recovery and low power latches and Flip Flops
Energy Recovery Circuit Design- Design with Partially Reversible Logic- Need for Low Power Latches and Flip Flops- Evolution of Latches and Flip Flops- Quality Measures for Latches and Flip Flops.

TEXT BOOKS

1. Gary yeap, "Practical Low Power Digital VLSI Design", Kluwer academic publishers, 2001.
2. Kaushik Roy, Sharat prasad, "Low Power CMOS VLSI Circuit Design", John Wiley & Sons Inc., 2000.

REFERENCE BOOKS
1. Anantha Chadrasekaran and Robert Broderson, "Low Power CMOS Design", Standard Publishers, 2000.
2. Kiat,Seng Yeo, Samir S.Rofail, Wang,Ling Goh, "CMOS/BiCMOS ULSI Low Voltage, Low Power", Pearson edition, Second Indian reprint, 2003.

11EC311 OPTICAL FIBER COMMUNICATION

Credits: 4:0:0

Objective
To learn various types of optical fibers- transmitter and receiver section- and fiber amplifiers

Outcome
Able to establish an efficient optical link.

UNIT I
Fiber Optic Guides
Light wave generation systems- system components- optical fibers- SI- GI fibers- modes- Dispersion in fibers- limitations due to dispersion- Fiber loss- Non linear effects. Dispersion shifted and Dispersion flattened fibers

UNIT II
Optical Transmitters and Receivers
Basic concepts- LED's structures spectral distribution-semiconductor lasers- gain coefficients- modes- Transmitter design- Reciever PIN and APD diodes design- noise sensitivity and degradation.

UNIT III
Light Wave System
Coherent- homodyne and heterodyne keying formats- BER in synchronous and asynchronousreceivers- sensitivity degradation- system performance- Multichannel- WDM- multiple access networks- WDM components- TDM- Subcarrier and Code division multiplexing.

UNIT IV
Amplifiers
Basic concepts- Semiconductor laser amplifiers- Raman - and Brillouin - fiber amplifiers- Erbium doped – fiber amplifiers- pumping phenomenon- LAN and cascaded in-line amplifiers.

UNIT V
Dispersion Compensation
Limitations- Post-and Pre-compensation techniques- Equalizing filters- fiber based gratings- Broad band compensation- soliton communication system- fiber soliton- Soliton based communication system design- High capacity and WDM soliton system.

TEXT BOOK
1. G.Keiser, “Optical fiber communication” 4th Edition, McGraw,Hill, New York, 2008.

REFERENCE BOOKS
1. G.P. Agarwal, "Fiber optic communication systems" 4th Edition, John Wiley & Sons, New York,2010.
2. John Senior, " Optical Fiber Communications: Principles and Practices", Prentice Hall Publications, New Delhi, 2008.

11EC312 MULTIMEDIA COMPRESSION TECHNIQUES
Credits: 4:0:0

Objective
To learn about the various compression techniques for audio signals- video signals and text data.

Outcome
Able to understand the concept of requirement for memory space reduction and motivated to develop efficient algorithms for compression

UNIT I
Introduction
Special features of Multimedia – Graphics and Image Data Representations – Fundamental Concepts in Text-Images-Graphics-Video and Digital Audio – Storage requirements for multimedia applications -Need for Compression - Lossy & Lossless Compression techniques – Overview of source coding- Information theory & source models- vector quantization theory: LGB algorithm– Evaluation techniques – Error analysis and methodologies

UNIT II
Text Compression

Compaction techniques – Huffmann coding – Adaptive Huffmann Coding – Arithmatic coding – Shannon-Fano coding – Dictionary techniques – LZW family algorithms.

UNIT III
Audio Compression
Audio compression techniques - μ- Law and A- Law companding. Frequency domain and filtering -. Predictive techniques – DM- PCM- DPCM: Optimal Predictors and Optimal Quantization-–Formant and CELP Vocoders – Application to speech coding – G.722 – Application to audio coding – MPEG audio- progressive encoding for audio – Silence compression- speech compression techniques.

UNIT IV
Image Compression
Contour based compression – Transform Coding – JPEG Standard – Sub-band coding algorithms: Design of Filter banks – Wavelet based compression: Implementation using filters – EZW- SPIHT coders – JPEG 2000 standards - JBIG- JBIG2 standards. Basic sub-band coding

UNIT V
Video Compression
Video compression techniques and standards – MPEG Video Coding I: MPEG – 1 and 2 – MPEG Video Coding II: MPEG – 4 and 7 – Motion estimation and compensation techniques – H.261 Standard – DVI technology – PLV performance – DVI real time compression – Packet Video.

TEXT BOOKS

1. Khalid Sayood, "Introduction to Data Compression", Morgan Kauffman Harcourt India, 2nd Edition, 2000.
2. David Solomon, "Data Compression,The complete reference", Springer Verlag New York INC, 2nd edition 2001.

REFERENCE BOOKS

1. Peter Symes, "Digital Video Compression", McGraw Hill Pub., 2004.
2. Mark Nelson, "Data compression", BPB Publishers, New Delhi,1998.
3. Mark S.Drew, Ze-Nian Li, "Fundamentals of Multimedia" PHI, 1st Edition, 2003
4. Yun A Shi, Huifang Sun, "Image & Video compression for Multimedia Engineering, Fundamentals, Algorithms & Standards", CRC Press, 2003.

11EC313 MICROWAVE INTEGRATED CIRCUITS

Credits: 4:0:0

Objective
To study the different technologies of microwave integrated circuits and to analyze the microstrip line.

Outcome

It will be helpful to design and fabricate different lumped elements and nonreciprocal components.

UNIT 1

Technology of Hybrid Mics & Monolithic Mics

Hybrid MICs: Dielectric substrates - thick film technology and materials - thin film technology and materials – methods of testing – encapsulation of devices for MICs – mounting of active devices. MMICs: Processes involved in fabrication – epitaxial growth of semiconductor layer – growth of dielectric layer – diffusion-ion implantation – electron beam technology.

UNIT II

Analysis Of Microstrip Line

Methods of conformal transformation – numerical method for analysis – hybrid mode analysis – coupled mode analysis- method of images – losses in miscrostrips.

UNIT III

Coupled Microstrips- Slot Line and Coplanar Waveguides

Coupled microstrips – even and odd mode analysis – microstrip directional couplers – branch lines couplers – periodic branch line couplers – synchronous branch line couplers.

UNIT IV

Lumped Elements and Non-Reciprocal Components

Design and fabrication using microstrips – flat resistors – flat inductors – interdigital capacitors – sandwich capacitors – ferromagnetic substrates for non-reciprocal devices – microstrip circulators –latching circulators – isolators – phase shifters.

UNIT V

Microwave Circuit Design

Microwave amplifier Design – Two port power gain- stability -single stage transistor amplifier design- low noise amplifier design- broad band amplifier design. Microwave Oscillator Design- negative resistance oscillator- transistor oscillators design- dielectric resonator oscillator design- oscillator phase noise- Periodic structures- Analysis of infinite- terminated periodic structures – filter design by image parameter method- insertion loss method -Distributed element (transmission line/TEM) filters.

TEXT BOOKS

1. D. M. Pozar, Microwave Engineering, 3rd Edition, John Wiley & Sons, 2005.
2. Robert E.Collin, Foundations for Microwave Engg., 2nd ed., McGraw Hill, 2001

REFERENCE BOOKS

1. Gupta,K.C, and Amarjit singh , “Microwave Integrated Circuits”, John Wiley and sons – Wiley Eastern Reprint, 1978.
2. Samuel Y. Liao, “Microwave Devices and Circuits”, 3rd Edition, Prentice Hall, 1996.
3. Hoffmann, R.K , “Handbook of Microwave Integrated Circuits”, Artec House, 1987.

11EC314 COMMUNICATION LAB-1

Credits: 0:0:2

Objective
To learn practically about different DSP algorithms- (LMS- RLS- QMF etc) Digital Modulation schemes & antenna design procedures

Objective
Able to understand the DSP algorithms used in communication field
It will be helpful to design different antennas

LAB EXPERIMENTS

Using Matlab(7 experiments)

1. Design and implementation of LMS-RLS and Kalman adaptive filters
   a. to remove noise
   b. estimation of channel
2. Design and implementation of QMF
3. Design and implementation of multistage/multirate system
4. Design and implementation of Digital Modulation Schemes (BPSK-GMSK-QPSK-OFDM)
5. Design and implementation of spread spectrum concepts
6. Implementation of linear, Convolutional and Cyclic codes
7. Simulation of Audio/Speech/Image Compression algorithms using Matlab/DSP Processor.

Using Hardware (2 experiments)

8. OTDR
9. Connecterization & Splicing

Using FEKO(3 experiments)

10. Design and simulation of Dipole antenna
11. Design and simulation of Horn antenna
12. Study of $\lambda/4$ and $\lambda 2$ transmission lines

11EC315 COMMUNICATION LAB-II

Credits: 0:0:2

Objective
To learn practically about different microwave components- Routing methods
To Understand Satellite- GSM mobile communication & Software defined radio concepts

Objective
Able to develop different microwave devices and antennas
Able to understand the communication concepts behind satellite communication and Mobile communication
Able to understand network routing procedures

LAB EXPERIMENTS

Using FEKO(3 experiments)

1. S parameter estimation of microwave devices
2. Simulation and implementation of microstrip antennas.
3. Design- implementation and testing of a microstrip coupler .

Using NS-2(3 experiments)

4. Creating topology in wireless using CBR and UDP
5. Routing –Unicast and multicast routing
6. Performance analysis in wireless networks

Using Hardware (2 experiments)

7. MIC characteristics of couplers and filters
8. MIC radiation pattern of antennas

Using Hardware (4 experiments)

9. Study of CDMA & GPS
10. Satellite Communication
11. GSM Mobile Communication
12. SDR

11EC316 ADVANCED SEMICONDUCTOR MEMORIES

Credits: 4:0:0

Objective
Study of recent developments in advanced semiconductor memories like (BSRAM- TSRAM- SDRAM- EDRAM- Floating gate- FRAM- MRAM- Single-electron memory).

Outcome
Help the students in doing research in advanced memories and its designs.

UNIT I
Static Random Access Memory Technologies:
Basic SRAM Architecture And Cell Structures-SRAM Selection Considerations-High Performance SRAMS-Advanced SRAM Architectures-Low Voltage SRAM-Bicmos Technology SRAMS-SOI SRAMS-Specialty SRAMs.

UNIT II
High-Performance Dynamic Random Access Memories:
DRAM Timing Specifications And Operations-DRAM cell capacitor –ESDRAM - Cache DRAM-Virtual Channel Memory (VCM)DRAM-Multilevel Storage DRAMS.

UNIT III
Application-Specific DRAM Architectures and Designs:
Video RAMS (VRAM)-Synchronous Graphic RAMS (SGRAMS)-Synchronous Link DRAMS-3-D RAMS-Memory Design Considerations.

UNIT IV
Advanced Non-Volatile Memory Designs and Technologies:

Floating Gate Cell Theory-Flash Memory Architectures-Flash Memory Reliability Issues-Ferroelectric Memories- Magneto Resistive Random Access Memories-Resonant Tunneling Diode-Based Memories-Single-Electron Memories -Phase-Change Non-Volatile Memories

UNIT V

Embedded Memories Designs And Its Applications:

Embedded Memory Developments- Cache Memory Designs-Embedded SRAM Designs-Embedded DRAM Designs-DRAM Process With Embedded Logic Architectures-Memory Cards And Multimedia Applications.

TEXT BOOKS

1. Ashok K.Sharma, "Advanced Semiconductor Memories Architectures, Designs and Applications", Wiley Interscience, 2003.
2. Tegze P.Haraszti, "CMOS Memory Circuits", Kluwer Academic publishers, 2001.
3. Betty Prince, "Emerging Memories: Technologies and Trends", Kluwer Academic publishers, 2002.

REFERENCE BOOK

1. Ashok K.Sharma, " Semiconductor Memories Technology, Testing and Reliability", Prentice,Hall of India Private Limited, New Delhi, 1997.

11EC317 HIGH SPEED SEMICONDUCTOR DEVICES

Credits: 4:0:0

Objective

To learn about various high speed devices

Outcome

To analyse different materials used in various high speed devices and the factors affecting the performance of high speed devices.

UNIT I

Silicon Based MOSFET and BJT Circuits for High Speed Operation Important Parameters of High Speed Performance of Devices: Transit Time of Charge Carriers- Junction Capacitances-ON-Resistances and Their Dependence on The Device Geometry and Size- Carrier Mobility-Doping Concentration and Temperature. Contact Resistance nd Interconnection/Interlayer Capacitances in the Integrated Electronic Circuits. Emitter Coupled Logic (ECL) and CMOS Logic Circuits with Scaled Down Devices. Silicon on Insulator (SOI) Wafer Preparation Methods - SOI Based Devices - SOICMOS Circuits for High Speed Low Power Applications.

UNIT II

Materials for High Speed Devices and Circuits

Merits of III –V Binary and Ternary Compound Semiconductors (Gaas- Inp- Ingaas- Algaas ETC.)- Silicon-Germanium Alloys and Silicon Carbide for High Speed Devices- as Compared to Silicon Based Devices. Brief Outline of the Crystal Structure- Dopants and Electrical Properties such as Carrier Mobility- Velocity Versus Electric Field Characteristics of These Materials. Material and Device Process Technique with These III-V and IV – IV Semiconductors.

UNIT III
MISFET- MESFET and III – V Semiconductor Devices
Metal Semiconductor Contacts- Schottky Barrier Diode. Thermionic Emission Model for Current Transport and Current-Voltage (I-V) Characteristics. Effect of Interface States and Interfacial Thin Electric Layer on the Schottky Barrier Height and The I-V Characteristics. Pinch off Voltage and Threshold Voltage of Mesfets. D.C. Characteristics and Analysis of Drain Current. Velocity Overshoot Effects and the Related Advantages of GaAs- InP and GaN Based devices for High Speed Operation. Sub Threshold Characteristics- Short Channel Effects and the Performance of Scaled Down Devices.

UNIT IV
High Electron Mobility Transistors (HEMT) & Hetero Junction Bipolar Transistors (HBTS)
Hetero-Junction Devices - The Generic Modulation Doped FET(MODFET) Structure for High Electron Mobility Realization - Principle of Operation and the Unique Features of HEMT. Ingaas/Inp HEMT Structures. Principle of Operation and the Benefits of Hetero Junction BJT for High Speed Applications - GaAs and InP Based HBT Device Structure and the Surface Passivation for Stable High Gain High Frequency Performance - Sige Hbts and the Concept of Strained Layer Devices.

UNIT V
High Speed Circuits
GaAs Digital Integrated Circuits for High Speed Operation- Direct Coupled Field Effect Transistor Logic (DCFL)- Schottky Diode FET Logic (SDFL)- Buffered FET Logic(BFL). GaAs FET Amplifiers. Monolithic Microwave Integrated Circuits (Mmics)- Resonant-Tunneling Hot Electron Transistors and Circuits.

TEXT BOOKS

1. S.M Sze, “High Speed Semiconductor Devices” Wiley,2008
2. S.Ghandhi “VLSI Fabrication Principles”, Wiley, 2003

REFERENCE BOOKS

1. C.Y Chang & F.Kat “GaAs High speed devices : Physics Technologies and Circuit applications”Wilney,N.Y,,1994.
2. H.Beneki9ng “High speed semiconductor devices: circuit aspects and fundamental behaviour” Chapman and Hall, London,1994.
3. Michael Shur “GaAS Devices and Circuits”,Plenum press,NY,1989.
4. N.G Einsprush and R.Weisseman “VLSI Electronics: GaAs Microelectronics”, Academic Press,NY, 1985.

11EC318 NANO CMOS DEVICE ARCHITECTURE

Credits : 4:0:0

Objective
To study the concepts of the nano devices and analyze their characteristics.

Outcome
Successful understanding of the concepts and emerging researchers.

UNIT I
Introduction
Physics of Scaling-Device Parameters for Superior Performance-Threshold Voltage-Historical Trends-International Technology Roadmap for Semiconductors-Different Scaling Methods-Ballistic Transistors

UNIT II
Short Channel Effects
Short Channel Effects-Threshold Voltage Roll-off-Drain Induced Barrier Lowering-Punch through-Hot Carrier Degradation Velocity Saturation-Reverse Short Channel Effects-Interconnects.

UNIT III
VLSI Devices
Break through solutions-Source/Drain Engineering-Channel Engineering-Vertical Substrate Engineering-Halo Implants-Gate Oxide Engineering-High K Dielectrics-Gate Engineering-DMG Mosfets

UNIT IV
SOI Devices
Partially Depleted SOI MOSFETs- Fully Depleted SOI MOSFETs -Fully Depleted Collector Mode- Partially Depleted Collector Mode-Accumulation Collector Mode –An Analytic Drain Current Model for Symmetric DG Mosfets-The Scale Length of Double –Gate Mosfets-Fabrication Requirements and Challenges of DG Mosfets-Multiple Gate Mosfets.

UNIT V
Emerging Devices
Resonant Tunneling Diodes-Single-Electron Transistor Logic- other SET and FET Structures-Quantum Dots and Arrays-Carbon Nanotube Transistors (Fets and Sets)- Semiconductor Nanowire (Fets and Sets)- Molecular Sets.

TEXT BOOKS

1. Donald A.Neamen, “Semiconductor physics and devices”, McGraw,Hill,3rd edition,2007.
2. Yuan Taur,T H.Ning, “Fundamentals of modern VLSI devices”, Cambridge university, Newyork,2nd ed.,2009.

REFERENCE BOOKS

1. Jean –Pierre Colinge, “FinFETs and other Multi,gate Transistors”, Springer Publishers, 2008.

2. Simon Deleonibus, “Electronic Device Architectures for the Nano,CMOS Era.From Ultimate CMOS Scaling to beyond CMOS devices”, Pan Stanford Publishing Pte.Ltd. Singapore, 2009.

11EC319 EMBEDDED SYSTEM DESIGN

Credits: 4: 0: 0

Objective

To learn the method of designing a real time systems

Outcome

The course would help to develop a new embedded real system design

UNIT I:

Embedded Architecture

Embedded Computers- Characteristics of Embedded Computing Applications- Challenges in Embedded Computing system design- Embedded system design process- Requirements-Specification- Architectural Design- Designing Hardware and Software Components- System Integration- Formalism for System Design- Structural Description- Behavioral Description-Design Example: Model Train Controller

UNIT II

Embedded Processor and Computing Platform

ARM processor- processor and memory organization- Data operations- Flow of Control SHARC processor- Memory organization- Data operations- Flow of Control- parallelism with instructions- CPU Bus configuration- ARM Bus- SHARC Bus- Memory devices- Input/output devices- Component interfacing- designing with microprocessor development and debugging-Design Example : Alarm Clock.

UNIT III

Networks

Distributed Embedded Architecture- Hardware and Software Architectures- Networks for embedded systems- I2C- CAN Bus- SHARC link ports- Ethernet- Myrinet- Internet- Network Based design- Communication Analysis- system performance Analysis- Hardware platform design- Allocation and scheduling- Design Example: Elevator Controller.

UNIT IV

Real Time Characteristics

Clock driven Approach- weighted round robin Approach- Priority driven Approach- Dynamic Versus Static systems- effective release times and deadlines- Optimality of the Earliest deadline first (EDF) algorithm- challenges in validating timing constraints in priority driven systems- Off-line Versus On-line scheduling**.**

UNIT V

System Design Techniques

Design Methodologies- Requirement Analysis- Specification- System Analysis and Architecture Design- Quality Assurance- Design Example: Telephone PBX- System Architecture- Ink jet printer- Hardware Design and Software Design- Personal Digital Assistants- Set-top Boxes.

TEXT BOOK

1. Wayne Wolf, "Computers as Components: Principles of Embedded Computing System Design", Morgan Kaufman Publishers, 2001.

REFERENCE BOOKS

1. Jane.W.S. Liu, "Real,Time systems", Pearson Education Asia, 2000
2. Frank Vahid, Tony Givargi, "Embedded System Design: A Unified Hardware/Software Introductions", John Wiley & Sons, 2000.

11EC320 MEMS AND NANO TECHNOLOGY

Credit: 4:0:0

Objective:
To learn about the emerging fields of MEMS and Nanotechnology and understand the concepts involved in realizing various types of Micro- and nano- devices and their applications.

Outcome:
Students are expected to learn physical principles involved in micro- and nano-sensors and design a suitable sensor for a given application.

UNIT I
Introduction to MEMS and Micro Systems
Microsystems and Microelectronics – Miniaturization – Microsensors: Chemical Sensors- Optical Sensors- Pressure Sensors- Thermal Sensors – Microactuators and Micromotors.

UNIT II
Microsystem Materials
Molecular Theory and Intermolecular Forces – Silicon Piezo Resistors – Electrochemistry – Substrates and Wafers – Silicon Compounds – Polymers – Packaging Materials.

UNIT III
Microsystem Fabrication Process
Photolithography – Ion Implantation – Diffusion – Oxidation – Chemical Vapor Deposition – Etching – Applications Of MEMS in Automatic- Telecom and Other Industries.

UNIT IV
Nanotechnology Basics
Nanobuilding Blocks – Atoms and Molecular Structure – Molecular Recognition – Tools For Measuring Nanostructures – Electron Microscopy – Spectroscopy – Molecular Synthesis and Polymerisation – Encapsulation.

UNIT V
Applications of Nanotechnology In Medicines
Nanobiosensors – Electronic Nose – Photo Dynamic Therapy – Molecular Motors – Protein Engineering.

TEXT BOOKS

1. Tai,Ran Hsu, "MEMS & Microsystems Design & Manufacture", Tata Mc Graw Hill,2002.
2. Richard Booker, Earl Boysen,"Nanotechnology", Wiley Dreamtech(p) Ltd, 2006.

REFERENCE BOOKS

1. Mart Ratner, Daniel Ratner, "Nanotechnology", Pearson Education, 2003.
2. Charles P.Poole. "Introduction to nanotechnology,", Wiley publications,2003

11EC321 INTEGRATED A/D AND D/A CONVERTERS

Credits: 4:0:0

Objective

To learn the various techniques& architectures of D/A & A/D Converters

Outcome

Will be used to develop low power- low voltage- high speed A/D & D/A Converters

UNIT I

Data Converter Fundamentals & Specifications of Converters

Analog Versus Discrete Time Signals-Converting Analog Signals to Digital Signals-Sample –and –Hold(S/H) Characteristics-Digital data coding-Digital coding schemes-Ideal and Non-ideal converters-DC specifications-Dynamic specifications-Figure of Merit.

UNIT II

High Speed A/D Converters & D/A converters

Design problems in high-speed converters- Full-flash converters-Interpolation-Averaging-Twostep flash converters-Pipeline converter architecture-Folding converter system- High speed D/A converter architecture- Voltage weighting based architecture- High speed segmented converter architecture.

UNIT III

High Resolution A/D & D/A converters

Introduction-Single slope A/D converter system-Dual-slope A/D converter system-Dual ramp single-slope A/D converter system-Algorithmic A/D converter-Cyclic redundant signed digitA/D converter-Self-calibrating capacitor A/D converter- Pulse width modulation D/A converters-Integrating D/A converters- Current weighting using ladder networks- Self calibrating D/A converter system- Current calibration principle

UNIT IV

Sample and hold amplifiers

Introduction-Basic Sample –and –Hold Configuration-Signal Bandwidth –Acquisition Time-Aperture Time Accuracy-Sampling Moment Distortion Calculation-Differential Sample-nd –Hold Circuit-Types of Bootstrapping System- Generalized Non-Inverting Configurations-Inverting Sample -and -Hold Circuit-Operational Range of Simple Sample –and –Hold Amplifiers

UNIT V
Sigma-delta A/D conversion & Testing of D/A and A/D converters
General Form of Sigma-Delta A/D Converters-General Filter Architectures-Discussion of Basic Converter Architectures-Multi Stage Sigma-Delta Converter (MASH)-Nth Order Sigma Delta Architecture- Sigma-Delta Digital Voltmeter- DC Testing of D/A Converters - Dynamic Testing of A/D Converters- Testing Very High-Speed A/D Converters

TEXT BOOK

1. Rudy van de Plassche, "CMOS Integrated Analog to Digital and Digital to Analog Converters", Springer International Edition, Second Edition, 2007.

REFERENCE BOOKS

1. Jacob Baker. R, Harry W. Li, David E. Boyce, "CMOS Circuit Design, Layout and Simulation", IEEE Press, Fifth Edition, 2003.
2. Randall L.Geiger, Philip E.Allen, Noel K.Strader, "VLSI Design Techniques for Analog and Digital Circuits", McGraw Hill International Co, 1990.

11EC322 VLSI ARCHITECTURES FOR IMAGE AND VIDEO PROCESSING

Credits: 4:0:0

Objective
To learn about the image and video compression algorithms and their hardware implementation in VLSI.

Outcome
Will be able to design practically feasible VLSI chips for image and video algorithms.

UNIT I
Fundamentals of Image and Video:
Light and Spectra-Human Vision-Image Formation-Camera Systems- Block diagram of Digital Image Processing – Image Data Types and Image Formats - Chromaticity Diagram-Color Models in Images-Color Models in Video- Types of Video Signals – Video Standards – Coding Techniques for Images and Videos : Huffman Coding- Arithmetic Coding & Dictionary Techniques

UNIT II
Spatio- Temporal Video Sampling and Two-dimensional Motion Estimation
Digital Video Concepts- Sampling Structures for Digital Video – Two- Dimensional Rectangular Sampling - Two- Dimensional Periodic Sampling - Sampling on 3-D Structures –Reconstruction from Samples - Sampling Structure Conversion-Two-dimensional Motion Estimation-Optical Flow Methods - Block-based Methods -Pixel-based Methods -Bayesian and Mesh Based Methods .

UNIT III

VLSI Architecture for DWT & JPEG 2000

VLSI Architecture for Convolution Approach- Mapping the DWT in a Semi-Systolic Architecture- JPEG 2000 Architecture for VLSI Implementation – VLSI Architecture for EBCOT- VLSI Architecture for Binary Arithmetic Coding- MQ-Coder –Decoder Architecture for JPEG 2000.

UNIT IV

Motion Estimation Algorithms and Analysis of Fast Motion Estimation Algorithms.

VLSI Design Methodology for MPEG-4 - MPEG – 4 Motion Estimation - Rate/distortion – Optimized Motion Estimation- Fast Motion Estimation Algorithms- Fast Motion Estimation for MPEG -4 - Analysıs of PSNR/bit rate and Complexity.

UNIT V

Design Space Motion Estimation Architectures and VLSI Implementation.

Introduction- General Design Space Evaluation - Design Space Motion Estimation Architectures - Motion Estimation Architecture for MPEG-4 —VLSI Architecture Search Engine I – Algorithm Architecture Mapping - Processor Element Array – Result Analysis – VLSI Architecture Search Engine II – Algorithm Architecture Mapping – Memory Configurations – Result Analysis.

TEXT BOOKS

1. Wang Y., Ostermann J.and.Zhang Y.Q., “Digital video processing and communications”, Prentice,Hall, 2002.
2. Tinku Acharya, Ping,Sing Tsai,”JPEG 2000 Standard for Image Compression: Concepts, Algorithms and VLSI Architectures, John Wiley Publishers, 2005.

REFERENCE BOOKS

1. Peter Kuhn, “Algorithms, Complexity Analysis and VLSI Architectures for MPEG,4 Motion Estimation”, Kluwer Academic Publishers,1999.
2. Watkinson J. “The MPEG Handbook – MPEG-1, MPEG-2, MPEG-4,” Oxford, UK: Focal Press, II Edition, 2005.
3. Richardson I.E.G.,”H.264 and MPEG-4 video compression”, Hoboken, NJ: Wiley, 2003.
4. Khalid Sayood, “Introduction to Data Compression”, Morgan Kaufmann Publishers, Third Edition, 2006.
5. Ze,Nian Li, Mark S.Drew, “Fundamentals of multimedia”, Prentice,Hall of India, 2004.

LIST OF SUBJECTS

Sub. Code	Name of the Subject	Credits
12EC101	Basic Electronics	3:0:0
12EC201	Electron Devices	4:0:0
12EC202	Electric Circuit Analysis	3:1:0
12EC203	Electromagnetic Fields	3:1:0
12EC204	Measurements and Instrumentation	3:0:0
12EC205	Digital Electronics	3:1:0
12EC206	C++ and Data Structures	3:0:0
12EC207	Solid State Circuits	3:1:0
12EC208	Linear Integrated Circuits and Applications	3:1:0
12EC209	Network Analysis and Synthesis	3:1:0
12EC210	Computer Architecture	3:0:0
12EC211	Transmission Lines and Wave Guides	3:1:0
12EC212	Pulse and Wave Shaping Circuits	4:0:0
12EC213	Communication Theory	4:0:0
12EC214	Signals and Systems	3:1:0
12EC215	Microprocessors and Interfacing Techniques	4:0:0
12EC216	Digital Signal Processing	3:1:0
12EC217	Antennas and Wave Propagation	3:1:0
12EC218	Microcontrollers and Applications	4:0:0
12EC219	Digital Communication	4:0:0
12EC220	Modern Control Systems	3:1:0
12EC221	Electron Devices and Circuits Lab	0:0:2
12EC222	Digital Electronics Lab	0:0:2
12EC223	C++ and Data Structures Laboratory	0:0:2
12EC224	Electronics and Integrated Circuits Lab	0:0:2
12EC225	Electronics and Communication Lab	0:0:2
12EC226	Microprocessor Lab	0:0:2
12EC227	Digital Signal Processing Lab	0:0:2
12EC228	Advanced Communication Lab	0:0:2
12EC229	Microcontroller Lab	0:0:2
12EC230	ADHOC Networks	3:0:0
12EC231	VLSI Design	4:0:0
12EC232	Digital Design Using VHDL	3:0:0
12EC233	Computer Communication	3:0:0
12EC234	MEMS And Nanoelectronics	3:0:0
12EC235	Digital Image Processing	4:0:0
12EC236	Cellular Mobile Communication	3:0:0
12EC237	Satellite Communication	3:0:0
12EC238	Biomedical Instrumentation	3:0:0
12EC239	Neural Networks And Fuzzy Systems	3:0:0
12EC240	Microwave and Optical Communication Lab	0:0:2
12EC241	VLSI Design Lab	0:0:2

12EC242	Digital System Design Using VHDL Lab	0:0:2
12EC243	Microwave and Optical Communication Engineering	4:0:0
12EC244	Mobile Communication	4:0:0
12EC245	Television And Video Engineering	3:0:0
12EC246	Microprocessor And Microcontroller	3:0:0
12EC247	Microprocessor And Microcontroller Lab	0:0:1
12EC248	Micro Electro Mechanical Systems	3:0:0
12EC249	Wireless Security	3:0:0
12EC250	Fundamentals of Nanoscience	3:0:0
12EC251	Basics of Mobile Communication	3:0:0
12EC252	Fundamentals of Digital Image Processing	3:0:0
12EC253	Digital Integrated Circuits	3:0:0
12EC254	Embedded Systems	3:0:0
12EC255	Basic VLSI Design	3:0:0
12EC256	Opto Electronic Devices	3:0:0
12EC257	Communication Engineering	3:0:0
12EC258	Fundamentals of Signals and Systems	3:0:0
12EC259	Electron Devices Lab	0:0:2
12EC260	Electronics and Microprocessors	4:0:0
12EC261	Electronics and Microprocessor Lab	0:0:1
12EC301	Statistical Digital Signal Processing	3:1:0
12EC302	CMOS Digital Integrated Circuit Design	4:0:0
12EC303	Modern Digital Communication Techniques	4:0:0
12EC304	Multimedia Compression Techniques	4:0:0
12EC305	Hardware Description Languages	4:0:0
12EC306	Digital Image Processing	4:0:0
12EC307	Embedded System Design	4:0:0
12EC308	High Performance Networks	4:0:0
12EC309	MEMS and Nano Technology	4:0:0
12EC310	Soft Computing	4:0:0
12EC311	Analysis and Design of Analog Integrated Circuits	4:0:0
12EC312	Analog VLSI Design	4:0:0
12EC313	CMOS VLSI Design	4:0:0
12EC314	Semiconductor Devices and Modeling	4:0:0
12EC315	Computer Aided Design for VLSI Circuits	4:0:0
12EC316	VLSI Technology	4:0:0
12EC317	VLSI Digital Signal Processing	3:1:0
12EC318	Testing of VLSI Circuits	4:0:0
12EC319	Low Power VLSI Design	4:0:0
12EC320	Advanced Radiation Systems	4:0:0
12EC321	Optical Fiber Communication	4:0:0
12EC322	Multimedia Compression Techniques	4:0:0
12EC323	Mobile Communication Networks	4:0:0
12EC324	Error Control Coding	3:1:0
12EC325	Microwave Integrated Circuits	4:0:0
12EC326	Satellite Communication	4:0:0
12EC327	Applied Electronics Lab – I	0:0:2
12EC328	Applied Electronics Lab – II	0:0:2
12EC329	HDL Laboratory	0:0:2

12EC330	ASIC Design Laboratory	0:0:2
12EC331	Communication lab I	0:0:2
12EC332	Communication lab-II	0:0:2
12EC333	C++ and Data Structures	3:1:0
12EC334	Hardware-Software Co-Design	4:0:0
12EC335	RISC Processor Architecture and Programming	4:0:0
12EC336	VLSI for Wireless Communication	4:0:0
12EC337	Analysis and Design of Multigate Transistors	4:0:0
12EC338	VLSI Circuits for Bio-Medical Applications	4:0:0
12EC339	Embedded Systems Laboratory	0:0:2
12EC340	Advanced Semiconductor Memories	4:0:0
12EC341	High Speed Semiconductor Devices	4:0:0
12EC342	Nano CMOS Device Architecture	4:0:0
12EC343	Embedded System Design	4:0:0
12EC344	Smart Antennas	4:0:0
12EC345	Integrated A/D and D/A converters	4:0:0
12EC346	VLSI Architectures for Image and Video processing	4:0:0
12EC347	Network Routing Algorithms	4:0:0
12EC348	Network Management	4:0:0
12EC349	Global Positioning system	4:0:0
12EC350	Digital communication receivers	4:0:0
12EC351	Optical Networks and photonic switching	4:0:0
12EC352	Wireless Sensor networks	4:0:0
12EC353	High Speed Switching Architecture	4:0:0
12EC354	High Speed VLSI Design	4:0:0
12EC355	Mixed Signal Processing	4:0:0
12EC356	RF System Design	4:0:0
12EC357	Genetic Algorithm for VLSI Design	4:0:0
12EC358	MEMS and Micro Systems	4:0:0
12EC359	Nanoelectronics	4:0:0
12EC360	Advanced Semiconductor Memories	4:0:0
12EC361	Designing With PLDs and ASICs	4:0:0
12EC362	ASIC Design	4:0:0
12EC363	Communication Network Security	4:0:0
12EC364	Advanced Digital System Design	4:0:0
12EC365	FPGA Design Using VHDL & VERILOG	4:0:0
12EC366	Genetic Programming & Particle Swarm Optimization	4:0:0
12EC367	Advanced Digital Image Processing	4:0:0
12EC368	Neuro – Fuzzy Modelling	4:0:0
12EC369	Pattern Recognition	4:0:0
12EC370	Artificial Neural Networks	4:0:0
12EC371	Optical Signal Processing	4:0:0
12EC372	RF MEMS	4:0:0
12EC373	Wavelets and Multi-Resolution Processing	4:0:0
12EC374	Neural Network for RF and Microwave Design	4:0:0

12EC101 BASIC ELECTRONICS

Credits: 3:0:0

Course Objective:

- To impart the basic knowledge about the passive components.
- To know about the fundamentals of electronics and some electronic devices.
- To get the knowledge about the various analog communication techniques.

Course Outcome:

- Student get an overview about the basics of electronics.
- Able to get an idea about the communication and some applications in communication.

Unit I

INTRODUCTION TO PASSIVE COMPONENTS AND SEMICONDUCTOR: Resistors – Types of resistors – colour coding, Capacitors – Types of capacitors, Inductors – Types of inductors. Covalent bond – N type & P type semiconductor – conduction in semiconductor.

Unit II

ELECTRONIC DEVICES: PN diode –Application: Half wave rectifier, Zener diode - Application: Zener Voltage Regulator-Bipolar Junction Transistor - Field Effect Transistors (JFET, MOSFET) - UJT.

Unit III

DIGITAL ELECTRONICS: Number system – Boolean algebra – logic gates –truth table - simplification of logic functions using karnaugh map (4 variables), combinational circuit -4 x 1 multiplexer – 1 x 4 demultiplexer

Unit IV

COMMUNICATION SYSTEMS: Basic block of communication system – need for modulation – types of analog modulation,Derivation of AM and FM signal-Block diagram of AM and FM transmitter - Superheterodyne receiver.

Unit V

APPLICATION: (Block diagram description only**):** Principle of Television - Satellite communication – Radar System - Fibre optic communication- ISDN

Text Book

1. Muthusubramanian ,R, Salivahanan S, Muraleedharan K.A, “Basic Electrical Electronics & Computer Engineering “Tata Mc.Graw Hill, 2009

Reference Books

1. Robert Boylestad and Louis Nashelsky, “Electronic Devices & Circuit Theory”, 9th Pearson Education Edition, 2009.
2. Anokh Singh, “Principles of Communication Engineering” S.Chand Co., 2001
3. V.K.Metha.”Principles of Electronics”,Chand Publications,2008.

12EC201 ELECTRON DEVICES

Credits: 4:0:0

Course Objective:

- To understand the mechanisms of current flow in semi-conductors. To understand the diode operation and switching characteristics.
- To know about the advanced semiconductor devices and practical applications of devices.

Course Outcome:

- Student will be familiarized with the principle of operation, capabilities and limitation of various electronic devices.
- Able to design practical circuits and to analyze various components.

Unit I

THEORY OF PN DIODES: Energy band structure of conductors, insulators and semiconductors – Comparison of Germanium, Silicon and gallium arsenide – Electron hole generation and recombination – Intrinsic and extrinsic semiconductors – Conductivity – Temperature dependence – Hall effect – drift and diffusion in semiconductors – Continuity equation – PN junction – Open circuited junction – depletion region – barrier potential – diode equation – Forward and Reverse characteristics – Transition and diffusion capacitance.

Unit II

THEORY OF JUNCTION TRANSISTORS: Transistor action – Transistor parameters – Transistor current components – emitter efficiency – base transport factor – collector efficiency – Large signal current gain – Continuity equation in base region – Eber Moll equation – static characteristics of transistors – Thermal runaway.

Unit III

TRANSISTOR MODELS: Transistor hybrid model – Determination of h parameters from the characteristics – Measurement of h parameters – Analysis of Transistor Amplifier circuit (CE, CB and CC) using h Parameters - Voltage gain – Current gain – Input impedance – Output impedance.

Unit IV

THEORY OF FET, UJT AND THYRISTOR: Junction FET operation – Static characteristics – Enhancement MOSFET, Depletion MOSFET – Static characteristics - Comparison of JFET and MOSFET – UJT : Operation, Static characteristics– SCR: Construction, Static Characteristics - DIAC – TRIAC.

Unit V

SPECIAL SEMICONDUCTOR DEVICES (Qualitative Treatment Only): Zener diodes – Varactor diode -Schotky Barrier Diode – Tunnel diodes– Photo diodes – Photo transistors – LED – LCD – Optocouplers – Gunn diodes – Laser diode.

Text Books

1. Millman & Halkias, "Electronic Devices & Circuits", Tata McGraw Hill, 2nd Edition, 2007.
2. Malvino A P, “Electronic Principles”, , McGraw Hill International, 7th Edition 2006.

Reference Books

1. David.A.Bell, "Electronic Devices & Circuits ", Oxford University Press, 5th Edition 2008.
2. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices & Circuit Theory", 9th Pearson Education Edition, 2009.
3. Allen Mottershead, "Electronic Devices & Circuits", PHI, 1998.

12EC202 ELECTRIC CIRCUIT ANALYSIS

Credits: 3:1:0

Course Objectives:

- To understand the basic concepts of electric circuits
- To study the various techniques which can be used to analyse electric circuits
- To understand the nature of the responses of electric circuits

Course Outcome:

- Make the students capable of applying the knowledge of circuit theory in other engineering subjects

Unit I

Basic Circuit Concepts: Kirchoffs Laws -VI relationships of R, L and C -independent sources - dependent sources – simple resistive circuits -network reduction, Series and parallel circuits reduction, Star delta transformation voltage division rule -current division rule - source transformation.

Unit II

Sinusoidal Steady State Analysis: Phasor- sinusoidal steady state response -concepts of impedance and admittance -analysis of simple circuits- power and power factor -series resonance and parallel resonance – bandwidth and Q factor. Solution of three-phase balanced circuits , Star connected load and delta connected load-power measurements by two wattmeter- solution of three phase unbalanced circuits, Star connected and delta connected load.

Unit III

Mesh-Current And Node-Voltage Methods: Formation of matrix equations and analysis of complex circuits using mesh-Super mesh analysisnodevoltage analysis-Super node analysis-mutual inductance- coefficient of coupling –ideal transformer.

Unit IV

Network Theorems And Applications: Superposition theorem -reciprocity theorem – compensation theorem -substitution theorem - maximum power transfer theorem -Thevenin's theorem. -Norton's theorem and Millman's theorem with applications.

Unit V

Transient Analysis: Forced and free response of RL, RC and RLC circuits with D.C. and sinusoidal excitations-Forced and free response of RL, RC and RLC circuits with D.C. and sinusoidal excitations using Laplace transform technique.

Text Books

1. Paranjothi S.R., 'Electric Circuit Analysis', New Age International Ltd. , Delhi, 2nd Edition, 2000.
2. Sudhakar, A. and Shyam Mohan S.P., 'Circuits and Network Analysis and Synthesis' Tata McGraw Hill Publishing Company Limited, 3rd Edition, 2007

Reference Book

1. Hyatt, W.H. Jr. and Kemmerly, J.E., 'Engineering Circuit Analysis', McGraw Hill International Editions, 1993.

12EC203 ELECTROMAGNETIC FIELDS

Credits: 3:1:0

Course Objective:

- To analyze fields a potentials due to static changes
- To evaluate static magnetic fields
- To understand how materials affect electric and magnetic fields
- To understand the relation between the fields under time varying situations
- To understand principles of propagation of uniform plane waves.

Course Outcome:

- The student will be exposed with the concepts, calculations pertaining to electricand magnetic fields
- They will also develop indepth knowledge of understanding the patterns of antennas, microwave devices and Waveguides .

Unit I

INTRODUCTION TO CO-ORDINATE SYSTEMS & VECTOR ALGEBRA: Introduction to Co-ordinate System – Rectangular – Cylindrical and Spherical Co-ordinate System – Introduction to line, Surface and Volume Integrals – Definition of Curl, Divergence and Gradient – Meaning of Stokes theorem and Divergence theorem - Problems

Unit II

STATIC ELECTRIC FIELD: Coulomb's Law in Vector Form – Principle of Superposition -Electric Field Intensity – Different cases of existence of electric field - discrete charges – continuous charge distribution - charges distributed uniformly on an infinite and finite line – the axis of a uniformly charged circular disc – an infinite uniformly charged sheet. Electric Scalar Potential – Relationship between potential and Electric field - Potential due to infinite uniformly charged line and electrical dipole - Electric Flux Density – Gauss Law and its applications – Problems on computation of Field Intensity and Flux Density

Unit III

STATIC MAGNETIC FIELD: The Biot-Savart Law in vector form – Magnetic Field intensity due to a finite and infinite wire carrying a current I – Magnetic field intensity on the axis of a circular and rectangular loop carrying a current I – Ampere'scircuital law and simple applications.Magnetic flux density – The Lorentz force equation for a moving charge and applications – Force on a wire carrying a current I placed in a magnetic field – Torque on a loop carrying a current I – Magnetic moment – Magnetic Vector Potential – Computation of Magnetic Field Intensities and Flux Densities.

Unit IV

ELECTRIC AND MAGNETIC FIELDS IN MATERIALS: Poisson's and Laplace's equation – Electric Polarization-Nature of dielectric materials- Definition of Capacitance – Capacitance of various geometries using Laplace's equation – Electrostatic energy and energy density – Boundary conditions for electric fields – Electric current – Current density – point form of ohm's law – continuity equation for current. Definition of Inductance – Inductance of loops and solenoids – Self and Mutual Inductance - Energy density in magnetic fields – Nature of magnetic materials – Magnetization and permeability - Magnetic boundary conditions – Problems on Boundary Conditions for Electric and Magnetic Fields.

Unit V

TIME VARYING ELECTRIC AND MAGNETIC FIELDS: Faraday's law – Maxwell's Second Equation in integral form from Faraday's Law – Equation expressed in point form.Displacement current – Ampere's circuital law in integral form – Modified form of Ampere's circuital law as Maxwell's first equation in integral form – Equation expressed in point form. Maxwell's four equations in integral form and differential form – Poynting Theorem and circuit application of poynting vector. Derivation of Wave Equation – Uniform Plane Waves – Plane waves in free space and in a homogenous material - Wave equation for a conducting medium – Plane waves in lossy dielectrics – Propagation in good conductors – Skin effect – Polarization.

Text Books

1. W H.Hayt & J A Buck, "Engineering Electromagnetics" Tata McGraw-Hill, 7th Edition, 2007
2. 2. E.C. Jordan & K.G. Balmain, "Electromagnetic Waves and Radiating Systems." Pearson Education/PHI , 4th edition 2006.

Reference Books

1. Matthew N.O. Sadiku, "Elements of Engineering Electromagnetics" Oxford University Press, 4th Edition, 2007.
2. Narayana Rao, N, "Elements of Engineering Electromagnetics" 6th Edition, Pearson Education, New Delhi, 2006.
3. Ramo, Whinnery and Van Duzer: "Fields and Waves in Communications Electronics" John Wiley & Sons, 3rd Edition 2003.
4. G.S.N. Raju, "Electromagnetic Field Theory & Transmission Lines", Pearson Education, 2006

12EC204 MEASUREMENTS AND INSTRUMENTATION

Credits: 3:0:0

Course Objective:

- To make student have a clear knowledge of the instruments, relevant circuits and their working.

- To provide adequate knowledge in electrical instruments and measurements techniques.
- Emphasis is laid on analog and digital techniques used to measure voltage, current, power etc

Course Outcome:
- Good understanding of comparison methods of measurements.
- Exposure to various transducers, storage and display devices.

Unit I
STANDARDS AND INDICATING INSTRUMENTS: SI units – units for charge, voltage, current, power, energy, flux. Standards – brief Introduction. D'Arsonval Galvanometer. Moving iron: attraction and repulsion type instruments- errors. Moving coil instruments – Permanent magnet moving coil instruments-Dynamometer type moving coil Instruments-Torque equations and errors-Extension of ranges- use of shunts and Instrument Transformers.

Unit II
MEASUREMENT OF POWER AND ENERGY: Dynamometer type wattmeter – Torque expression- Errors- Energy meters- Calibration of energy meters- Measurement of power using Instrument Transformers- Maximum demand indicator- Power factor meter.

Unit III
MEASUREMENT OF R-L-C: Resistance measurement – Kelvin double bridge, Wheatstone bridge- substitution method- Loss of charge method- Guard Wire method. Measurement of inductance and capacitance – Maxwell, Anderson- Hay's and Schering bridges- Measurement of Earth resistance.

Unit IV
MEASUREMENT OF NON-ELECTRICAL QUANTITIES: Transducers – Classifications- Principle of operation of Resistance potentiometer- Inductive and capacitive transducers- LVDT- Strain Gauge and Piezo-electric transducers- Encoders- Hall effect sensors and photo sensors. Measurement of Pressure – High Pressure and low pressure measurement. Measurement of Temperature – Resistance thermometers, thermistors and thermocouples- Speed measurement- contact and noncontact type.

Unit V
ELECTRONIC LABORATORY INSTRUMENTS: Electronic voltmeter – Digital voltmeter of ramp and integrating types. Digital Multimeter – block diagram. Block diagram of dual channel oscilloscope. Spectrum Analyzer. Pulse- signal and function generators. Harmonic distortion analyzer. Strip chart and X-Y recorders- Field Bus Instrumentation.

Text Book

1. Sawhney.A.K., "A Course in Electrical & Electronic Measurement and Instrumentation", Dhanpat Rai & Company Private Limited, New Delhi, 18th Edition,2007.

Reference Books

1. Helfrick A.D., "Modern Electronic Instrumentation & Measurements", Prentice Hall India Private Limited, New Delhi, 2007.

2. Doeblin,E.O., “Measurement Systems : Application and Design”, 5th Edition, Tata Mc-Graw Hill Publishing Company Limited , New Delhi, 2004.
3. Golding,E.W., and Widdis,F.C., “Electrical Measurements and Measuring Instruments”, A H Wheeler & Company, Calcutta, 5th Edition, 2003.
4. Rangan,C.S., Sharma, G.R., Mani, V.S., “Instrumentation Devices and Systems”, Tata McGraw Hill, New Delhi, 1998.

12EC205 DIGITAL ELECTRONICS

Credits: 3:1:0

Course Objectives:

- To learn about number systems, binary codes
- To learn the basic postulates of Boolean algebra, methods for simplifying Boolean expressions
- To study formal procedures for the analysis and design of combinational circuits sequential circuits
- To learn the implementation of digital circuits in programmable logic devices.

Course Outcomes:

- The student will be able to do number conversions and various simplification techniques.
- They will be able to design various combinational and sequential circuits and combinational circuit using PLDs

Unit I

NUMBER SYSTEMS & BOOLEAN ALGEBRA: Review of Binary, Octal, & Hexadecimal Number Systems-Representation of Signed Numbers -Floating point number representation-BCD-ASCII-EBCDIC-Excess 3 codes-Gray code-error detecting & correcting codes. Boolean Algebra:Postulates & Theorems of Boolean Algebra – Canonical Forms – Simplification of Logic Functions using Karnaugh map - Quine Mcclusky method.

Unit II

COMBINATIONAL LOGIC DESIGN: Logic gates –Implementation of Combinational Logic Functions – Half Adder and Full Adder – Half and Full subtractor - Parallel Adder/Binary Adder – Encoders & Decoders – Multiplexers & Demultiplexers –Code Converters – Comparator - Parity Generator/Checker – Implementation of Logical Functions using Multiplexers.

Unit III

FLIP FLOPS & SYNCHRONOUS SEQUENTIAL LOGIC DESIGN LATCHES: Level triggering clock and edge triggering clock-Latches- RS, JK, D&T flip flops – JK Master–slave flip flop –Excitation tables – Basic models of sequential machines – Concept of State Table – State diagram – State Reduction through Partitioning - Implementation of Synchronous Sequential Circuits- Sequence Detector –Sequence Generator.

Unit IV

COUNTERS &REGISTERS: Asynchronous Counters- Modulus Counters - Timing Waveforms-Counter Applications.- Synchronous Counters–Synchronous Modulus Counters-Shift Register –Johnson Counter- Ring Counter

Unit V

DIGITAL LOGIC FAMILIES: Basic structure of PLDS: PAL-PLA-PROM Implementation of simple combinational circuits using PLDS

LOGIC FAMILIES: TTL families, Schottky Clamped TTL- Emitter Coupled (ECL)- MOS inverter- CMOS Logic Gates -Comparison of performance of various logic families.

Text Books

1. Morris Mano,"Digital logic and computer Design", 3rd edition Prentice Hall of India, 2002.
2. A. Anand Kumar, "Fundamental of Digital Circuits", PHI, 2nd Edition 2009.

Reference Books

1. Jain R.P, "Modern Digital Electronics", Third edition, Tata Mcgraw Hill,2003
2. Floyd T.L., "Digital Fundamentals ", Prentice Hall, 9th edition, 2006.
3. V.K. Puri, "Digital Electronics: Circuits and Systems", Tata Mc Graw Hill, First Edition, 2006.

12EC206 C++ AND DATA STRUCTURES

Credits: 3:0:0

Course Objective:

- To learn the C++ programming language fundamentals: its syntax, properties and styles
- To learn object oriented programming concepts
- To learn the data structures in C++

Course Outcome:

- The students will be able to write their own programs using object oriented programming and data structures.

Unit I

OBJECTS AND CLASSES: A Simple Class- C++ Objects as Physical Objects - C++ Objects as Data Types - Object as function argument -Constructors - Copy Constructors-Returning Objects from functions - Structures and Classes – Array fundamentals-Initializing arrays-Multidimensional arrays-Array as function arguments-Strings-String variables-String constants-Reading Embedded blanks-Reading multiple lines-Arrays of strings.

Unit II

PRINCIPLES OF OBJECT ORIENTED PROGRAMMING: Overloading Unary and Binary Operator - Data Type Conversion and its Pitfalls- Inheritance: Derived Class and Base Class - Derived Class Constructors-Overloading Member Functions- Class Hierarchies - Public and Private Inheritance - Levels of Inheritance - Multiple Inheritance. Pointers: Address and Pointers - Pointers and Arrays - New and Delete Operator - Pointer to Pointer.

Unit III

ADVANCED OBJECT ORIENTED PROGRAMMING: Virtual Functions and Polymorphism - Friend Functions - Static Functions - this Pointer - Streams and Files: Stream Classes - Stream Errors - Disk File I/O with Streams - File Pointers. Templates and Exception: Function Templates - Class Templates - Exceptions.

Unit IV

INTRODUCTION TO DATA STRUCTURES: Linked List Introduction-Implementation of Linked Lists Using Arrays-Linear Linked List-Basic Operations on linear linked List-Searching-Reversing-Concatenating-Disposing on linear linked Lists- Doubly linked List-Basic Operations on Doubly Linked List- Circular Linked List- Basic Operations on Circular Linked List.

Unit V

SORTING AND SEARCHING TECHNIQUES: Sorting - Bubble Sort- Insertion Sort-Selection Sort- Quick Sort- Heap Sort- Merge Sort. Searching- Linear Search- Binary Search.

Text Books

1. Robert Lafore, "Object Oriented Programming in C++", Third Edition, Galgotia Publishers, Pune, Reprint, 2006.
2. Abhishek Daya Sagar, "Expert Data Structures using C/C++", BPB Publications, New Delhi 2004.

Reference Books

1. Herbert Schmidt, " C++, The Complete Reference" , Mc Graw-Hill Publishing Company Limited, New Delhi, 3rd Edition, 2002
2. Owen L. Astrachan, "Programming with C++ - A Computer Science Tapestry", Special Indian edition 2007, Tata McGraw-Hill, Second reprint, 2008.

12EC207 SOLID STATE CIRCUITS

Credits: 3:1:0

Course Objective:

- To know about the analysis and design of power supplies.
- To know about the analysis and design of basic transistor Amplifier circuits.
- To understand about the advantages and method of analysis of feed back amplifiers
- To know about the analysis and design of RC and LC oscillators and tuned amplifiers

Course Outcome:

- Students will be able to design simple power supplies and transistor Amplifier circuits.
- Students will be familiarized with the analysis and design of feedback amplifiers, oscillators and tuned amplifiers

Unit I

REGULATED POWER SUPPLIES: Diode as Rectifiers – Half wave rectifier – Full wave rectifier – Ripple factors – DC and AC components in rectifiers – Capacitor and inductor filters – Analysis and design of L section and π section filter– Regulators-series and shunt type- problems. Voltage and Current regulators – Short circuit and over load protection.

Unit II

TRANSISTOR AND FET BIASING: Transistor Biasing: Location of the Q point – Fixed bias circuit – Collector to base circuit – Self bias circuit – Graphical DC bias analysis –

Design of DC bias circuit- problems . FET biasing - Self biasing – Voltage feedback biasing- Problems

Unit III

AMPLIFIERS: Frequency response – Single stage Amplifier- Multistage amplifiers - RC coupled and Transformer coupled amplifiers Power amplifiers: Class A, AB, B and D amplifiers – Distortion – Push pull amplifiers – Complementary symmetry amplifier.

Unit IV

FEEDBACK AMPLIFIERS & DC AMPLIFIERS : Positive and Negative feedback – Current and Voltage feedback – Effect of feedback on gain – Input and Output impedance – Noise and Distortion. DC amplifiers: Drift in amplifiers –Differential amplifiers.

Unit V

OSCILLATORS AND TUNED AMPLIFIERS : Barkhausen criterion – RC and LC Oscillators (Hartley oscillator and Colpitts oscillator) – Crystal oscillators (Piezo-electric) – Tuned amplifiers: – Single tuned – Double tuned – Stagger tuned.

Text Books

1. Millman .J. & Halkias.C , "Electronic Devices And Circuits", Tata McGraw Hill, 2007.
2. Mathur S.P, Kulshrestha D.C., Chanda P.R., "Electronic Devices Applications and Integrated Circuits, Umesh Publications, 2004.

Reference Books

1. Malvino A.P., "Electronic Principles", McGraw Hill International, 2005.
2. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuits Theory", PHI, 8th Edition, 2003.

12EC208 LINEAR INTEGRATED CIRCUITS AND APPLICATIONS

Credits: 3:1:0

Course Objective:

- To get knowledge about IC fabrication
- To learn about IC 741 and its applications
- To learn about IC 555 and its applications

Course Outcome:

- Students will be able to design and analyze circuits using IC 741.
- Students will be able to design and analyze circuits using IC 555

Unit I

OP-AMP CHARACTERISTICS AND APPLICATIONS: Characteristics of ideal op-amp. Pin configuration of 741 op-amp – Bias - offsets and drift - bandwidth and slew rate - Frequency compensation - Applications: inverting and non-inverting amplifiers - inverting and non-inverting summers - difference amplifier - differentiator and integrator - Log and antilog amplifiers - Multiplier and divider.

Unit II

COMPARATORS AND SIGNAL GENERATORS: Comparators - regenerative comparators - input output characteristics - astable multivibrator -Monostable multivibrator - Triangular wave- generators - RC-phase shift oscillator -Wein's bridge oscillator.

Voltage Regulator

Series op amp regulator - IC voltage regulator -723 general purpose regulator – Switching Regulator.

Unit III

ACTIVE FILTERS, TIMERS AND MULTIPLIERS : Low pass - High pass - Band pass and Band Reject filters – Butterworth - Chebychev filters - first and second order filters-switched capacitor filters. 555 Timer functional diagram, monostable operation – Application in monostable mode: missing pulse detector, frequency divider, PWM – Astable operation - Application in Astable mode: FSK generator, PPM.

Unit IV

PLL, ADC AND DAC: PLL- basic block diagram and operation - capture range and lock range simple applications of PLL - AM detection - FM detection and FSK demodulation. Weighted resistor DAC, R-2R and inverted R-2R DAC, monolithic DAC - Flash ADC - counter type ADC - successive approximation ADC - dual slope ADC - conversion times of typical ADC.

Unit V

INTEGRATED CIRCUIT TECHNOLOGY : Monolithic Integrated Circuit Technology – Basic Planar process – Monolithic diodes – Metal –Semiconductor contact – Integrated Circuit Resistors – Integrated Circuit Capacitors – Bipolar Junction Transistor fabrication – Fabrication of FET's (JFET, MOSFET) – CMOS Fabrication –Integrated Circuit Packaging – Characteristics of Integrated Circuit Components.

Text Book

1. Roy Choudhury.D., Shail Jain, "Linear Integrated Circuits", New Age International Publications, 3rd Edition,2007.

Reference Books

1. Gayakwad.A.R., "Op-Amps & Linear IC's", PHI, 4th Edition,2004
2. Robert F. Coughlin, Frederick F. Driscoll, "Operational Amplifiers & Linear Integrated Circuits", PHI 6th Edition, 2001.
3. Sergio Franco, "Design with Operational Amplifier and Analog Integrated Circuits", TMH, 3rd Edition, 2002.

12EC209 NETWORK ANALYSIS AND SYNTHESIS

Credits 3:1:0

Course objectives:

- To make the students capable of analyzing any given electrical network
- To make the students learn how to synthesize an electrical network from a given impedance/admittance function

Course outcomes:

- Students will be able to analyze the various electrical and electronic networks using the techniques they learn
- Students will be able to construct a circuit to suit the need

Unit I

S-DOMAIN ANALYSIS: Network functions for the one port and two port networks – Driving point and transfer functions
– Properties of driving point and transfer functions - Poles and zeros of Network Functions – Significance of poles and zeros -Time domain response from pole zero plots.

Unit II

FREQUENCY DOMAIN ANALYSIS: Amplitude and phase response from pole zero plots – Stability criterion for active networks –Routh Criteria - Magnitude and phase plots for RL and RC networks – Complex loci for RL, RC and RLC networks - Plots based on S- Plane Phasors.

Unit III

NETWORK TOPOLOGY: Network graph, Tree, Incidence matrix - Fundamental cutsets and fundamental loops – Tie set and cut set schedules – V shift and I shift – Formulation of equilibrium equation on loop basis and node basis, Formulation of equilibrium equation in matrix form – Duality, Construction of dual of a network.

Unit IV

TWO PORT NETWORKS & FILTERS: Characterization of two port networks in terms of Z, Y, h, g, T and inverse T parameters –Relations between the network parameters - Network equivalents – Analysis of T, π , ladder and lattice networks - Transfer function of terminated two port networks.Filters- Design of constant K, m derived and composite filters

Unit V

ELEMENTS OF NETWORK SYNTHESIS: Realisability of one port network – Hurwitz polynomials and properties – Positive real functions and its properties – Synthesis of RL, RC and LC one port networks.

Text Books

1. W.H Hayt, JE Kemmerly, SM Durbin, "Engineering Circuit Analysis", Tata McGraw Hill Publishing Company Limited, ND, 6th Edition, 2006.
2. Sudhakar A. Shyammohan, "Circuits and Networks Analysis and Synthesis" Tata Mc Graw Hill Publishing company limited, New Delhi, 3rd edition, 2007.

Reference Books

1. Umesh Sinha, "Network Analysis And Synthesis,"Sathya Prakasan Publishers Limited, New Delhi, Fifth edition, 1992.
2. Allan H. Robbins, Wilheln C Miller, "Circuit Analysis, Principles of Applications" First Indian reprint 2008.
3. Paranjothi S.R., "Electric Circuit Analysis", New age International Publishers Limited, New Delhi, 2nd edition 2000.

12EC210 COMPUTER ARCHITECTURE

Credits: 3:0:0

Course Objective:

- To know about the basic concepts of Computer Organisation.
- Central Processor Organization, Arithmetic operation algorithms, Various Memory Organization
- To study the concepts of parallelism in Processor systems.

Course Outcome:

- Good understanding of computer processor, memory and input output organization.
- Knowledge in parallel Processing concepts.

Unit I

INTRODUCTION: Register transfer language-register, bus and memory transfers– Arithmetic logic and shift micro operations. Basic Computer Organisation: Instruction codes – Instructions – Timing and Control – Instruction Cycle – Fetch and Decode – Execution – Typical register and memory sequence instructions – Input, Output and Interrupt – Design stages.

Unit II

CENTRAL PROCESSOR ORGANIZATION: General register organization – Stack organization – Instruction formats – Addressing modes – Data transfer and manipulation – Program control – Control memory – Address sequencer – Data path structure - CISC characteristics, RISC Characteristics, RISC pipeline.

Unit III

ARITHMETIC PROCESSING: Introduction – Addition, Subtraction, Multiplication and Division algorithms – Floating point Arithmetic operations.

Unit IV

MEMORY AND INPUT/OUTPUT ORGANIZATION: Basic concepts – Memory Hierarchy – Main memory – Auxiliary memory – Associative memory – Cache and Virtual memory concepts – Input – Output interface – Asynchronous Data transfer – Modes of transfer – Direct memory access – I/O processor.

Unit V

INTRODUCTION TO PARALLEL PROCESSING: Parallelism in Uni-processor systems – Taxonomy of architectures – SISD, SIMD, MISD, MIMD modes of Memory access - shared memory, distributed memory – typical applications.

Text Books

1. Morris Mano, M., “Computer System Architecture”, Prentice Hall of India , New Delhi, 3rd Edition, 2000.
2. Stallings W., “Computer Organization and Architecture”, Pearson Education, New Delhi, 7th edition, 2006.

Reference Books

1. Carl Hamacher, V., Vranesic, Z.G., and Zaky, S.G., “Computer Organisation”, Mc Graw- Hill International Edition, New York, 5th Edition, 2002.
2. Hwang K., and Briggs F.A., “Computer Architecture and Parallel Processing”, McGraw–Hill Publishing Company Limited , New Delhi, 1989.

12EC211 TRANSMISSION LINES AND WAVEGUIDES

Credits: 3:1:0

Course Objective:

- To understand basic terminology in a transmission line and the distortions
- Calculation of various line parameters by conventional and graphical methods.
- To analyze and study the methods of impedance matching.
- To understand principles of Waveguide transmission and resonators.

Course Outcome:

- Student will be familiar with the concepts of transmission lines and theory of waveguides and resonators

Unit I

TRANSMISSION LINE THEORY: Introduction - Types of transmission lines – Losses in a Transmission line – Line Constants –T and л equivalents of a Transmission line - General theory of transmission line –Transmission line equation – Physical significance of the equations – The Infinite line – Distortionless Line – Waveform Distortion – Loading of lines – Types of loading – Campbell's formula – General equation for line with any termination – Open and Short circuited line – Transfer Impedance – Problems

Unit II

HIGH FREQUENCY TRANSMISSION LINES: Parameters of open wire line at radio frequency - parameters of coaxial lines at radio frequencies - constants for the line of zero dissipation – Voltages and Currents on the dissipation-less lines – Input impedance of a lossless line – Standing Wave Patterns– Reflection – Reflection coefficient, Reflection loss, Reflection factor - Standing wave ratio – Relation between VSWR and Reflection Coefficient.

Unit III

IMPEDANCE MATCHING: Impedance Matching - Types of transmission line sections – Half wave line – One eighth wave line – Quarter wave line – Properties of Quarter wave transformer – Baluns –– Stub Matching - Single and Double stub matching– Circle Diagram - Smith chart – Impedance and Admittance determination using Smith Chart – Determination of length and location of stub using Smith Chart - Applications of Smith Chart

Unit IV

WAVES BETWEEN PARALLEL PLANES: Review of Maxwell's/Faraday's Equation – Waves between parallel planes – Transverse electric waves –Transverse magnetic waves – Characteristics of TE and TM waves – Transverse electromagnetic waves – Velocities of propagation – Attenuation in parallel plane waves – Wave impedance.

Unit V

RECTANGULAR WAVEGUIDES & CAVITY RESONATORS: Rectangular wave guides – TE and TM waves in rectangular wave guides – Dominant mode – Excitation Modes - Cut off frequency in wave guides – Impossibility of TEM waves in wave guides – Attenuation – Wave Impedance - Cavity Resonators – Rectangular and Circular Cavity Resonators – Cavity tuning and excitation.

Text Books

1. Edward Jordan and K.G.Balmain, "Electromagnetic Waves and Radiating Systems", 2nd Edition, PHI, 2005.
2. Umesh Sinha, "Transmission Lines and Networks", 8th Edition, Sathya Prakasham Publishers, 2003.

Reference Books

1. John D. Ryder, "Network Lines and Fields", 2nd Edition, Prentice Hall of India, 2003.
2. Samuel Y. Liao, "Microwave Devices and Circuits", 3rd Edition, Prentice Hall of India, 2003.
3. David M.Pozar, "Microwave Engineering", John Wiley, 2nd Edition, 2002.
4. Seth S.P., Elements of Electromagnetic Fields, Dhanpat Rai & Sons, 2nd Edition, 2007.
5. Raju G.S.N., "Electromagnetic Field Theory and Transmission Lines", Pearson Edn. pvt. Ltd., 2005.

12EC212 PULSE AND WAVE SHAPING CIRCUITS

Credits: 4:0:0

Course Objective:

- To understand the concepts of wave shaping.
- To know about the design of various multivibrator circuits.

Course Outcome:

- Students will be able design various linear and non-linear wave shaping circuits.
- Students will be able design various multivibrators, blocking oscillators and time based generators

Unit I

LINEAR WAVE SHAPING CIRCUITS: High pass and low pass RC circuits – response for step, pulse, square wave, ramp and exponential signals as input – High pass circuit as a differentiator – low pass circuit as an integrator – attenuators. Non Linear Wave Shaping Circuits: Diode and transistor - clippers –Clamping Circuits – clamping theorem – practical clamping circuits.

Unit II

BISTABLE AND SCHMITT TRIGGER CIRCUITS: Fixed and self bias bistable circuits – Loading – Commutating capacitors – Triggering methods – Design of bistable circuits – Schmitt Trigger circuit, critical voltages, Design example – Applications: Comparator, Sine wave to square wave converter.

Unit III

MONOSTABLE AND ASTABLE CIRCUITS : Collector and emitter coupled monostable circuits – Waveforms – equation for delay – collector coupled, emitter coupled astable circuits –Design examples for monostable and astable circuits.

Unit IV

VOLTAGE AND CURRENT TIME BASE GENERATORS : General feature of a time base signal – exponential sweep circuit – A transistor constant current sweep – Miller and Bootstrap time base generators – General considerations – Current time base generator: A simple current sweep – A transistor current time base generator – Transistor Television sweep circuit.

Unit V

BLOCKING OSCILLATOR CIRCUITS AND SAMPLING GATES: Blocking oscillators – Triggering Transistor blocking oscillators – Base and emitter timings – Triggering circuits – Astable blocking oscillators – Sampling gates: Unidirectional and bidirectional sampling gates using Diodes and Transistors.

Text Books

1. Millman & Taub "Pulse Digital and Switching Waveforms", McGraw Hill, 2nd Edition 2007.
2. Suryaprakash Rao Mothiki, "Pulse and Digital Circuits", McGraw Hill, 2nd Reprint 2009.

Reference Books

1. Ronald Tocci, "Fundamentals of Pulse and Digital Circuits", Merrill Publishing Company, 3rd Edition, 1997.
2. David A Bell, "Solid State Pulse Circuits", PHI, Fourth Edition, 2005.

12EC213 COMMUNICATION THEORY

Credits: 4:0:0

Course Objective:

- To study the various analog communication fundamentals
- To study about Amplitude modulation and demodulation, angle modulation and demodulation.
- To learn about Noise performance of various receivers

Course Outcome:

- To provide indepth knowledge of various Amplitude modulation and demodulation systems.
- To provide some depth analysis in noise performance of various receiver.

Unit I

AMPLITUDE MODULATION & DEMODULATION TECHNIQUES: Introduction, Definition of communication - Communication system block diagram –Types of signal-spectrum of signal-Need for modulation – Types of Modulation-Amplitude Modulation: Introduction – Theory of Amplitude Modulation – AM power calculations – Need for suppression of carriers – Suppressed carrier systems (DSB, SC, SSB & VSB systems). Generation of AM signal–Square law diode modulation –Suppressed carrier AM generation (Balanced Modulator, Ring Modulator). AM Demodulation: Square law detector, envelope detector – synchronous demodulation-phase modulation-Armstrong phase modulator.

Unit II

ANGLE MODULATION & DEMODULATION TECHNIQUES: Angle Modulation: Theory of Frequency modulation, Mathematical analysis of FM and representation of FM – Narrow band FM and wide band FM - Comparison of AM & FM. Frequency modulation: Generation - FM signal by Direct method (Varactor diode modulator) – Indirect generation of FM-Armstrong method -FM Demodulation:(Travis detector, Balanced slope detector, Foster Seeley discriminator, Ratio detector).

Unit III
AM TRANSMITTERS AND RECEIVERS: AM Transmitter and Receiver: AM transmitters block schematic- high level and low level transmitters-SSB transmitters- ISB transmitters - Tuned radio frequency receivers – Super heterodyne receiver- Basic elements of AM super heterodyne receiver: - Image frequency rejection – frequency conversion – IF amplifier –Tracking and alignment – Merits and demerits of different receivers - Characteristics of Receivers.

Unit IV
FM TRANSMITTERS AND RECEIVERS: Allocation of frequency for various services FM Transmitter and Receivers: Block diagram of FM transmitter and methods of frequency stabilization – Armstrong FM transmitter system – FM stereo-Pre-emphasis. Block diagram of FM receiver – De-emphasis – Noise Limiter-Squelch circuit-Automatic Frequency Control-Volume expander-Automatic selection of channels. Receiver performance.

Unit V
NOISE: Noise and Interference-Thermal and Shot noise-Signal to Noise ratio – Noise-figure – Noise temperature – Noise figure of cascaded stage-Noise in AM and FM – SSB SC - calculation of output signal to noise ratio - DSBS Calculation of output signal to noise ratio Figure of merit-SNR calculation of FM.

Text Books

1. Anokh Singh, "Principles of Communication Engineering" S.Chand Co., 2001
2. Roody, Coolen, "Electronic Communication", PHI, 4th Edition, 2003

Reference Books

1. Taub and Schilling, "Principles of Communication Systems", Mc Graw Hill, 2nd Edition, 25th Reprint, 2003
2. G.Kennedy, "Electronic Communication Systems", Mc Graw Hill, 4th Edition, 8^{th} Reprint, 2003

12EC214 SIGNALS AND SYSTEMS

Credits: 3:1:0

Course Objective:

- To impart the basic knowledge about discrete and continuous time signals and systems
- To know about the frequency of continuous time signals and systems using CTFT and Laplace transform.
- To understand the sampling process and frequency analysis of discrete time signals and systems using DTFT and Z transform.
- To study the analysis and synthesis of discrete time systems.

Course Outcome:

- Gain knowledge about signals, systems and the analysis of the same using various transforms.
- Able to apply the knowledge obtained to prepare for future developments in the fields like analog and digital signal processing and communication.

Unit I

Introduction to Signals and Systems: **Continuous and Discrete time signals:** Classification of Signals – Periodic and aperiodic – even and odd –energy and power signals – Deterministic and random signals – complex exponential and sinusoidal signals – Unit step, Unit ramp, Unit impulse – Representation of signals in terms of unit impulse – Continuous Time (CT) signals operations – DT signal operations–**CT and DT systems:** Properties of the systems – Causality and stability of Systems – Linear Time Invariant (LTI) and Linear Shift Invariant (LSI) Systems- Continuous and Discrete Convolutions- Properties of convolution and the interconnection of Systems.

Unit II

Frequency Analysis of CT Signals and Systems Fourier Transform: Representation of aperiodic signals by Continuous Time Fourier Transform (CTFT) – Properties –Frequency response of systems characterized by Differential Equations – Power and Energy Spectral Density concepts related to CT signals –Parseval's Relation–**Laplace Transform:** Laplace transforms Solution of Differential Equations–Analysis and characterization of LTI system using the Laplace Transform, Block Diagram representation.

Unit III

Discretisation of CT Signals Sampling: Representation of CT signals by samples – Sampling Theorem – Sampling Methods: Impulse, Natural and Flat Top Sampling – Reconstruction of CT signal from its samples – Effect of under sampling – Aliasing Error – discrete time processing of continuous time signals, sampling of band pass signals
MATLAB: Time domain and Frequency domain analysis of Natural sampling, Flat Top sampling and aliasing effect using MATLAB.

Unit IV

Frequency Analysis of DT Signals and Systems Fourier Transform: Representation of DT aperiodic signals by Discrete Time Fourier Transform (DTFT) – Properties – Frequency response of systems characterized by Difference Equations – Power and Energy Spectral Density concepts related to DT signals –Parseval's Relation – **Z Transform:** Z transforms Solution of Difference Equations – Analysis and characterization of LSI systems using Z transform, Block Diagram representation

Unit V

Systems with Finite and Infinite duration Responses: Systems with finite duration and infinite duration impulse response –step response-recursive and non-recursive discrete time system – Frequency response-Zero Pole plot realization structures – direct form – I, direct form – II, Transpose, cascade and parallel forms–MATLAB Examples for time and frequency response.

Text Books

1. Alan V Oppenheim, Alan S Wilsky and Hamid Nawab S, "Signals & Systems", 2nd Edition, PHI, New Delhi, Reprint 2009.
2. Simon Haykin and Barry Van Veen, "Signals & Systems", 2nd Edition, John Wiley and Sons Inc., 2005

Reference Books

1. Samir S Solimon and Srinath M.D., "Continuous and Discrete Signals and Systems", 2nd Edition, PHI, 2003.
2. Rodger E Zaimer and William H Tranter, "Signals & Systems – Continuous and Discrete", McMillan Publishing Company, 4th Edition, III Reprint, 2002.
3. Steven T. Karris , "Signals and Systems with MATLAB Computing and Simulink Modeling ", Orchard Publications, 4th Edition 2008

12EC215 MICROPROCESSORS AND INTERFACING TECHNIQUES

Credit: 4:0:0

Course Objective:
- To know about the basic concepts of Computer Organisation.
- To learn about the basics of 8085 and 8086 Microprocessor.
- To introduce the interfacing techniques of peripheral devices.

Course Outcome:
- On successful completion of the subject, students can able to write the assembly language coding using 8085 and 8086 microprocessors.
- Knowledge about memory interfacing, interfacing techniques of peripheral devices.

Unit I

BASIC COMPUTER ORGANISATION: Register transfer language-register, bus and memory transfers–Instruction codes – Computer registers- Computer Instructions – Timing and Control – Instruction Cycle –Memory reference instructions – Input, Output and Interrupt – Design stages.

Unit II

8085 MICROPROCESSOR: Organisation of 8085 microprocessor – Addressing modes-Instruction set- -Assembly language programming-Timing diagrams – memory interfacing-

Unit III

8086 MICROPROCESSOR: Organisation of 8086 microprocessor – memory segmentation –Address modes in 8086 – Assembly language programming – minimum mode and maximum mode – Bus arbitration in minimum mode and maximum
mode.

Unit IV

MICROPROCESSOR INTERFACING TECHNIQUES: Methods of parallel data transfer -Programmable parallel ports-8255 PPI - Input/Output Interface using 8255 -Serial communication – Asynchronous Synchronous -8251A Programmable communication interface -DMA - Direct memory access - 8237 -Programmable DMA Controller.

Unit V

PROGRAMMABLE PERIPHERAL DEVICES: 8259A Programmable interrupt controller -8279 Programmable Keyboard/display interface - 8253 programmable interval timer -8295 Printer Controller.

Text Books

1. Morris Mano, M., "Computer System Architecture", Prentice Hall of India , New Delhi, 3rd Edition, 2000.
2. Ramesh.S.Goankar "Microprocessor Architecture, Programming & Applications with 8085/8080a" – Penram International, Fifth Edition, 2002
3. D.V. Hall "Microprocessor and Interfacing Programming and Hardware", McGraw Hill Publishing Company, 2nd Edition, Reprint 2006.

Reference Books

1. Yu.Cheng Liu & Glenn A Gibson, "Microcomputer System,8086/8088 Family" 2nd Edition, PHI, 2003
2. Ajit Pal "Microprocessor Principles And Applications", Tata McGraw Hill, 1st Reprint, 2003
3. Avatar Singh and Walter A.Tribel "The 8088 and 8086 Microprocessor, Architecture, Software and Interface Techniques", PHI, 3rd Edition, 2000.
4. Rafiquzzaman M., "Microprocessor Theory And Applications-Intel And Motorola", PHI, 2002

12EC216 DIGITAL SIGNAL PROCESSING

Credits: 3:1:0

Course Objective:

- To impart the basic knowledge about digital signal processing
- To understand Digital (IIR and FIR) filter design procedures.
- To know about the finite word length effects.
- To study the adaptive filter algorithms and TMS processor.

Course Outcome:

- Gain knowledge about convolution, DTFT, DFT, FFT and digital filter design.
- Able to apply the knowledge obtained to prepare for future developments in the fields digital audio, image and video processing and communication.
- Make use of signal processing concepts in TMS processors

Unit I

Introduction to DSP and Discrete Fourier Transform: Discrete Time LTI Systems: Convolution- Linear and Circular convolution, sectioned convolution: Overlap-add and save methods-Correlation.DFT and its properties, Relation between DTFT and DFT, FFT computations using Decimation in time and Decimation in frequency algorithms.

Unit II

Infinite Impulse Response Digital Filters: Design of classical analogue Butterworth and Chebyshev Filters. Frequency transformation in Digital domain – Design of IIR digital filters using impulse invariance technique. Design of IIR digital filters using bilinear transform method – pre warping. Realization stuctures of IIR filters-Direct, cascade, parallel forms.

Unit III

Finite Impulse Response Digital Filters: Symmetric and Antisymmetric FIR filters – Linear phase response and its implication – FIR filter design using window method: Design using Rectangular, Triangular and Raised cosine Windows - Gibbs phenomenon – Frequency sampling method – Realization structures of FIR filters – Transversal, Linear phase and Polyphase structures.

Unit IV

Finite Word Length Effects*:* Fixed point and floating point number representations – Comparison – Truncation and Rounding errors - Quantization noise – derivation for quantization noise power – coefficient quantization error – Product quantization error - limit cycle oscillations due to product round off and addition overflow errors – deadband-reduction scheme-Addition over flow errors-Principle of scaling.

Unit V

Special Topics in DSP and DSP Processors: Adaptive filtering: Basic wieners filter theory –LMS adaptive algorithm – recursive least square algorithm. **DSP Processor:** Introduction to general and special purpose hard ware for DSP – Harvard architecture –pipelining-Special instruction-Replication- Hardware digital filter – Texas Instruments TMS320C5416 – Instruction set of TMS320C5416 –Simple programs.

Text Book

1. John G Proakis and Manolakis, "Digital Signal Processing Principles, Algorithms and Applications", Pearson, Fourth Edition, 2007.

Reference Books

1. Emmanuel C. Ifeacher and Barrie W. Jervis, "Digital Signal Processing – A Practical Approach", Wesley Longman Ltd., 2nd Edition, 2004
2. Sanjit K.Mitra, "Digital Signal Processing - A Computer Based Approach", Tata McGraw-Hill, New Delhi, 2nd Edition, 2001
3. Johny R. Johnson, " Introduction to Digital Signal Processing", PHI, 2006
4. B.Venkataramani & M.Bhaskar- "Digital Signal Processor Architecture-Programming and Application"- TMH ,2002
5. S.Salivahanan, A. Vallavaraj, C. Gnanapriya, "Digital Signal Processing", McGraw Hill International, 2007

12EC217 ANTENNAS AND WAVE PROPAGATION

Credits: 3:1:0

Course Objective:

- To understand basic terminology in an antenna
- To analyze fields distribution due to antenna elements
- To design different types of antennas based on its frequency and applications
- To understand principles of different types of propagation of fields

Course Outcome:

- Student will understand the concepts of field distribution , radiation pattern due to an antenna.
- They will be able to design different types of antennas with various frequencies depending on the applications.

Unit I

ANTENNA TERMINOLOGY& FUNDAMENTALS: Radiation Patterns – Gain and Directivity – Effective Aperture – Radiation Resistance – Antenna Efficiency – Beam Width and Beam Efficiency – Front to Back Ratio – Reciprocity Theorem – Isotropic Radiators – Problems. Retarded Vector Potential – Radiation from a small current element and its radiation resistance – Power radiation from a Half wave dipole and its Radiation resistance.

Unit II

ANTENNA ARRAYS: Various forms of antenna arrays - Arrays of point sources - Linear arrays of point sources – Determination of direction of Maxima, direction of Minima and Beam Width for Broadside and Endfire arrays – Collinear - Parasitic arrays - Pattern Multiplication – Binomial arrays – Superdirective arrays - Problems

Unit III

TRAVELLING WAVE AND BROADBAND ANTENNAS: Travelling Wave Antennas - Rhombic Antenna – Design of Rhombic antenna – Rhombic Arrays – Loop Antenna – EMF equation of a loop antenna – Direction finding – Self and Mutual Impedances – 2 and 3 element Yagi Uda Antenna – Log Periodic Antennas - Helical Antennas – Modes of Radiation in a Helical Antenna

Unit IV

APERTURE ANTENNAS: Radiation from Huygen's Source – Radiation from a rectangular aperture treated as an array of Huygen's source – Babinet's Principle – Slot Antennas – Impedance of Slot Antennas – Microstrip Antenna – Horn Antenna – Microwave Antennas - Reflector Antennas – Feed System for Reflectors – Cassegrain Feed – Problems

Unit V

PROPAGATION: Sky wave propagation: Structure of ionosphere-Effective dielectric constant of ionized region-Refraction-Refractive index-critical frequency-Skip distance-Effect of earth's magnetic field-collisions-Max usable frequency-fading-diversity reception

Space wave propagation: Reflection of polarized waves-Reflection characteristics of earth-Resultant of direct and reflected wave at the receiver-Duct propagation

Ground wave propagation: Attenuation characteristics-calculation of field strength

Text Books

1. J.D.Kraus, "Antennas", 3rd Edition, Tata Mc-Graw Hill, 2002.
2. K.D.Prasad, "Antennas and Wave Propagation", Satya Prakasan, New Delhi, 3rd Edition, 2001.

Reference Books

1. C A Balanis, "Antenna Theory Analysis and Design", 3rd Edition, John Wiley Publishers, 2005.
2. F.E.Terman, "Electronic and Radio Engineering", McGraw Hill Book Company, 2004.
3. Robert E. Collin, "Antennas and Radio wave propagation", McGraw Hill, 2002.
4. Edward C. Jordan, "EM Waves and Radiating Systems", PH1, 2003

12EC218 MICROCONTROLLERS AND APPLICATIONS

Credits 4:0:0

Course Objective:

- To learn about the basics of 8051 microcontrollers.
- To introduce the basics of Motorola 68HC11 and PIC Microcontroller.

Course Outcome:

- On successful completion of the subject, students can able to write the assembly language coding using 8051 microcontrollers.
- Knowledge about Motorola 68HC11 and PIC microcontroller

Unit I

INTEL 8051: Architecture of 8051 -Memory Organization – Register Banks-Bit addressable area – SFR area -Addressing Modes – Instruction Set -Programming examples.

Unit II

MCS51 FAMILY FEATURES: 8051 Interrupt Structure – Timer modules – Serial Features – Port Structure – Power Saving Modes -Comparison of 8031, 8051 and 8751.

Unit III

MOTOROLA 68HC11: 68HC11 features – Different modes of operation and memory map – Functions of I/O ports in single chip and expanded multiplexed mode – Timer system of 68HC11 – Input capture, output compare and pulsed accumulator features of 68HC11.

Unit IV

INTERFACE TECHNIQUES: Serial peripheral interface of 68HC11 **-** serial communication interface **of 68HC11** -Analog to digital conversion features of 68HC11 – Watchdog timer feature.

Unit V

PIC MICROCONTROLLER: CPU architecture – Timer – Interrupts – I/O port expansion – I2C bus – A/D converter – Instruction set. Typical applications: Stepper motor control – DC motor control – AC power control using any microcontroller mentioned above.

Text Books

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi, "8051 Microcontroller and Embedded Systems" Prentice Hall, 1999.

2. Kenneth J. Ayala, “The 8051 Microcontroller Architecture Programming and Applications”, Penram International, 2nd Edition, 2004
3. John B Peatman “Design with PIC Microcontrollers”, Pearson Education Asia, Singapore, 8th Edition, 2004

References Books

1. John B Peatman “ Design with Microcontrollers”, McGraw Hill, Singapore, 1st Edition, 1988.
2. “8-bit Embedded controllers”, Intel corporation,1990.

12EC219 DIGITAL COMMUNICATION

Credits: 4:0:0

Course Objective:

- To study pulse modulation and discuss the process of sampling, quantization and coding that are fundamental to the digital transmission of analog signals.
- To learn baseband pulse transmission, which deals with the transmission of pulse-amplitude, modulated signals in their baseband form.
- To study passband pulse transmission, which deals with digital modulation of data, like ASK, FSK and PSK.
- To learn error control coding which encompasses techniques for the encoding and decoding of digital data streams for their reliable transmission over noisy channels.
- To discuss about the spread spectrum modulation schemes.

Course Outcome:

- Knowledge gained will help the student to design an efficient baseband and passband communication systems.
- Will help the student to understand the coded communication and spread spectrum communication

Unit I

Sampling and Band Limited Signaling: Basic building blocks of Digital communications, Analog versus Digital communication, Advantages and disadvantages of digital communications. Sampling process: Natural sampling, Flat top sampling. PCM: Introduction to PAM, PPM and PWM forms of pulse modulation –PCM-TDM- Digital multiplexers- Uniform Quantization –Non uniform Quantization– fundamentals of Line coding (RZ, NRZ, Polar & Bipolar) - Limitation and modification of PCM- DPCM, Delta modulation- Linear prediction- Adaptive delta modulation.

Unit-II

Baseband Pulse Transmission: Matched Filter- Error Rate due to noise – Inter symbol Interference- Ideal Nyquist channel- Raised cosine channels- Pulse Shaping, Nyquist criterion for Distortionless Base band Binary Transmission, Correlative level coding - Base band M-ary PAM transmission -Signalling with duobinary pulses, Adaptive equalization - Eye patterns

Unit III

Passband Data Transmission: Introduction – Pass band Transmission model- Generation, Detection, Signal space diagram, bit error probability and Power spectra of BPSK, QPSK, FSK and MSK schemes –Differential phase shift keying – Comparison of Digital modulation systems using a single carrier – Carrier and symbol synchronization

Unit IV

Error Control Coding: Discrete messages- information-entropy- Shannon's Source Coding Theorem- Huffman Coding- Discrete memoryless channels – Shannon's theorems: -Channel Coding Theorem -Capacity of gaussian channel (theorem)- bandwidth-S/N trade off- Linear block codes – Syndrome Decoding- Considerations of Cyclic codes - Convolutional codes – Decoding of convolutional codes- Maximum likelihood decoding ,Viterbi Algorithm - Essentials of Turbo codes.

Unit V

Spread Spectrum Modulation: Pseudo- noise sequences –a notion of spread spectrum – Direct sequence spread spectrum with coherent binary phase shift keying – Signal space Dimensionality and processing gain –Rake Receiver – Frequency –hop spread spectrum – Maximum length and Gold codes. Applications of spread spectrum: CDMA and Multipath Communication.

Text Books

1. Simon Haykins, "Communication Systems" John Wiley, 4th Edition, 2004
2. John G.Proakis, "Digital Communication" McGraw Hill 3rd Edition, 2008

Reference Books

1. Sam K.Shanmugam "Analog & Digital Communication" John Wiley.2006
2. Taub & Schilling, "Principles of Digital Communication " Tata McGraw-Hill" 28th Reprint, 2003.
3. Bernard Sklar, "Digital Communication, Fundamental and Application" Pearson Education Asia, 2nd Edition, 2001.

12EC220 MODERN CONTROL SYSTEMS

Credits: 3:1:0

Course Objective:

- To teach the fundamental concepts of Control systems and mathematical modeling of the system
- To study the concept of time response and frequency response of the system
- To teach the basics of stability analysis of the system

Course Outcome:

- Students will have the knowledge of mathematical modelling of the system
- Students will be able to find the response of different order systems for a step input
- Students will be able to identify the stability of the system

Unit I

Introduction: Open loop and closed loop systems - transnational and rotational mechanical systems and analogous electrical systems - Basic components of control systems - potentiometer - synchros - tachogenerator - a.c and d.c servo motor – Mathematical representation – block diagram – signal flow graph and transfer function of electrical systems.

Unit II

Time Response: Time response - step response of first order and second order systems - time domain specifications - type and order of a system - steady state error - static error and generalized error coefficients.

Unit III

Frequency Response: Frequency domain specifications - estimation of the specifications for a second order system. Bode plot - Nichol's chart - Nyquist stability criterion - applications of Bode plots and Nyquist stability criterion – polar plot.

Unit IV

Stability Analysis and Controllers: Stability - characteristic equation - location of roots in s plane for stability – Routh Hurwitz criterion -Root Locus Techniques- P, PI, PD and PID controllers Design using opamp – time response analysis of PI - PD – PID controllers.

Unit V

State Space Analysis of Control Systems: State space representation – The concept of state – State space representation of systems – Solution of state equations – Eigen values and Eigen vectors of n x n nonsingular matrix – Diagonalization of n x n matrix – Transfer matrix – Controllability – Observability.

Text Books

1. Ogata, K., "Modern Control Systems Engineering", Prentice Hall, Eaglewood, New Jersey, 2002.
2. Nagrath and Gopal.,:"Control System Engineering", Wiley & Sons, New Delhi, 2007.

Reference Book

1. Benjamin C. Kuo., "Automatic Control Systems", John Wiley & Sons, New York, 2002.

12EC221 ELECTRON DEVICES AND CIRCUITS LAB

Credits: 0:0:2

Course Objective:

- To learn practically about different Electron Devices and its operation.
- They will also learn the basics SPICE software

Course Outcome:

- Students will be able to understand the device characteristics and help them to develop experimental skills.
- Students will be able to do various electronics based projects.

1. Study of CRO
2. Characteristics of PN Junction diode, Zener diode
3. Characteristics of Photo diode

4. Characteristics of BJT
5. Characteristics of Triac
6. Characteristics of SCR
7. Characteristics of UJT
8. Characteristics of FET
9. Verification of Thevenin's Theorem (Also using PSPICE)
10. Verification of KCL (Also using PSPICE)
11. Verification of KVL (Also using PSPICE)
12. Verification of Superposition Theorem (Also using PSPICE)

12EC222 DIGITAL ELECTRONICS LAB

Credits: 0:0:2

Course Objective:

- To provide hands on experience on the topics studied in Digital Electronics Theory.

Course Outcome:

- Students can design, implement and test the practical working module.
- This will enable them to do hardware module of their project.

1. Realization of logic gates using Universal Gates.
2. Half adder & full adder
3. Half subtractor & full subtractor
4. Code conversion
5. Odd and even parity generator and checker
6. Multiplexer & demultiplexer
7. Encoder & decoder
8. Bcd to excess three converter
9. Flip flops
10. Shift register
11. Counters
12. Comparator

12EC223 C++ AND DATA STRUCTURES LABORATORY

Credits: 0:0:2

Course Objective:

- To give hands on training on the fundamentals of object oriented concepts in C++ and data structure programming

Course Outcome:

- The students will be able to design and develop their own programs for real world modeling.

1. Classes and objects
2. Constructors and destructors
3. Operator overloading
4. Data type conversion
5. Inheritance
6. Pointers
7. Virtual functions and polymorphism
8. Friend functions
9. Static Functions
10. Linked list
11. Function Template
12. Files

12EC224 ELECTRONICS AND INTEGRATED CIRCUITS LAB

Credits: 0:0:2

Course Objective:

- To learn practically about working of different transistor amplifier circuits and power supply unit.
- Also to learn the use and applications of IC 741 and IC 555.

Course Outcome:

- Students will be able to understand the amplifier characteristics, applications of analog IC's and help them to develop experimental skills.
- Students will be able to do various electronics based projects and basic PCB fabrication.

Electronics Experiments

1. Half wave & Full wave Rectifiers
2. Voltage Regulator
3. Single stage amplifier
4. Single tuned Amplifier
5. RC Phase shift Oscillator
6. Differential Amplifier

Liner Integrated Circuits Experiments

1. Design of inverting and non- inverting amplifiers
2. Design of Integrator and Differentiator using op amp
3. Design of Astable multivibrator using op amp and 555 IC timer
4. Design of Active filters using op amp
5. Design of Schimitt Trigger using op amp 555 IC timer
6. Design of Digital to analog converter

Any one of these experiments to be implemented in PCB and submitted by end of semester

12EC225 ELECTRONICS AND COMMUNICATION LAB

Credits: 0:0:2

Course Objective:

- To learn practically about working of different multivibrator circuits, wave shaping circuits and modulation and demodulation in communication circuits.

Course Outcome:

- Students will be able to understand the multivibrator characteristics and help them to develop experimental skills.
- Students will understand modulation concepts, basic designing concepts in communication.

1. Clippers And Clampers
2. Schmitt Trigger
3. Astable Multivibrator
4. Monostable Multivibrator
5. Equalizers
6. Attenuators
7. Amplitude Modulation And Demodulation
8. Frequency Modulation
9. Preemphasis and Deemphasis
10. If Amplifier
11. Phase Locked Loop (PLL)
12. Balanced Modulator

12EC226 MICROPROCESSOR LAB

Credits: 0:0:2

Course Objective:

- To learn about microprocessors (8085 & 8086) programming and applications.

Course Outcome:

- Students will develop assembly level programming skills.
- Students will be able to apply interfacing techniques for various applications.

1. Arithmetic operations using 8085
2. Sorting of n-number
3. Searching of n- numbers
4. Block transfer
5. Arithmetic operations using 8086
6. Square wave generation
7. Serial communication
8. Analog to digital Convertor
9. Digital to Analog Converter
10. Stepper motor
11. DC motor

12. 7 segment display

12EC227 DIGITAL SIGNAL PROCESSING LAB

Credits: 0:0:2

Course Objective:

- The course will make extensive use of MATLAB and CCS as an analysis, design, and visualization tool for the techniques of modern digital signal processing that are fundamental to a wide variety of application areas.
- It gives insight to Implementation of fast Fourier transform algorithms and digital filters.

Course Outcome

- Students will be able to apply the knowledge in real-time DSP applications like FIR, IIR filters and FFT.
- Students will gain knowledge on ADSP BS533and Texas Instrument TMS320C6416 /6713 DSK Hardware description of the board, Architecture, Functional Block Diagram, Memory organization, data formats, addressing modes

USING TMS320C 6416/TMS320C 6713/BS533

1. Waveform generation
2. Sampling of input signal and display
3. Implementation of Linear and Circular Convolution
4. Implementation of FFT
5. Implementation of IIR filters
6. Implementation of FIR filters

USING MATLAB/SIMULINK

1. Linear and circular convolution of two sequences
2. Calculation of FFT of a signal
3. Sampling and effect of aliasing
4. Design of IIR filters
5. Design of FIR filters
6. Implementation of Finite word length effects

12EC228 ADVANCED COMMUNICATION LAB

Credits: 0:0:2

Course Objective:

- To know about digital communication concepts and antenna measurements.

Course Outcome:

- Students will understand digital modulation concepts, antenna radiation pattern measurements, RF filters and amplifiers

ANY 12

1. Modulation and Demodulation of PAM, PWM, PPM
2. Digital Modulation techniques (ASK, FSK, PSK, QPSK)
3. Pulse code modulation and demodulation
4. Delta modulation and demodulation
5. RF filters (LPF, HPF, and BPF)
6. RF tuned amplifier/single end diode mixer/double end diode mixer
7. Radiation pattern of parabolic/dipole/yagi uda antenna
8. Inverse square law of propagation and verification of reciprocity theorem
9. Determination of characteristics impedance & dielectric constant of transmission line
10. Measurement of VSWR, Refection coefficient & return loss of transmission line
11. Study of various wireless topologies
12. Modulation using MATLAB
13. Study of GPS
14. Study on mobile phone communication
15. Study of direct sequence spread spectrum.

12EC229 MICROCONTROLLER LAB

Credits: 0:0:2

Course Objective:

- To learn about microcontroller (8051,68HC11 & PIC controllers) programming and applications.

Course Outcome:

- Students will develop assembly level programming skills.
- Students will be able to apply interfacing techniques for various applications which can be extended to the project level

1. Programs involving Data Transfer instructions
2. Programs involving Arithmetic and Logical operations
3. Programs on Code conversions
4. Programs on ascending/descending order.
5. Stepper motor Interfacing
6. DC Motor Interfacing
7. ADC Interfacing
8. Traffic Light Controller
9. DAC Interfacing
10. Serial Communication
11. Square wave generation.
12. Keyboard Display Interfacing

12EC230 ADHOC NETWORKS

Credits: 3:0:0

Course Objective:

- This course covers fundamental principles of ADHOC Networks
- To develop a comprehensive understanding of AdHoc network protocols
- To understand current and emerging trends in Wireless Networks.

Course Outcome:
- This will help the student to design his own wireless network
- Students will be able to evaluate the existing network and improve its quality of service

Unit I
ADHOC WIRELESS NETWORKS: Introduction -Heterogeneity in mobile devices-wireless sensor networks-traffic profiles-types of Adhoc mobile communications-types of mobile host movements-challenges facing Adhoc mobile networks-Synchronous MAC protocols- Asynchronous MAC protocols-problems in Adhoc channel access.

Unit II
EFFECTS OF BEACONING & BANDWIDTH EFICIENT LINK STATE ROUTING: Motivation- Ad Hoc Wireless Networks-Power Issues- Smart Batteries and Battery Characteristics-Effects of Beaconing on Battery Life- Associativity based Routing- ABR protocol Description-ABR route discovery phase-ABR route deletion phase-Updating routes in wireless networks

Unit III
COMMUNICATION PERFORMANCE OF ADHOC NETWORKS: Performance parameters of interest-route discovery time-end to end delay performance-communication throughput performance-packet loss performance-route reconfiguration repair time-TCP Reno-TCP Tahoe-TCP Vegas-TCP SACK-Problems facing TCP in wireless last hop-Problems facing TCP in Wireless Ad Hoc

Unit IV
MULTICASTING IN ADHOC WIRELESS NETWORKS: Multicasting in wired networks-DVMRP-Multicast mesh-CAMP-Group Based-ODMRP-location based-LBM-ABAM-Comparisons of multicast routing protocols.

Unit V
MULTIHOP ADHOC NETWORKS: Real world evaluation of mobile Adhoc networks-Mobile MAN design- integration and experimentation of mobile multi hop ad hoc networks

Text Books
1. Charles .E. Perkins, “AdHoc Networking”,Pearson Education,2008.
2. C.K.Toh, “Ad Hoc Mobile Wireless Networks-Protocols and Systems”, Pearson Education, 2007.

Reference Books
1. Marco Conti,, Jon Crowcroft, Andrea Passarella,”Multihop AdHoc Networks from Theory to Reality” ,Nova Science Publishers,Inc,NewYork,2007.
2. Siva Ram Murthy. C and Manoj. B.S, “AdHoc Wireless Networks: Architectures and protocols”, Prentice Hall PTR, 2004.

12EC231 VLSI DESIGN

Credits: 4:0:0

Course Objective:

- To learn about VLSI Design Process , Layout Design , CMOS logic Design styles
- To learn about the sub system design

Course Outcome:

- Students are able to Design various CMOS Design Styles
- Students are able to design different application of digital logic in CMOS

Unit I

OVERVIEW OF VLSI DESIGN METHODOLOGY: VLSI Design Process – Arcitectural Design – Logical Design – Physical Design – Layout Styles – Full Custom Semi Custom Approaches – Overview of wafer fabrication – Wafer processing – Silicon gate NMOS process – CMOS process – N well – P well – Twin Tub – Silicon On Insulator

Unit II

BASIC ELECTRICAL PROPERTIES OF MOS AND CMOS CIRCUITS: NMOS and PMOS enhancement transistors – Threshold voltage – MOS device equations – Basic DC equations – Second order effect – Small signal AC characteristics – NMOS and CMOS inverter – Inverter delay – Pass Transistor – Transmission gate

Unit III

LAYOUT DESIGN RULES: Need for design rules – Mead Conway design rules for the Silicon gate NMOS processCMOS N well / P well design rules – Sheet resistance – Area Capacitance – Wiring Capacitance

Unit IV

LOGIC DESIGN: Switch logic- Gate Logic – Inverter – Two input NAND and NOR gate- Other forms of CMOS logic – Dynamic CMOS logic – Clocked CMOS logic – Prechared domino CMOS logic – Structure Design – Simple combinational logic design examples – Parity generator – Multiplexer – Clocked sequential circuits – 2 Phase clocking – Charge storage – Dynamic Register Element – NMOS and CMOS dynamic shift register

Unit V

SUB SYSTEM DESIGN PROCESS: Design of a 4 bit shifter – 4 bit arithmetic processor – ALU Subsystem – Implementing ALU functions with an Adder – Carry look ahead adders – Multipliers – Serial/ Parallel Multipliers – Pipelined multiplier array – Modified booths algorithm – high density memory – FSM – PLA Control Implementation

Text Books

1. Dougulas A Pucknell and Kamran Eshranghian, "Basic VLSI Design", PHI, 3rd Edition, 2004
2. Neil H E West and Kamran Eshranghian, "Principles of CMOS VLSI Design : A System Perspective", Addison Wesley, 2nd Edition, 2002

Reference Books

1. Wayne Wolf, "Modern VLSI Design" Pearson Education Inc., 2008

2. Eugene D.Fabricius ,"Introduction to VLSI Design", Mc-Graw-Hill International Editions,1990.
3. N.A. Sherwari, "Algorithms for VLSI Physical Design Automation", John Wiley, 2003.

12EC232 DIGITAL DESIGN USING VHDL

Credits: 3:0:0

Course Objective:

- To learn about the implementation of digital logic in PLDs
- To know about RTL ,ABEL
- To learn about different FPGA architectures.
- To learn various VHDL modeling.

Course Outcome:

- Students will be able to write program using RTL, ABEL and VHDL
- They will be able to implement digital logic in PLD

Unit I

PROGRAMMABLE LOGIC DEVICES: Introduction - Programming Technologies - Programmable Read only Memory (PROM or PLE) - Programmable Logic Array (PLA) - Programmable Array Logic (PAL). System Design using PLD's: Design of Combinational and Sequential circuits using PLD's -

Unit II

PROGRAMMED LOGIC: Introduction – Register transfer language (RTL) – RTL notations – Microprogrammed Controller – Designing of micro programmed controller – Preparing a Micro instruction – ROM simulation – Emulation – Bit sliced computers – Advanced Boolean expression language.

Unit III

FPGA AND CPLD: Semi custom and full custom IC design- Xilinx XC3000 series, Xilinx XC4000 series -Logic cell Array (LCA)-Configurable Logic block (CLB) - Input and output block (IOB) – Programmable Interconnection Point (PIP) – structure of PLD and Complex PLD – Altera 7000 series.

Unit IV

INTRODUCTION TO VHDL: Design flow process – Software tools – Data objects – Data types – Data operators – Entities and Architectures – Component declaration and instantiation.

Unit V

DATA FLOW, BEHAVIORAL AND STRUCTURAL MODELING: Concurrent signal assignment – conditional signal assignment – selected signal assignment – concurrent and sequential statements – Data flow, Behavioral and Structural Modeling - Test bench

Text Books

1. Palmer. J.E, Perlman. D.E, "Introduction to Digital Systems", McGraw Hill Book Co., International Student Edn., 2001
2. Nelson. V.P, Nagale. N.T, Carroll. B.D and Irwin. J.D, "Digital Logic Circuit Analysis and Design", Prentice Hall International Inc., New Jersy, 1995.

Reference Books

1. Navabi. Z, "VHDL: Analysis and Modeling of Digital Systems", Prentice Hall Inc., 2nd Edition, 1998
2. Bhutyani, "Digital Logic Design", Prentice Hall International, Simon & Schuster (Asia) Pte., Ltd, 1996.
3. J. Bhaskar, "A VHDL Synthesis Primer", BS Publications, 3rd Edition, 2004.

12EC233 COMPUTER COMMUNICATION

Credits: 3:0:0

Course Objective:

- To introduce the concept, terminologies, and technologies used in modern data communication and computer networking.
- To introduce the students the functions of different layers.
- To introduce IEEE standard employed in computer networking.

Course Outcome:

- Students will get familiarized with different protocols and network components.
- They will learn about various IEEE standards.

Unit I

DATA COMMUNICATIONS: Components – Direction of Data flow – networks – Components and Categories – types of Connections – Topologies –Protocols and Standards – ISO / OSI model – Transmission Media –Coaxial Cable – Fiber Optics – Line Coding – Modems.

Unit II

DATA LINK LAYER: Error – detection and correction – Parity – LRC – CRC – Hamming code – Flow Control and Error control: stop and wait – go back N ARQ – selective repeat ARQ- sliding window techniques – HDLC.

Unit III

MEDIUM ACCESS TECHNIQUES: LAN: Ethernet IEEE 802.3, IEEE 802.4, and IEEE 802.5 – IEEE 802.11–FDDI, SONET –Bridges.

Unit IV

NETWORK LAYER: Internetworks - Packet Switching and Datagram approach – IP addressing methods – Subnetting – Routing – Distance Vector Routing – Link State Routing – Routers.

Unit V

TRANSPORT AND APPLICATION LAYER: Transport protocols-User Datagram Protocol (UDP) – Transmission Control Protocol (TCP) –Application layer-Domain Name Space (DNS) – SMTP, FDP, WWW –Cryptography.

Text Book

1. Behrouz A. Foruzan, "Data communication and Networking", Tata McGraw-Hill, 2004.

Reference Books

1. James .F. Kurouse & W. Rouse, "Computer Networking: A Top down Approach Featuring",Pearson Education, 4th Edition 2008
2. Larry L.Peterson & Peter S. Davie, "Computer Networks", Harcourt Asia Pvt. Ltd., 3rd Edition,2007
3. Andrew S. Tannenbaum, "Computer Networks", PHI, 4th Edition, 2003.
4. William Stallings, "Data and Computer Communication", 6th Edition, Pearson Education,2000.
5. Prakash C.Gupta," Data Communication and Computer Networks, PHI Learning Private Limited,2006

12EC234 MEMS AND NANOELECTRONICS

Credits: 3:0:0

Course Objective:

- To understand the basic concepts of MEMS and Microsystems and the fundamentals of nano electronics.

Course Outcome:

- The students will understand the basic concepts of MEMS and Microsystems the necessity of Micro systems, principle of Microsystems
- They will know the Materials used in Microsystems and the devices in nano electronics.

Unit I

OVERVIEW OF MEMS AND MICROSYSTEMS: MEMS and Microsystems – MEMS and Microsystem products – Evolution of Microfabrication – Microsytems and Microfabrication – Microsystems and Microelectronics – Microsystems and Miniaturization – Applications of Microsystems in Automative Industry – Applications of Microsystems in Other Industries.

Unit II

WORKING PRINCIPLE OF MICROSYSTEMS: Microsensors: Biomedical sensors – Chemical Sensors – Optical Sensors – Pressure sensors – Thermal Sensors. Micro actuation: Actuation using thermal forces- Actuation using Shape Memory alloys- Actuation using piezo electric crystals – Actuation using electro static forces.

Unit III

MATERIALS FOR MEMS AND MICROSYSTEMS: Silicon Compounds – Silicon Piezoresistors – Gallium Arsenide – Quartz – Piezoelectric crystals – Polymers.

Unit IV

INTRODUCTION TO NANOELECTRONICS: Basics Of Nanoelectronics – Capabilities Of Nanoelectronics – Physical Fundamentals Of NanoElectronics – Microelectronic Circuits – MOSFET Characteristics – Advantages And Issues With MOSFET Scaling – Microelectronics To Nanoelectronics.

Unit V

NANOELECTRONICS WITH TUNNELING DEVICES AND SUPERCONDUCTING DEVICE: Tunnel Effect And Tunneling Elements – Tunneling Diode – Resonant Tunneling Diode – Three Terminal RTD – Technology Of RTD – Digital Circuit Design Based On RTD Super Conducting Switching Devices – Cryotron – The Josephson Tunneling Device.

Text Books

1. Karl Goser, Peter Glosekotter, Jan Dienstuhl., "Nanoelectronics and Nanosystems" , Springer, 2004.
2. A.M. Ionescu and K. Banerjee (ed.), "Emerging Nanoelectronics, Life with and after CMOS", Kluwer Academic Publishers, 2004.

Reference Book

1. Tai Ran Hsu, "MEMS and Microsytems Design and Manufacture", Tata MC Graw Hill, 2002.

12EC235 DIGITAL IMAGE PROCESSING

Credits: 4:0:0

Course Objective:

- To learn the fundamental and various techniques in the field of digital image processing
- Students will learn about various image compression, restoration and enhancement techniques.

Course Outcome:

- Students will develop interest towards digital image processing and take up project work related to this subject.

Unit I

DIGITAL IMAGE FUNDAMENTALS & IMAGE TRANSFORMS: Elements of Digital Image Processing systems – Elements of visual perception – Image Sampling and Quantization – Basic relationships between pixels – Image processing applications – Discrete Fourier Transform (DFT) – Properties of Two-Dimensional DFT – Fast Fourier Transform (FFT) – Walsh Transform - Hadamard Transform – Discrete Cosine Transform.

Unit II

IMAGE ENHANCEMENT: Gray level Transformations – Histogram equalization and matching – Enhancement using arithmetic/Logic operations – Smoothing Linear filters – Order-Statistics filter – Basics of filtering in frequency domain – Ideal, Butterworth and Gaussian low pass filters – Ideal, Butterworth and Gaussian high pass filters - Laplacian, Gradient, Un-sharp masking and high boost filtering in spatial and frequency domain.

Unit III

IMAGE RESTORATION: Degradation/Restoration process model – Noise probability density functions – Mean filters – Order-Statistics filters – Periodic noise reduction using Bandpass, Bandreject and Notch filters – Linear, Position-Invariant degradations – Estimating the degradation function – Inverse filtering – Wiener filtering – Constrained Least Squares filtering.

Unit IV

IMAGE COMPRESSION: Coding, Interpixel and Psychovisual redundancy - Fidelity criteria – Image compression models – Huffman coding, Golomb coding, Arithmetic coding, LZW coding, Run-length coding, Bit-plane coding, Predictive coding – JPEG compression standard.

Unit V

IMAGE ANALYSIS AND COMPUTER VISION: Spatial, Shape and Texture features – Connectivity, Contour following, Edge linking and Heuristic graph searching – Chain codes, Fourier descriptors – Run-length codes, Quad trees – Amplitude thresholding, Region based approaches and Clustering – Decision tree classification

Text Books

1. Rafael C. Gonzalez and Richard E. Woods, “Digital Image Processing”, Pearson Education, 3rd Edition, 2009.
2. Anil K.Jain, “Fundamentals of Digital Image Processing”, Prentice Hall of India, 9th Edition, Indian Reprint, 2002

Reference Books

1. William, K.Pratt., “Digital Image Processing”, John Wiley and Sons, 3rd edition, 2002.
2. Wilhelm Burger and Mark J. Burge, “Principles of Digital Image Processing: Fundamental Techniques”, Springer, 1st Edition, 2nd Printing 2009.

12EC236 CELLULAR MOBILE COMMUNICATION

Credits: 3:0:0

Course Objective:

- To learn the fundamental concepts in cellular communication.
- To understand various propagation and signal quality improvement methods for cellular system.
- To learn the different wireless systems and standards.

Course Outcome:

- Able to analyze various generation of cellular system
- Capable to understand traffic and system capacity calculations
- Realize the applications various cellular systems

Unit I

INTRODUCTION TO WIRELESS MOBILE COMMUNICATIONS: History and evolution of mobile radio systems. Types of mobile wireless services/systems- Cellular, WLL, Paging, Satellite systems, Standards, Future trends in personal wireless systems,2G and 3G networks.

Unit II

CELLULAR CONCEPT AND SYSTEM DESIGN FUNDAMENTALS: Cellular concept and frequency reuse, Multiple Access Schemes, channel assignment and handoff, Interference and system capacity, Trunking and Erlang capacity calculations, Improving coverage and system capacity.

Unit III

MOBILE RADIO PROPAGATION: Large scale models-Free space propagation model, Two ray ground reflection model, Durkins model, Factors for small scale fading, Doppler shift, impulse respond models, parameters of mobile multipath channels, types of small scale fading.

Unit IV

SIGNAL QUALITY IMPROVEMENT METHODS: Equalization-Linear and non linear, algorithm for adaptive equalization, Diversity, Rake receiver concepts, speech coding-Vocoders, LPC.

Unit V

WIRELESS SYSTEMS AND STANDARDS: Wireless networking-CCS,SS7, PCN, Systems and Standards-AMPS,GSM,IS-95, Design issues in personal wireless systems.

Text Book

1. T.S.Rappaport, "Wireless Communications; Principles and Practice", Prentice Hall, NJ, 2001.

Reference Books

1. K.Feher, "Wireless Digital Communications", PHI, New Delhi,1995
2. W.C.Y.Lee, "Mobile communications Engineering: Theory and Applications", McGraw Hill, New York, 2nd Edition, 1998.
3. Schiller, "Mobile Communications" Pearson Education Asia Ltd.,2000

12EC237 SATELLITE COMMUNICATION

Credits: 3:0:0

Course Objective:

- To learn the fundamental concept in satellite Communication.
- To understand various satellite orbits and network architecture.
- To learn the working principles of earth station and multiplexing schemes

Course Outcome:

- Able to analyze various satellite system
- Capable to understand science behind orbiting satellites
- Realize the applications various satellites

Unit I

COMMUNICATION SATELLITE - ORBIT AND DESCRIPTION: Kepler's laws- Orbital period and velocity – Azimuth and elevation - orbital patterns–Placement of satellite in a geo-stationary orbit – satellite description – transponder subsystem– Telemetry, Command and ranging subsystem – Attitude control and electrical power.

Unit II
EARTH STATION: Earth Station Transmitters, Receivers-antenna types – Gain and radiated power – Poynting loss – Noise temperature – G/T ratio – High power amplifiers – Redundancy configurations –Carrier & power combining – Low noise amplifiers – Redundancy configuration and nonlinearity – Up converter & down converter – Conversion process – Monitoring& control.

Unit III
SATELLITE LINK ANALYSIS AND DESIGN: Basic link analysis – Interference analysis – Carrier to noise plus interference ratio –Terrestrial interference – Cross polarization interference – Adjacent channel and inter symbol interference – Rain Induced attenuation – Path diversity – Up link power control – Rain induced cross polarization interference – Satellite link design – Link without frequency reuse – Link design with frequency reuse.

Unit IV
MULTIPLE ACCESS TECHNIQUES: Frequency Division multiple access (FDMA) – Time division multiple access (TDMA) and code division multiple access (CDMA) – SPADE – Performance comparison of various multiple access schemes.

Unit V
APPLICATIONS AND SERVICES: Very small aperture terminal (VSAT) networks – Technologies & configurations – Mobile satellite (MSAT) networks – Low orbital satellites – Domestic satellite systems-the INSAT System-International systems-INTELSAT / INMARSAT

Text Books

1. Tri. T. Ha, "Digital Satellite Communications", , McGraw-Hill Publishing Co., Reprint 2nd Edition 2008.
2. Wilbur L.Pritchard and Joseph A.Sciulli, "Satellite Communication Systems Engineering", Prentice Hall Inc, 2nd Edition, 1st Indian Print, 2003

Reference Books

1. Timothy Pratt and Charles W. Bostian, "Satellite Communication", John Wiley and Sons, 1st Edition, 1994
2. B.N. Agarwal, "Design of Geosynchronous Spacecraft", Prentice Hall, 1986.
3. D. Roddy, "Satellite Communication", McGraw Hill, 4th Edition, 2008.

12EC238 BIOMEDICAL INSTRUMENTATION

Credits: 3:0:0

Course Objective:

- To learn about the instrumentations used in biomedical fields
- Also gives the wide knowledge about the study of human functioning system.
- To know about the Clinical measurements of Instrumentation.

Course Outcome:

- Able to analyze the human functioning system in biomedical field.
- Able to get a clear view of surgical equipments
- Awareness of safety hazards in biomedical field

Unit I

ELECTROPHYSIOLOGY AND BIOPOTENTIAL RECORDERS: Neuron - Axon - Action potential - Electrophysiology of Cardiovascular system- ECG - Phonocardiography - Central nervous system - EEG - Respiratory system - Muscular system- EMG – ERG

Unit II

MEASUREMENT OF PHYSIOLOGICAL PARAMETERS: Physiological transducers-Pressure-Variable capacitance-Linear variable Differentiable transformer Body Temperature-Electrical Resistance Thermometer-Thermistor-Pulse Sensor-Respiration Sensor - Measurement of Blood pressure - Blood flow - Cardiac output measurement - heart rate - respiration rate - measurement of lung volume - Oximeters - Audiometer.

Unit III

THERAPEUTIC AND SURGICAL EQUIPMENTS: Electro Surgical unit - short wave & microwave diathermy - Laser surgical unit – Anesthesia machine - Pacemakers - Total artificial heart (TAH) - Dialyser - Heart lung machine - Defibrillators - Ventilators - Nerve stimulators - centralized and Bedside patient monitoring system.

Unit IV

BIOCHEMICAL EQUIPMENTS AND ELECTRICAL SAFETY: Flame photometer - spectrophotometer - chromatography- PH, PCO_2 and PO_2 analysis - sterilizers - Electrical safety hazards in hospitals

Unit V

IMAGING SYSTEMS AND TELEMETRY: Computerized tomography (CT) - MRI instrumentation - Ultrasound scanner - X-ray machine - Fluroscopic techniques - angiography - Echo cardiograph - vector cardiograph - Biotelemetry.

Text Book

1. Arumugam.M., " Biomedical Instrumentation", Anuradha Agencies Publishers, 2 nd Edition sixth reprint, 2003.

Reference Books

1. Geddes. L.A., and Baker, L.E., "Principles of Applied Biomedical Instrumentation", John Wiley, 1989.
2. Kandpur R.S., "Handbook of Biomedical Instrumentation", TMH, 2nd Edition 2005.
3. Richard Aston., "Principles of Biomedical Instrumentation and Measurement", Merrill Publishing Company, 1990.

12EC239 NEURAL NETWORKS AND FUZZY SYSTEMS

Credits: 3:0:0

Course Objective:

- To learn the concepts and techniques of hybrid neuro fuzzy systems

Course Outcome:

- Will be able to develop new algorithms for real – time classification problems
- Will be able to improve the performance of the existing techniques.
- Will be able to design systems for practical applications.

Unit I

FUNDAMENTALS OF ARTIFICIAL NEURAL NETWORK: Artificial neuron-Biological Neural networks-Applications- Typical architectures-Training- Common activation functions-Single layer net- Back Propagation neural net-Radial Basis Function-Linear Vector Quantization.

Unit II

NEURAL NETS FOR PATTERN CLASSIFICATION & PATTERN ASSOCIATION: Hebb Net-Perceptron-Adaline-Madaline- Hetroassociative Memory Neural Network-Autoassociative Net-Iterative Autoassociative Net-Bidirectional Associative Memory(BAM)-Architecture- Algorithm and Applications.

Unit III

NEURAL NETS FOR CLUSTERING: Fixed Weight Competitive Nets : Maxnet-Mexican Hat-Hamming Net-Kohonen Self-Organising Maps- Counter Propagation- Adaptive Resonance Theory-Architecture, algorithm and application.

Unit IV

FUNDAMENTALS OF FUZZY LOGIC: Fuzzy sets- Fuzzy Relations- Fuzzy Equivalence Relations- Membership functions- Defuzzification methods-Extension principle-Approximate Reasoning-Rule based systems-Fuzzy Associative Memories(FAMs).

Unit V

FUZZY LOGIC APPLICATIONS: Fuzzy classification-Fuzzy Pattern Recognition-Fuzzy Control systems-Fuzzy image processing- Fuzzy optimization**.**

Text Books

1. Laurence Fausett, “Fundamentals of Neural Networks, Architecture, Algorithm and Applications”, Prentice-Hall, Inc, 2008.
2. Timothy J.Ross, “Fuzzy Logic with Engineering Applications”, Mc.Graw Hill International Editions, Reprint 2010.

Reference Books

1. Phillip D. Wasserman, “Neural Computing” Theory and Practice”, Van Nostrand Reinhold, New York, 1989.

12EC240 MICROWAVE & OPTICAL COMMUNICATION LAB

Credits: 0:0:2

Course Objective:

- To learn about the characteristics of microwave and optical devices.

Course Outcome:

- Students will understand about scattering parameter analysis, VSWR, Gain, Bandwidth, Coupling of microwave signals.

A. Microwave Experiments

1. Characteristics of Reflex Klystron Oscillator.
2. Characteristics of Gunn Diode Oscillator.
3. Study of Power Distribution in directional coupler.
4. Study of Power Distribution in E/H Plane Tee, Magic Tee
5. Frequency measurement.
6. Impedance measurement by Slotted Line Method.

B. Optical Communication Experiments

1. D.C. Characteristics of LED and PIN Photo Diode.
2. Optical transmission using Analog Modulation.
3. System bandwidth Determination by Intensity Modulation.
4. Data transmission through Fiber Optic Link.
5. Time Division Multiplexing.
6. PI Characteristics of LASER diode.

12EC241 VLSI DESIGN LAB

Credits: 0:0:2

Course Objective:

- To learn the designing and simulation of digital circuits using VHDL program
- To learn the schematic entry of digital circuits using Tanner EDA.

Course Outcome:

- Will be able to design and simulate Digital circuits.
- Will be helpful to do their VLSI based projects.

1. Design and Simulation Half adder and Full adder
2. Design & Simulation simple ALU
3. Design & Simulation of
4. 4x1 Multiplexer & Demultiplexer
5. Design & Simulation of Combinational Circuits
   • Magnitude Comparator
   • 3x8 Encoder
6. Design and Simulation of up-down counter
7. Design & Simulation of flip-flops.
   • JK Flip-flop
   • RS Flip-flop
   • T Flip-flop
   • D Flip-flop
8. Design and Simulation of Memory Module

SIMULATION PROGRAMS

1. Design & Simulation of CMOS Inverter/NAND & NOR.
2. Design & Simulation Half adder & Full adder
3. Design & Simulation of Transmission Gate and Multiplexer using TG
4. Design & Simulation of Boolean Expression & Bi CMOS Logic
5. Design & Simulation of different CMOS Design styles.

Required Software Tools:
Xilinx 9.1,Model Sim, Tanner EDA

12EC242 DIGITAL SYSTEM DESIGN USING VHDL LAB

Credits: 0:0:2

Course Objective:

- To learn the concepts VHDL Program.
- To understand the designing techniques of digital system using VHDL.

Course Outcome:

- Can design and verify any digital system using Xilinix 9.1 and modelsim simulator.
- Will be helpful to do their VLSI based projects

1. Design and Simulation Half adder and Full adder
2. Design & Simulation simple ALU
3. Design & Simulation of 4x1 Multiplexer & Demultiplexer
4. Design & Simulation of Combinational Circuits
    - Magnitude Comparator
    - 3x8 Encoder
5. Design and Simulation of up-down counter
6. Design & Simulation of flip-flops.
    - JK Flip-flop
    - RS Flip-flop
    - T Flip-flop
    - D Flip-flop
7. Design and Simulation of Memory Module
8. Design and simulation of Shift Register
9. Design and simulation of state diagram
10. Design and simulation of BCD to Seven segment display
11. Design and simulation of traffic light controller
12. Design and simulation of vending machine

12EC243 MICROWAVE AND OPTICAL COMMUNICATION ENGINEERING

Credits: 4:0:0

Course Objective:

- To enable the student to become familiar with optical communication
- Active & passive microwave devices & components.

Course Outcome:

- To study optical communication, passive microwave components and their S-Parameters.

- To study Microwave semiconductor devices & applications.
- To study Microwave sources and amplifiers.

Unit I

MICROWAVE PASSIVE DEVICES: Review of electromagnetic theory on Transverse magnetic and electric waves in rectangular and Circular wave-guides - Passive microwave devices: Coaxial Connectors and Adapters - WaveGuide Choke Flanges - Matched Terminations - Short Circuit Plunger - Rectangular to circular Wave guide transition -Tuning screws - Wave guide Corners - Bends and Twists – Windows -Coaxial line to Wave guide Adapters - Coupling Loops and Coupling Aperture – Attenuators -Phase shifters - Wave guide Tees - E plane Tee - H plane Tee - Magic Tee and their applications– Isolators - Circulators - Directional couplers - Scattering matrix derivation for all components.

Unit II

MICROWAVE VACUUM TUBE DEVICES: Introduction - Two cavity Klystron Amplifier – Mechanism and mode of Operation – Power Output and Efficiency - Reflex Klystron Oscillator – Mechanism and mode of Operation - Modulation of Reflex Klystron; Applications - TWT amplifier - Principle of Operation gain and Applications; Magnetron Oscillator – Hull cut-off voltage, Mechanism of Operation - ModeSeparation.

Unit III

MICROWAVE SOLID STATE DEVICES AND MEASUREMENT: Microwave diodes – Crystal diode, Schottky diode, Harmonic Mixer; PIN diode – Gunn Diode – Mode of operation - Oscillator Circuit – TRAPAT - IMPATT and BARITT diodes - Mechanism of Operation - Application as Oscillator and Amplifiers - Microwave transistors – Unipolar and Bipolar - Applications. Power measurements – Low and High power measurement, Insertion loss and Attenuation measurement, VSWR - measurement – Low and High VSWR, Impedance measurement -Frequency measurement.

Unit IV

OPTICAL COMMUNICATION: Overview of optical communication - Need for optical communication – Comparison with the Electrical communication - Optical Fiber light guides theory: Ray theory – Mode theory. Snell's Law – Critical angle – Acceptance angle – Numerical Aperture. Types of fibers: Step and Graded Index fibers. Wave propagation in multi mode and single mode optical fibers Attenuation Dispersion – Polarization.

Unit V

OPTICAL TRANSMITTERS AND RECEIVERS: Optical sources and Transmitters: Review of Physical Electronics - Physics of light Emission and amplification in semiconductors - LEDs - types of LEDs – principle of operation - Laser Diodes – working principle -Power launching and coupling – Numerical Aperture. Optical Detectors and Receivers: Photo detectors - photodiodes - pin and Avalanche photo detectors - Photo detector requirements for optical communications - Mechanisms of photon detection – Quantum Efficiency - Detector responsively –Phototransistors.

Text Books

1. Samuel.Y.Liao, "Microwave Devices and Circuits", Prentice Hall of India Pvt Ltd., 3rd Edition, 5th Reprint, 2000
2. Keiser.G. "Optical Fiber Communications", McGraw Hill, 3rd Edition, 2000

Reference Books

1. Collin. R.E, "Foundation of Microwave Engineering", McGraw-Hill, 2nd Edition, 2002.
2. Annapurna Das, Sisir K. Das, "Microwave Engineering", Tata McGraw-Hill Co., Ltd., 1st Edition, 1999. Reprint 2001.
3. John Senior "Optical Communications" Prentice Hall India, 2nd Edition, 2004.

12EC244 MOBILE COMMUNICATION

Credits: 4:0:0

Course Objective:

- To learn the fundamental and emerging trends in Mobile Communication.
- To understand the wireless network/protocol architecture.
- To learn the working principles of Mobile networks

Course Outcome:

- Able to analyze various 3G mobile techniques
- Capable to design wireless protocol architecture
- Able to simulate mobile network structures and routing protocols

Unit I

WIRELESS TRANSMISSION: Frequencies for radio transmission- Signals- Antennas-Signal Propagation-Multiplexing- Modulation- Spread Spectrum- Cellular Systems-Medium Access Control: Motivation- SDMA- FDMA- TDMA- CDMA - Comparison

Unit II

TELECOMMUNICATION SYSTEMS: GPRS- GSM- DECT- TETRA-UMTS and IMT-2000- Satellite Systems: Basics - Routing - Localization - Handover

Unit III

BROADCAST SYSTEMS: Cyclic repetition of data - Digital Audio Broadcasting- Digital Video Broadcasting Wireless LAN: Infrared VS Radio transmission- Infrastructure and AD-HOC networks- IEEE 802.11- Hyper LAN- Bluetooth.

Unit IV

WIRELESS ATM: Motivation- Working group- WATM services- reference model-functions- radio access layer- handover- location management- addressing- quality of service-access point control protocol - Mobile Network Layer: Mobile IP- Dynamic host configuration protocol- MANET-Routing Protocols

Unit V

MOBILE TRANSPORT LAYER: Traditional TCP- indirect TCP -snooping TCP - mobile TCP- fast retransmission/ fast recovery- selective retransmission- transaction oriented TCP - Support for Mobility: File systems- World Wide Web- Wireless application protocol

Text Books

1. Jochen Schiller, "Mobile Communications", Addison Wesley Publishers, 2000.
2. Lee W.C.Y., "Mobile communications Engineering: Theory And Applications", McGraw- Hill, New York.1998.

Reference Books

1. Yi-Bing Lin and Imrich Chlamtac, “Wireless and Mobile Network Architecture”, John Wiley and Sons, New Delhi, 2nd Edition, 2001.
2. Feher K., “Wireless Digital Communications”, Prentice Hall of India, New Delhi,1995
3. Rappaport T.S., “Wireless Digital Communications; Principles and Practice”, Prentice Hall, New Jersey,1996.

12EC245 TELEVISION AND VIDEO ENGINEERING

Credits: 3:0:0

Course Objective:

- To impart the knowledge about the fundamentals of television.
- To understand the working of various building blocks of monochrome and colour television.
- To know about the advanced television systems.

Course Outcome:

- Learners will be able to understand the transmission of video signals
- Knowledge about the importance of television standards to effectively work with broad casting applications.

Unit I

THE FUNDAMENTALS OF TELEVISION: Aspect Ratio-Image-continuity Number of scan lines, interlaced scanning-Picture resolution-Camera tubes-Image Orthicon-vidicon-Plumbicon-Silicon Diode Array Vidicon-Solid-state Image scanners, Monochrome picture tubes-composite video signal-video signal-dimensional horizontal sync. Composition-vertical sync.Detailsfunctions of vertical pulse train-scanning sequence details. Picture signal transmissionpositive and negative modulation, VSB transmission, sound signal transmission-The default channel bandwidth.

Unit II

MONOCHROME TELEVISION TRANSMITTER AND RECEIVER:TV Transmitter TV Signal Propagation, Interference TV Transmission Antenna Monochrome TV receiver / tuner RF-UHF, VHF tuner-Digital tuning techniques-AFT-IF Subsystems-AGC, noise cancellation- Video and Sound inter-carrier detection-Vision IFsubsystems-DC re-insertion-video amplifier circuits-Sync operation-typical sync processing circuits-Deflection current waveforms- Deflection Oscillators-Frame deflection circuits-requirements-line deflection circuits Eht-generation-Receivers antennas.

Unit III

ESSENTIALS OF COLOUR TELEVISION: Compatibility Colour Perception Three-color theory-Luminance, Hue and saturation- Colour television cameras-Values of Luminance and color difference signal-Colour television display tubes-delta-gun Precision in-line and Trinitron color picture tubes-Purity and Convergence-Purity and static and dynamic convergence Adjustment Pincushion-correction techniques-Automatic degaussing circuit-Gray scale tracking color signal transmission-Bandwidth-Modulation of color difference signal-Weighting factors-Formation of chrominance signals.

Unit IV

COLOUR TELEVISION SYSTEMS: NTSC color TV system, PAL-SECAM system color TV system-cancellation of phase errors- PAL-D Colour system PAL coder-PAL-Decoder receiver-chromo signal amplifier-separation of U and V signals, color burst separation-burst phase Discriminator-amplifier ACC-Reference Oscillator-Ident and color killer circuits-U and V demodulators-Colour signal matrixing- Sound in TV .

Unit V

ADVANCED TELEVISION SYSTEMS: Satellite TV technology-Geo Stationary Satellite's Satellite-Electronics-Domestic Broadcast System Cable TV Cable Cable Signal Sources Signal Processing, Distribution & Scrambling-Video Recording VCR Electronics-Video-Home Formats Video disc recording and playback DVD-Players of Teletext signal coding and broadcast Receiver-Digital Television-Transmission and reception-Projection Television Flat Panel display television receivers-LCD and plasma screen receivers- 3DTV EDTV.

Text Books

1. RRGulati, "Monochrome Television Practice Principles, Technology and servicing.", New Age International (P) Publishers, 3rd Edition 2006.
2. RRGulati, Monochrome & Colour Television, New Age International Publisher, 2003.

Reference Books

1. AM Dhaka, "The Television and Video Engineering", TMH, 2nd Edition, 2003.
2. RP Bali," Colour Television, Theory and Practice", Tata McGraw-Hill, 1994

12EC246 MICROPROCESSOR AND MICROCONTROLLER

Credits: 3:0:0

Course Objective:

- To introduce the architecture and programming of 8085, 8086 microprocessor and 8051 micro controller.
- To introduce the interfacing techniques of peripheral devices .

Course Outcome:

- Learners will be able to write programs using 8085, 8086 microprocessors and 8051 Microcontrollers.
- Knowledge about the interfacing techniques of peripheral devices

Unit I

8085 MICROPROCESSOR: Organization of 8085 microprocessor - Addressing modes-Instruction set – Simple Assembly Language programs.

Unit II

8085 MACHINE CYCLES: Machine cycles-Read, Write – Interrupt acknowledge – Bus Cycles-Timing diagram-Memory Interfacing.

Unit III

MICROPROCESSOR INTERFACING TECHNIQUES: Programmable parallel ports-8255 PPI - 8251A Programmable communication interface -8279 Programmable Keyboard/display interface- 8259A Programmable interrupt controller.

Unit IV

MICROCONTROLLER 8051: Organization of 8051 microcontroller - I/O ports - External memory – Interrupts – Addressing Modes - Instruction set – Simple Assembly language programs.

Unit V

APPLICATIONS: Counter and Timers of 8051- Serial data input and output of 8051-Simple applications – Analog to Digital convertor-Stepper motor- DC Motor.

Text Books

1. Ramesh.S.Gaonkar "Microprocessor Architecture, Programming & Applications With 8085/8080a", Penram International, 2006.
2. Kenneth J.Ayala, "The 8051 Microcontroller Architecture, Programming & Applications", Penram International Publishing, 2008.

Reference Books

1. Rafiquzzaman.M. "Microprocessor Theory and Applications-Intel and Motorola", PHI, 2007.
2. Muhammad Ali Mazidi,J.G.Mazidi,R.D.Mckinlay, "The 8051 Microcontroller and Embedded Systems" Prentice Hall, 2nd Edition 2007.

12EC247 MICROPROCESSOR AND MICROCONTROLLER LAB

Credit: 0:0:1

Course Objective:

- To learn about microprocessors and microcontrollers (8085 & 8051) programming and applications.

Course Outcome:

- Students will develop assembly level programming skills.
- Students will be able to apply interfacing techniques for various applications

(Any 6)

1. Arithmetic operations using 8085
2. Searching of given numbers using 8085
3. Digital to Analog Converter
4. Arithmetic operations using 8051
5. Code conversion using 8051
6. Analog to digital Converter

7. Stepper motor control using 8051
8. Dc Motor control using 8051

12EC248 MICRO ELECTRO MECHANICAL SYSTEMS

Credits: 3:0:0

Course Objective:

- To study the fundamentals of fabrication, design and applications of Micro Electro Mechanical Systems (MEMS)
- To introduce the historical background of development of MEMS technology and Micromachining.
- To study the process of surface micromachining.

Course Outcome:

- The students will be able to apply the principles of micro-sensors & micro-actuators in Real Time.

Unit I

MICRO FABRICATION AND BULK MICROMACHINING: Historical background of Micro Electro Mechanical Systems (MEMS) and micromachining – bulk micromachining – isotropic etching and anistropic etching, wafer bonding – high aspect ratio processes (LIGA).

Unit II

SURFACE MICROMACHINING: One or two sacrificial layer processes, Surface micromachining requirements –Pollysilicon surface micromachining – other compatible materials – SiliconNitride- Piezoelectric materials surface micro machined systems – Success stories – Micro motors –Gear Trains- Mechanisms.

Unit III

PHYSICAL MICRO SENSORS: Classification of Physical sensors – Integrated, Intelligent or smart sensors – Sensor principles and examples: Thermal sensors- Electrical sensors- Mechanical sensors-Chemical and Biosensors.

Unit IV

MICROACTUATORS: Electromagnetic and thermal micro actuation – mechanical design of Microactuators – Microactuator examples – Microvalves- Micropumps- Micromotors - Micro actuator systems – Ink Jet printer heads – Micro – Mirror TV Projector.

Unit V

APPLICATION AREAS: All mechanical miniature devices -3D electromagnetic actuators and sensors – RF electronic devices – Optical / Photonic devices – Medical devices : DNA – chip, micro arrays.

Text Books

1. Stephen D.Senturia, "Micro System Design", Kluwer Academic Publishers, 2001.
2. Tsu, "Micro Electro Mechanical Systems", 2006.

Reference Books

1. Marc Madou, "Fundamentals of Microfabrication", CRC Press, 1997.
2. Boston, "Micromachined Transducers Sourcebook", WCB McGraw Hill, 1998.
3. M.H.Bao, "Micromechanical Transducers: Pressure Sensors, Accelerometers, and Gyroscopes", Elsevier, Newyork, 2000.

12EC249 WIRELESS SECURITY

Credits: 3:0:0

Course Objective:

- To examine the various challenges in a wireless network due to active and passive attacks
- To learn various detecting schemes to overcome the security challenges

Course Outcome:

- This helps them to design a wireless network which is free from intrusion and mitigation
- Helps students to design a network with Robust and Ubiquitous security support

Unit I

ATTACKS ON ROUTING PROTOCOLS: Vulnerability of MANET to attack - review of AODV and DSR - type of attack - active and passive - internal and external - behaviour of malicious node - black hole- DoS- Routing table overflow- Impersonation- Energy consumption- Information Disclosure - Misuse type – Misuse goals – Security flaw in AODV -attack on AODV - wormhole and rushing attack

Unit II

INTRUSION DETECTION IN WIRELESS AD HOC NETWORKS: Problem in current IDS techniques - requirements of IDS - classification of IDS – Network and host based – anamoly detection- misuse detection- specification based - intrusion detection in MANETs using distributed IDS and mobile agents - Intrusion resistant routing algorithms .

Unit III

MITIGATING TECHNIQUES FOR ROUTING MISBEHAVIOR: Introduction – Dynamic Source Routing algorithm-Detection of misbehaving nodes-Watchdog- path rater-Evaluation metrices- throughput-overhead-false positives-Effects of false detection. packet leashes –defence against warm hole attacks-TIK protocol(Tesla with Instant Key disclosure protocol)- Rushing Attack Preventation

Unit IV

SECURE ROUTING PROTOCOLS: Self organized network layer security in MANETs - on demand secure routing protocol resilent to Byzantine failures – ARIADNE-SEAD.

Unit V

CHALLENGES IN ROUTING SECURITY: Security - Challenges and solutions - Providing Robust and Ubiquitous security support - Denial of service Attack at the MAC layer - Detection and handling of MAC layer Misbehavior.

Text Books

1. Siva Ram Murthy. C and Manoj. B.S, "AdHoc Wireless Networks: Architectures and Protocols", Prentice Hall PTR, 2004.
2. C.K.Toh, "Ad Hoc Mobile Wireless Networks-Protocols and Systems", Pearson Education, 2007.

Reference Books

1. Ivan Stojmenovic, "Handbook of Wireless Networks and Mobile Computing", Wiley, 2002.
2. Charles .E. Perkins, "AdHoc Networking", Pearson Education, 2008.

12EC250 FUNDAMENTALS OF NANOSCIENCE

Credits: 3:0:0

Course Objective:

- To make the students understand the importance, relevance and potentialities of this emerging field of study.

Course Outcome:

- Study the basic nano technology and nano science.
- Understand interdisciplinary nature of this field.
- Understand the important role of physics, chemistry, biology.
- Recognize that the rules of nano science are fundamentally different than those we experience.
- Study the basic fabrication strategies of nano science.

Unit I

INTRODUCTION: Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots- nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

Unit II

PREPARATION METHODS: Bottom-up Synthesis-Top-down Approach: Precipitation, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

Unit III

PATTERNING AND LITHOGRAPHY FOR NANOSCALE DEVICES: Introduction to optical/UV electron beam and X-ray Lithography systems and processes,
Wet etching, dry (Plasma /reactive ion) etching, Etch resists-dip pen lithography

Unit IV

PREPARATION ENVIRONMENTS: Clean rooms: specifications and design, air and water purity, requirements for particular processes, Vibration free environments: Services and facilities required. Working Practices, Sample cleaning, Chemical Purification, Chemical and Biological contamination, Safety Issues, Flammable and Toxic Hazards, Biohazards.

Unit V

CHARACTERISATION TECHNIQUES: X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation

Text Books

1. A.S. Edelstein and R.C. Cammearata, eds., "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, "Nanoscale charecterisation of surfaces & Interfaces", 2^{nd} Edition, Weinheim Cambridge, Wiley-VCH, 2000

Reference Books

1. G Timp (Editor), "Nanotechnology", AIP press/Springer, 1999
2. Akhlesh Lakhtakia (Editor), "The Hand Book of Nano Technology, Nanometer Structures – Theory, Modeling and Simulation" SPIE Press, 2004.

12EC251 BASICS OF MOBILE COMMUNICATION

Credits: 3:0:0

Course Objective:

- To introduce the mobile communication concepts using wireless medium for UG students.
- To introduce the basic concepts of mobile communication systems used under interference parameters
- To understand the concepts of medium to aid propagation in wireless medium.
- To introduce various modulation and mitigation techniques

Course Outcome:

- The students will be able to aware of the concepts of noiseless transmission and enhancement of number of users.

Unit I

BASICS OF CELLULAR MOBILE : Evolution of mobile communication – mobile radio systems – cellular concept – mobility and frequency management of radio in vehicle traffic environment – frequency reuse – channel assignment – co-channel interference – hand off – interference & system capacity – trunking & GOS.

Unit II

PROPAGATION FACTORS IN MOBILE RADIO : Large scale path loss – path loss models – link budget design – small scale fading – fading due to multipath – delay spread and coherent bandwidth – flat fading – frequency selective – fading due to Doppler spread – fast fading – slow fading – parameters of mobile multipath channels – time dispersion parameters.

Unit III

MODULATION TECHNIQUES & MITIGATION : MSK, GMSK – QPSK – M Ary QAM, performane of MSK modulation : Techniques – linear and nonlinear equalisation, algorithms of adaptive equalisation :diversity – time, frequency, polarization – diversity combiners – interleaving – RAKE receiver, OFDM.

Unit IV

CODING & MULTIPLE ACCESS METHODS : Vocoder- LPC-CELP- HELP- RELP – selection of codecs for mobile communication: GSM coders MA techniques: FDMA-TDMA-SDMA- CDMA power control – channel codes – (qualitative) comparison.

Unit V

SYSTEMS AND STANDARDS : 1G Analog systems, AMPS – 2G digital systems: GSM, NADC, JDC, IS-95, IS-136, Standards DECT, CDMA one, Bluetooth, GPRS, UMTS; FDD & TDD – 3G: WCDMA.

Text Books

1. William Y.Lee "Cellular Mobile Communication, Analog And Digital" Tata McGraw Hill, 1998.
2. Rappaport T.S "Wireless Communication" Pearson Education, 2003.

Reference Books

1. K.Feher, "Wireless Digital Communications", PHI, New Delhi,1995
2. Schiller, "Mobile Communications" Pearson Education Asia Ltd.,2000

12EC252 FUNDAMENTALS OF DIGITAL IMAGE PROCESSING

Credits: 3:0:0

Course Objective:

- To learn the fundamental concepts of Image processing techniques

Course Outcome:

- Can develop simple algorithms for image processing.
- Can use the various techniques involved in Medical applications,etc.

Unit I

Fundamentals of Image Processing: Fundamental steps and applications of digital image processing--Basic concepts in Sampling & Quantization-Representing Digital Images-Spatial & Gray-Level resolution – Neighbors of a pixel-Adjacency,Connectivity,Regions & Boundaries- Introduction to Two dimensional discrete Fourier Transform –Color Fundamentals-RGB color model-The HSI color model.

Unit II

Image Enhancement: Basic gray level transformations – Histogram Equalization – Enhancement using Arithmetic and logic operations-Use of first and second Derivatives for Enhancement .

Unit III

Image Segmentation: Point Detection-Line Detection-Edge Detection-Foundation of Thresholding – Role of Illumination-Region Based Segmentation : Region Growing-Region splitting & Merging.

Unit IV

Image Compression: Image Compression models – Variable Length Coding: Huffman Coding-Arithmetic coding-LZW Coding-Basics of Image compression standards: JPEG, MPEG.

Unit V

Morphological Image Processing: Introduction to Dilation & Erosion – Introduction to Opening & Closing – Basic Morphological Algorithms: Boundary Extraction-Region Filling-Thinning - Thickening

Text Book

1. Rafael C.Gonzalez and Richard E. Woods, "Digital Image Processing", PHI 2nd Edition, 2002.
2. Anil K.Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, 9th Edition, Indian Reprint, 2002

Reference Books

1. William, K.Pratt, "Digital Image Processing", John Wiley and Sons, 3rd Edition,2002
2. Wilhelm Burger and Mark J. Burge, "Principles of Digital Image Processing: Fundamental Techniques", Springer, 1st Edition, 2nd Reprint, 2009.

12EC253 DIGITAL INTEGRATED CIRCUITS

Credits: 3:0:0

Course Objective

- To learn the fundamentals of Digital Design concepts

Course Outcome

- Able to design simple digital application circuits.

Unit I

Number Systems: Need for binary numbers - Conversions: binary to decimal - decimal to binary - octal to decimal- decimal to octal - hexadecimal to binary and vice versa. ASCII code - Excess-3 code -Graycode. Arithmetic Circuits: Binary Addition – subtraction – multiplication – division – signed -unsigned numbers - 2's complement arithmetic - arithmetic building blocks: adder - subtractor.

Unit II

Logic Circuits Analysis And Design: Binary number system- NOT, OR, AND, NAND, NOR gates, Boolean algebra - laws and theorems, sum of products - products of sum method - Karnaugh map. Data Processing Circuits:Multiplexer – Demultiplexer – Decoder – Encoder - XOR gate - Parity Generator and Checker.

Unit III

Digital ICs: TTL circuits and CMOS circuits - 7400 devices - TTL parameters - AND-OR-invert gate – open collector gates - Three state TTL devices - External drive for TTL loads -

positive and negative logic - CMOS Circuits: E-type MOSFET - MOS inverter - 74C00 CMOS characteristics – TTLCMOS interface - TTL clock.

Unit IV
Flip flops: RS, JK and D Flip-flops - Schmitt trigger - Types of shift register - synchronous and asynchronous counter.

Unit V
Memories: Semiconductors Memories: Memory Addressing - ROMs, PROMs, EPROMs, RAMs - DRAMs, memory cells. (In all the five units, trouble-shooting section not included)

Text Book

Albert Paul Malvino and Donald P. Leech, Digital Principles and Applications, 4^{TH} Edition, Tata McGraw Hill, 2006.

Reference Book:

M. Morris Mano, Digital Logic and Computer Design, Fourth Edition, Prentice-Hall of India Private Limited, 2007.

12EC254 EMBEDDED SYSTEMS

Credits: 3:0:0

Course Objective:

- To learn about Real time Embedded system, Programming languages and tools

Course Outcome:

- The student will be able to do embedded projects

Unit I
Introduction to Embedded Systems: An Embedded System – Processor in the System – Other hardware units – Software embedded into a System – Exemplary Embedded Systems - Embedded System On Chip and in VLSI circuit

Unit II
Real Time Systems: Introduction – Issues in Real time Computing – Structure of a Real Time System – Architecture of Real Time Systems – Performance measures for Real Time Systems – Properties of Performance Measures

Unit III
Real Time Operating Systems: Task and Task States, tasks and data, semaphores and shared Data Operating system Services-Application of Semaphores -Message queues-Timer Function-Events – Memory management

Unit IV
Programming Languages and Tools: Language features-Programming environments-Introduction to-assembler-compiler-cross compilers and Integrated Development Environment (IDE). Simulators, Emulators.

Unit V

Programming Concepts and Embedded Programming in C and C++: Software programming in Assembly Language and in High level language – C Program Elements – Queues – Stacks – lists and ordered lists – Embedded programming in C++.

Text Books

1. W. Valvano ,Thomson Brroks,"Embedded Microcomputer Systems", Jonathan, 1st Edtion, 2002
2. Jane W.S. Liu, "Real Time Systems", Pearson International Edition, 1st Indian Reprint, 2001

Reference Books

1. C.M. Krishna, Kang G. Shin, "Real Time systems", McGraw Hill, 2 nd Edition, 2005.
2. Raj Kammaal, "Embedded System" McGraw Hill, 1st Edition, 2003.

12EC255 BASIC VLSI DESIGN

Credits: 3:0:0

Course Objective:

- The purpose of this course is to give an exposure to the standard algorithms for VLSI Physical design Automation.

Course Outcome:

- Introduction to VLSI Design Automation Tools
- Students will know various Placement and Routing Algorithms, Floor Planning Algorithms
- Simulation and Logic Synthesis Concepts
- High Level Synthesis

Unit I

Overview of VLSI Design Methodology: VLSI Design Process – Arcitectural Design – Logical Design – Physical Design – Layout Styles – Full Custom Semi Custom Approaches – Overview of wafer fabrication – Wafer processing – Silicon gate NMOS process – CMOS process – N well – P well – Twin Tub – Silicon On Insulator

Unit II

Layout Design: MOS & CMOS Layers – stick diagram – design rules & layout – subsystems design: switch logic – gate logic, combinational logic design example:passing generator – bus arbitration logic multiplexers – gray to binary code converter –sequential circuit example: two phase clocking – dynamic register element – dynamic shift register

Unit III

Design of System: PLA – Finite state machine – PLA based finite state machine design – design of 4-bit shifter – design of ALU subsystem: adders – multiplexers – memory: dynamic shift register – dynamic RAM cells – one transistor dynamic memory cell – 4*4 bit register array

Unit IV

Tools for Design: Grounds rules for successful design – design styles & philosophy – CAD tools for design & simulation: textual entry layout language – graphical entry layout – design verification – design rule checkers – simulators – tests & testability.

Unit V

CMOS Design Projects & Fast VLSI Circuits: Incremental/decremental – left/right – serial/parallel shift register – comparator – GaAs device – layout design for GaAs devices.

Text Book

1. Pucknell D.A., & Eshraghian K., "Basic VLSI Design", PHI, Third edition,2007.

Reference Book

1. Neil H E West and Kamran Eshranghian, "Principles of CMOS VLSI Design : A System Perspective", Addison Wesley, 2nd edition, 2002

12EC256 OPTO ELECTRONIC DEVICES

Credits: 3:0:0

Course Objective:

- To learn different types of optical emission, detection, modulation and opto electronic integrated circuits and their applications.

Course Outcome:

- To know the basics of solid state physics and understand the nature and characteristics of light.
- To understand different methods of luminescence, display devices and laser types and their applications.
- To learn the principle of optical detection mechanism in different detection devices.
- To understand different light modulation techniques and the concepts and applications of optical switching.
- To study the integration process and application of opto electronic integrated circuits in transmitters and receivers.

Unit I

Elements Of Light And Solid State Physics: Wave nature of light – Polarization – Interference – Diffraction - Light Source - review of Quantum Mechanical concept - Review of Solid State Physics - Review of Semiconductor Physics and Semiconductor Junction Device.

Unit II

Display Devices And Lasers: Introduction - Photo Luminescence - Cathode Luminescence - Electro Luminescence – Injection Luminescence - Injection Luminescence - LED, Plasma Display - Liquid Crystal Displays - Numeric Displays - Laser Emission – Absorption – Radiation - Population Inversion – Optical Feedback - Threshold condition - Laser Modes - Classes of Lasers - Mode Locking – laser applications.

Unit III

Optical Detection Devices: Photo detector - Thermal detector - Photo Devices - Photo Conductors - Photo diodes – Detector Performance.

Unit IV

Optoelectronic Modulator: Introduction - Analog and Digital Modulation - Electro-optic modulators - Magneto Optic Devices - Acoustoptic devices – Optical - Switching and Logic Devices.

Unit V

Optoelectronic Integrated Circuits: Introduction - hybrid and Monolithic Integration - Application of Opto Electronic Integrated Circuits - Integrated transmitters and Receivers - Guided wave devices.

Text Book

1. J. Wilson and J.Haukes, "Opto Electronics – An Introduction", Prentice Hall of India Pvt. Ltd., New Delhi, 2003.

Reference Books

1. Bhattacharya "Semiconductor Opto Electronic Devices", Prentice Hall of India Pvt., Ltd., New Delhi, 1995.
2. Jasprit Singh, "Opto Electronics – As Introduction to materials and devices", cGraw-Hill International Edition, 1998.

12EC257 COMMUNICATION ENGINEERING

Credits: 3:0:0

Course Objective:

- To introduce the basic concepts of Digital Communication modulation to baseband signals,
- To learn about the fundamental concepts in Mobile communication, Satellite Communication and Optical communication.

Course Outcome:

- It will help to enable the student to become familiar with different types of communications services.

Unit I

Introduction: Need for wireless transmission and modulation – Concept of baseband and bandwidth – Multichannel Transmission-Modulation of AM signals-Demodulation of AM signals -Modulation of FM signals- Demodulation of FM signals-Noise in Communication Networks-Noise and interference – Thermal noise and shot noise – signal to noise ratio – Noise figure – Equivalent noise BW – Available noise power density – Noise temperature.

Unit II

Digital Communication: Review of Sampling Theorem, PAM and TDMA Principles, Quantization, PCM, DPCM and Delta Modulation-Adaptive Delta Modulation

Unit III

Mobile Communication Systems: Cellular engineering concepts– Frequency Reuse-Channel Assignment, Co-channel interference and Handoff-GSM Architecture.

Unit IV

Elements of Satellite Communication: Satellite systems, Orbital description and Orbital mechanics of LEO, MEO and GEO, Placement of a satellite in a GSO, Satellite – description of different Communication Subsystems, Bandwidth allocation.

Unit V

Optical Communication: Overview of optical communication - Need for optical communication – Comparison with the electrical communication - Snell's law – Critical angle – Acceptance angle – Numerical Aperture.Types of fibers: Step and Graded index fibers. Wave propagation in multi mode and single mode optical fibers –Attenuation – dispersion – Polarization.

Text Book

1. Simon Haykins, "Digital Communications", John Wiley, 1st edition, Reprinted, 2004.

Reference Books

1. Lathi B.P., "Introduction to Communication Systems", John Wiley Sons Inc., 19th reprint, 1992.
2. T.S.Rappaport,"Wireless digital communications; Principles and practice", PrenticeHall,NJ,1996.
3. Dennis Roddy, "Satellite Communications", McGraw -Hill International. 4th Edition,2006.
4. Gerd Keiser, "Optical Fiber Communication" McGraw -Hill International, Singapore, 3rd Edition, 2000.

12EC258 FUNDAMENTALS OF SIGNALS AND SYSTEMS

Credits: 3:0:0

Course Objective:

- It introduces the fundamentals of continuous-time and discrete-time signals as well as systems.
- It also deals with Fourier analysis of signals and systems.

Course Outcome:

- The concepts studied can be applied to real time signal processing.

Unit I

Signals and Systems: Continuous Time (CT) signals – CT signal operations – Representation of CT signals by samples – Sampling Theorem, Discrete Time (DT) signals – Representation of DT signals by impulses –DT signal operations – CT and DT systems – Properties of the systems

Unit II

Linear Time Invariant Systems: Introduction – Discrete Time LTI systems: Convolution sum – Continuous Time LTI systems: Convolution Integral – Properties of Linear Time-Invariant systems – Causal LTI systems described by differential and difference equations

Unit III

Fourier analysis of CT Signals and Systems: Fourier series representation of periodic signals – Properties – Harmonic analysis of LTI systems –Representation of a periodic signals by Continuous Time Fourier Transform (CTFT) –Properties – Frequency response of systems characterized by Differential Equations

Unit IV
Fourier analysis of DT Signals and Systems: Discrete Time Fourier series representation of DT periodic signals – Properties – Representation of DT aperiodic signals by Discrete Time Fourier Transform(DTFT) – Properties – Frequency response of systems characterized by Difference Equations

Unit V
Transform Operations of DT Signals and Systems: Z transform and its properties – Region of convergence of Z transform – The inverse Z Transform Some common Z transform pairs - Analysis and Characterization of LTI system using the Z transform – System function algebra and block diagram representation – Unilateral Z transform.

Text Books

1. Simon Haykin and Barry Van Veen, “Signals & Systems”, John Wiley and Sons Inc., 2005.
2. Alan V Oppenheim, Alan S Wilsky and Hamid Nawab S, “Signals & Systems”, 2^{nd} Edition, PHI, New Delhi, 1997.

Reference Book

1. Rodger E. Ziemer, William H. Tranter and D. Ronald Fannin, “Signals and Systems – Continuous and Discrete”, Fourth Edition, Pearson Education Inc., 1998.

12EC259 ELECTRON DEVICES LAB

Credits: 0:0:2

Course Objective:

- To learn practically about different Electron Devices and its operation.
- They will also learn the basics SPICE software

Course Outcome:

- Students will be able to understand the device characteristics and help them to develop experimental skills.
- Students will be able to do various electronics based projects.

1. Study of CRO
2. Characteristics of PN Junction diode, Zener diode
3. Characteristics of Photo diode
4. Characteristics of BJT
5. Characteristics of Triac, SCR
6. DC Analysis of Electric Circuits
7. AC Analysis of Electric Circuits
8. Rectifiers

9. Characteristics of UJT, FET
Implementation of the above using PSPICE & Hardware

12EC260 ELECTRONICS AND MICROPROCESSORS

Credits: 4:0:0

Course Objective:

- To learn about various semiconductor devices, transducer and measuring Instruments and microprocessors applications.

Course Outcome:

- On successful completion of the subject, students will be able to analyse basic electronic circuits and write simple microprocessor based programs.

Unit I

Review Of Semiconductor Devices-Electronics Circuits (Qualitative Study Only): Circuitry and description of half wave and full wave rectifier – Capacitor and inductor filter – zener regulator-I.C. voltage regulators. Transistor Amplifiers:CB, CE, and CC configurations -Biasing Circuits RC coupled amplifier FET amplifiers - power amplifiers – Classification-class A and B Push Pull Configurations. Oscillators, Barkihausen criterion- Colpits-Wien bridge and phase shift oscillators-OP-amp comparators.

Unit II

Transducer And Measuring Instruments (Qualitative Study Only): Classification-working principle of potentimeter, strain gauges, piezoelectric crystals, thermistors, photodiodes, phototransistors- Study of working principle (using block diagram of multimeters, digital voltmeters, signal generators, CRO)

Unit III

Digital Electronics: Comparison between analog and digital systems-Number representation–Logic gates-Flip-flops- Registers, Counters, Multiplexers, Decoders, and Encoders-Half and full adders, Half and full subtractor.

Unit IV

Introduction to Microprocessor: Block diagram of Microcomputer - Architecture of Intel 8085 - Instruction formats, Addressing methods- types of Instruction - Intel 8085 - Instruction set - Development of simple assembly language programs and examples.

Unit V

I/O Devices: Memory and I/O devices and interfacing RAM, ROM, EPROM - Printers-I/O ports-Key boards- Asynchronous and synchronous data transfer schemes-interrupt driven data transfer- DMA data transfer-Simple applications of Microprocessors.

Text Books

1. Albert Malvino, David A Bates, “Electronic Principles”, Tata McGraw Hill, Seventh Edition, 2008.

2. Adithya P. Mathur, "Introduction to Microprocessor", Tata McGraw Hill, 6th Edition, 2002.
3. Morris Mano, "Digital logic and computer Design", 3rd edition Prentice Hall Of India,2002.

Reference Book

1. Kalsi H S "Electronics Instrumentation" ,Tata Mcgraw Hill, 2nd Edition reprint 2006

12EC261 ELECTRONICS AND MICROPROCESSOR LAB

Credit: 0:0:1

Course Objective:

- To learn practically about different Electron Devices and its operation, basics of digital circuits and microprocessors.

Course Outcome:

- Students will be able to understand the basics of electronics to do various electronics based projects.

Any 6 experiments

1. Characteristics of semi conductor diode.
2. Characteristics of zener diode.
3. Study of Half -Wave and Full-Wave rectifier
4. Study of Bridge Rectifiers.
5. Transistors as a Switch and Amplifier
6. Operational amplifier Configurations: Adder, Integrators, and Current to Voltage
7. Converters.
8. Verifications of truth tables of logic gates AND, OR, NOT, NAND exclusive OR.
9. Combination logic realisation: Adder, Subtrator.
10. Sequential logic: Counters, Shift Registers with display devices.
11. Study of Microprocessor Kits.
12. Arithmetic operations on 8085.
13. StepperMotor Interface.
14. Display Interface

12EC301 STATISTICAL DIGITAL SIGNAL PROCESSING

Credits: 3:1:0

Course Objective:

- To learn the concepts of signal processing and analyze the statistical properties of signals

Course Outcome:

- Will be able to solve the practical signal applications.

Unit I

Discrete Random Signal Processing: Discrete Random Processes - Expectations – Variance - Co-Variance - Scalar Product – Energy of Discrete Signals - Parseval's Theorem - Wiener Khintchine Relation-Power Spectral Density - Periodogram - Sample Autocorrelation - Sum Decomposition Theorem - Spectral Factorization Theorem - Discrete Random Signal

Processing by Linear Systems-Simulation of White Noise - Low pass Filtering of White Noise.

Unit II

Spectrum Estimation: Non-Parametric Methods-Correlation Method-Co-Variance Estimator-Performance Analysis of Estimators - Unbiased - Consistent Estimators - Periodogram Estimators - Barlett Spectrum Estimation - Welch Estimation - Model based Approach - AR - MA - ARMA Signal Modeling- Parameter Estimation using Yule - Walker Method.

Unit III

Linear Estimation And Prediction: Maximum likelihood criterion - Efficiency of estimator - Least mean squared error criterion- Wiener filter - Discrete Wiener Hoff equations - Recursive estimators - Kalman filter – Linear Prediction - Prediction Error - Whitening filter - Inverse filter - Levinson recursion – Lattice realization and Levinson Recursion algorithm for solving Toeplitz System of equations.

Unit IV

Adaptive Filters: FIR adaptive filters - Newton's steepest descent method - Adaptive filter based on steepest descent method - Windrow Hoff LMS adaptive algorithm - Adaptive channel equalization - Adaptive echo chancellor - Adaptive noise cancellation - RLS adaptive filters – Exponentially Weighted RLS - Sliding window RLS - Simplified IIR LMS Adaptive filter.

Unit V

Multirate Digital Signal Processing: Mathematical description of change of sampling rate-Interpolation and Decimation-continuous time model - Direct digital domain approach - Decimation by an integer factor - Interpolation by an integer factor - Single and multistage realization - Poly phase realization - Application to sub band coding - Wavelet transform and filter bank implementation of wavelet expansion of signals.

Text Book

1. Monson H.Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley and Sons Inc., New York, Reprint, 2008.

Reference Books

1. John G.Proakis, Dimitris G.Manolakis, "Digital Signal Processing", Prentice Hall of India, 4th Edition, 2007.
2. P.P Vaithyanathan, "Multirate systems and filter Banks", Prentice Hall of India, 1993.

12EC302 CMOS DIGITAL INTEGRATED CIRCUIT DESIGN

Credits: 4:0:0

Course objective:

- To study the basic concepts of MOS transistors,
- Understand circuit characterization and performance estimation
- Know about CMOS circuit and logic design, Systems design and design methods and CMOS subsystem design

Course outcome:

- Good understanding of CMOS VLSI design concepts.
- the course would help to arouse student's interest in the area of VLSI design.

Unit I

Introduction to CMOS circuits: MOS Transistors, MOS Transistor Switches -CMOS Logic - Circuit and System Representations - MOS Transistor Theory - MOS Device Design Equations - Complementary CMOS Inverter - DC Characteristics - Static Load MOS Inverters - Differential Inverter- Transmission Gate – Tri State Inverter - Bipolar Devices.

Unit II

Circuit characterization and performance estimation: Introduction, Estimation of Resistance - Capacitance and Inductance, Switching – Characteristics –MOS Gate Transistor Sizing - Power Dissipation - Routing Conductors - Charge Sharing -Design Margining – Reliability - Scaling of MOS transistor dimensions.

Unit III

CMOS circuit and logic design: CMOS Logic Gate Design - Basic Physical Design of Simple Gate - CMOS Logic Structures - Clocking Strategies, I/O Structures - Low Power Design.

Unit IV

Systems design and design method: Design Strategies - CMOS Chip Design Options - Design Methods - Design Capture Tools- Design Verification Tools- Design Economics- Data Sheets- CMOS Testing – Manufacturing Test Principles- Design Strategies for Test- Chip Level Test Techniques- System Level Test Techniques- Layout Design for Improved Testability.

Unit V

CMOS sub system design: Data Path Operations-Addition/Subtraction- Parity Generators- Comparators- Zero/One Detectors- Binary Counters- ALUs- Multiplication- Shifters- Memory Elements- Control- FSM- Control Logic Implementation.

Texts Book

1. N. Weste and K. Eshranghian "Principles of CMOS VLSI Design: A Systems Perspective", Pearson Education India, 2008.

Reference Books

1. Jacob Backer, Harry W.Li and David E.Boyce, "CMOS Circuit Design- Layout and Simulation", John Wiley & Sons, 2008.
2. S. M. Kang, Y. Lablebici, "CMOS Digital Integrated Circuits Analysis & Design",McGraw Hill, 2003.

12EC303 MODERN DIGITAL COMMUNICATION TECHNIQUES

Credits: 4:0:0

Course Objective:

- To understand the various digital communication concepts like coherent and non-coherent- band limited channels
- To analyze block coded and convolution code and spread spectrum signals.

Course Outcome:

- Understanding of various digital communication techniques.
- Understanding spread spectrum signals and its application for digital communication.

Unit I

Coherent and Non-Coherent Communication: Coherent receivers – Optimum receivers in WGN – IQ modulation & demodulation –Noncoherent receivers in random phase channels; M-FSK receivers – Rayleigh and Rician channels – Partially coherent receivers – DPSK; M-PSK; M-DPSK--BER Performance Analysis.

Unit II

Bandlimited Channels and Digital Modulations: Eye pattern; demodulation in the presence of ISI and AWGN; Equalization techniques – IQ modulations; QPSK; QAM; QBOM; -BER Performance Analysis. – Continuous phase modulation; CPFM, CPFSK, MSK-OFDM. Matched filter

Unit III

Block Coded Digital Communication: Architecture and performance – Binary block codes; Orthogonal; Biorthogonal; Transorthogonal – Shannon's channel coding theorem; Channel capacity theorem - Coded BPSK and DPSK demodulators – Linear block codes; Hamming-Cyclic codes- Golay codes- Cyclic BCH - Reed –Solomon codes.

Unit IV

Convolutional Coded Digital Communication: Representation of codes using Polynomial-State diagram- Tree diagram- and Trellis diagram – Decoding techniques Maximum likelihood- Viterbi algorithm- Sequential decoding; Turbo Coding-BCJR algorithm.

Unit V

Spread Spectrum Signals for Digital Communication: Model of spread Spectrum Digital Communication System-Direct Sequence Spread Spectrum Signals- Error rate performance of the coder- Generation of PN Sequences and its properties - Frequency Hopped Spread Spectrum Signals- Performance of FH Spread Spectrum Signals in an AWGN Channel-Synchronization of Spread Spectrum Systems.

Text Books

1. M.K.Simon, S.M.Hinedi and W.C.Lindsey, "Digital communication techniques; Signaling and detection; Prentice Hall India, New Delhi, 1995.
2. Bernad Sklar, "Digital Communication – Fundamentals and Applications", Pearson Education, India, 2001.

Reference Books

1. Simon Haykin, "Digital communications", John Wiley and sons, 1998
2. B.P.Lathi, "Modern digital and analog communication systems", 3rd Edition, Oxford University press, 1998.
3. John G. Proakis, "Digital Communications" 4th Edition, McGraw-Hill, New York, 2003.

12EC304 MULTIMEDIA COMPRESSION TECHNIQUES

Credits: 4:0:0

Course Objective:

- To learn about the various compression techniques for audio signals, video signals and text data.

Course Outcome:

- Able to understand the concept of requirement for memory space reduction
- Able to develop efficient algorithms for compression

Unit I

Introduction: Special features of Multimedia – Graphics and Image Data Representations – Fundamental Concepts inVideo and Digital Audio – Storage requirements for multimedia applications -Need for Compression -Taxonomy of compression techniques – Overview of source coding, source models, scalar and vectorquantization theory – Evaluation techniques – Error analysis and methodologies

Unit II

Text Compression: Compaction techniques – Huffmann coding – Adaptive Huffmann Coding – Arithmatic coding – Shannon-Fano coding – Dictionary techniques – LZW family algorithms.

Unit III

Audio Compression: Audio compression techniques - μ- Law and A- Law companding. Frequency domain and filtering –Basic sub-band coding – Application to speech coding – G.722 – Application to audio coding – MPEG audio, progressive encoding for audio – Silence compression, speech compression techniques – Formant and CELP Vocoders.

Unit IV

Image Compression: Predictive techniques – DM, PCM, DPCM: Optimal Predictors and Optimal Quantization – Contourbased compression – Transform Coding – JPEG Standard – Sub-band coding algorithms: Design of Filter banks – Wavelet based compression: Implementation using filters – EZW, SPIHT coders – JPEG 2000 standards - JBIG, JBIG2 standards.

Unit V

Video Compression: Video compression techniques and standards – MPEG Video Coding I: MPEG – 1 and 2 – MPEG Video Coding II: MPEG – 4 and 7 – Motion estimation and compensation techniques – H.261 Standard – DVI technology – PLV performance – DVI real time compression – Packet Video.

Text Book

1. Khalid Sayood: Introduction to Data Compression, Morgan Kauffman Harcourt India, 2nd Edition, 2000.

Reference Books

1. Peter Symes : Digital Video Compression, McGraw Hill Pub., 2004.
2. Mark Nelson : Data compression, BPB Publishers, New Delhi,1998.
3. Mark S.Drew, Ze-Nian Li : Fundamentals of Multimedia, PHI, 1st Edition, 2003.

12EC305 HARDWARE DESCRIPTION LANGUAGES

Credits: 4:0:0

Course Objective:

- To know about the various flow of VHDL and Verilog programming techniques and synthesis

Course Outcome:

- Knowledge in VHDL Programming and Verilog Programming
- Knowledge in synthesizing circuits using HDL

Unit I

Introduction To VHDL Data Flow And Structural Modeling: VHDL Overview – FPGA Design Flow Process – Software Tools - Xilinx Tool Flow – Libraries – Data Objects - Data Types – Data Operators – Entities – Architectures. Basic Concurrent Statements – Signal Assignment Statements – Conditional Signal Assignment – Selected Signal Assignment – Usage of Blocks In Dataflow Modeling. Component Declarations – Component Instantiation – Types of Component Instantiation- Test Benches – Combinational & Sequential Test Benches.

Unit II

Behavioral Modeling & Packages: Process – Delays – Basic Sequential Statements – If, If Else Statements, Case Statements – Loops – For Loop, While Loop, Next, Exit, Null Statements – Usage of Variables Inside The Process –Multi Process Statements – Generics – Operator Overloading – Conversion Functions – Attributes – File Concepts - Packages – Functions & Procedures – Predefined & User Defined Library Implementations.

Unit III

Introduction to Verilog HDL: Design Methodology – Module – Ports – Basic Concepts – Operators – Nos. Specification – Data Types – Arrays – Parameters – Gate Delays – Operator Types – Conditional Statements – Multiway Branches - Loops - Switch – Modeling Elements -Dataflow Modeling- Continuous Assignment. Delays, Expression, Operators and Operands.

Unit IV

Modeling With Verilog HDL: Behavioral Modeling-Procedural Assignments, Timing Controls, Loops- Implementation of Basic Circuit Using Dataflow & Behavioral Modeling. Switch Level Modeling. Applications of all Dataflow, Behavioral and Structural Modeling in FPGA – FSM Implementation – Test Benches.

Unit V

HDL Synthesis: VHDL Synthesis: Synthesis basics-modeling a wire- modeling combinational logic- modeling sequential logic- Modeling Flip-flop-Flip-flop with Synchronous Preset and clear- Flip-flop with Asynchronous Preset and clear-Modeling a latch. Verilog Synthesis: Synthesis of combinational logic-synthesis of sequential logic with latches and flip flops- synthesis of explicit and implicit state machines- Synthesis of gated clocks and clock enables synthesis of Loops.

Text Books

1. M.D. Ciletti, “Advanced Digital Design with the VERILOG HDL” PHI.2008
2. J. Bhaskar, “A VHDL Synthesis Primer”, BS Publications, II Edition, 2001.

Reference Books

1. Kevin Skahill ”VHDL for Programmable Logic” Pearson Publications,2004.
2. SamirPalnitkar, “Verilog HDL”, Pearson Publication, II Edition. 2003.
3. Douglas Perry, “VHDL”, 3rd Edition, McGraw Hill 2001.

12EC306 DIGITAL IMAGE PROCESSING

Credits: 4:0:0

Course Objective:

- To study the basics and techniques of digital image processing

Course Outcome:

- Students will be able to apply and develop new techniques in the areas of image enhancement restoration- segmentation- wavelet processing and image morphology.

Unit I

Fundamentals of Image Processing: Elements of visual perception - Image sensing and acquisition – Sampling and Quantization- Pixel relationships - Color fundamentals and models – Separable image transforms – DFT- DCT - Walsh- Hadamard- Haar – Karhunen Loeve and SVD

Unit II

Image Enhancement and Restoration: Histogram equalization & matching - Image smoothening and sharpening (spatial & frequency domain) - Homomorphic filtering - Model of image degradation/restoration process – Noise models – Inverse filtering - Least mean square filtering – Constrained least mean square filtering –Pseudo inverse – Kalman filtering.

Unit III

Image Segmentation and Feature Analysis: Edge detection – Edge linking and boundary Detection – Intensity and histogram based image segmentation - Region based segmentations – Contour based segmentation – Motion segmentation - Feature analysis and extraction – spatial techniques for shape and texture feature extraction.

Unit IV

Multi Resolution- Wavelets and Morphological Processing: Image Pyramids – Sub-band coding - Multi resolution expansion – Wavelet transforms in two dimensions – Wavelet Packets – Dilation and Erosion – Opening and Closing – Hit-or-Miss transformations - Morphological Algorithms

Unit V

Applications of Image Processing: Image classification – Image recognition – Image understanding – Image fusion – Image registration - Steganography – Digital compositing – Mosaics – Content based image retrieval - Color image processing –Video motion analysis.

Text Book

1. Rafael C. Gonzalez, Richard E. Woods, “Digital Image Processing”, Pearson Education, 2nd Edition, 2003.

Reference Books

1. A.K. Jain, “Fundamentals of Digital Image Processing”, Pearson Education, 2003.
2. William K. Pratt, “Digital Image Processing”, John Wiley 2001.
3. B. Chanda, D. Dutta Majumder, “Digital Image Processing and Analysis”, Prentice Hall of India,2000
4. Milan Sonka, Vaclav Hlavac, Roger Boyle, “Image Processing Analysis and Machine Vision”, Thompson Learning, 2008.

12EC307 EMBEDDED SYSTEM DESIGN

Credits: 4: 0: 0

Course Objective:

- To learn the method of designing a real time systems

Course Outcome:

- The course would help to develop a new embedded real system design

Unit I

Embedded Architecture: Embedded Computers- Characteristics of Embedded Computing Applications- Challenges in Embedded Computing system design- Embedded system design process- Requirements- Specification- Architectural Design- Designing Hardware and Software Components- System Integration- Formalism for System Design- Structural Description- Behavioral Description- Design Example: Model Train Controller

Unit II

Embedded Processor and Computing Platform: ARM processor- processor and memory organization- Data operations- Flow of Control SHARC processor- Memory organization- Data operations- Flow of Control- parallelism with instructions- CPU Bus configuration- ARM Bus- SHARC Bus- Memory devices- Input/output devices- Component interfacing- designing with microprocessor development and debugging- Design Example : Alarm Clock.

Unit III

Networks: Distributed Embedded Architecture- Hardware and Software Architectures- Networks for embedded systems- I2C- CAN Bus- SHARC link ports- Ethernet- Myrinet- Internet- Network Based design- Communication Analysis- system performance Analysis- Hardware platform design- Allocation and scheduling- Design Example: Elevator Controller.

Unit IV

Real Time Characteristics: Clock driven Approach- weighted round robin Approach- Priority driven Approach- Dynamic Versus Static systems- effective release times and deadlines- Optimality of the Earliest deadline first (EDF) algorithm- challenges in validating timing constraints in priority driven systems- Offline Versus On-line scheduling.

Unit V

System Design Techniques: Design Methodologies- Requirement Analysis- Specification- System Analysis and Architecture Design- Quality Assurance- Design Example: Telephone

PBX- System Architecture- Ink jet printer- Hardware Design and Software Design- Personal Digital Assistants- Set-top Boxes.

Text Book

1. Wayne Wolf, "Computers as Components: Principles of Embedded Computing System Design", Morgan Kaufman Publishers, 2001.

Reference Books

1. Jane.W.S. Liu, "Real,Time systems", Pearson Education Asia, 2000
2. Frank Vahid, Tony Givargi, "Embedded System Design: A Unified Hardware/Software Introductions", John Wiley & Sons, 2000.

12EC308 HIGH PERFORMANCE NETWORKS

Credits: 4:0:0

Course Objective:

- To study internet protocols, ATM and some advanced networks like optical and wireless network.

Course Outcome:

- It will be helpful to perform different operations in communication networks

Unit I

Packet - Switched Networks: OSI and IP models - Ethernet (IEEE802.5) - Token Ring - FDDI - DQDB - Frame Delay - SMDS - Internet and TCP/IP Networks: The Internet - Overview of Internet Protocols - Internet Protocol - TCP and UDP - Internet Success and Limitation - Performance of TCP/IP Network.

Unit II

Circuit Switched Networks: Performance of Circuit Switched Networks - SONET – Dense Wave Division Multiplexing (DWDM) - Fiber to the Home - Digital Subscriber Line (DSL) - Intelligent Networks – CATV.

Unit III

ATM: Main Features of ATM - Addressing Signaling & Routing - Header Structure – ATM Adaptation layer - Management control - BISDN - Internetworking with ATM

Unit IV

Wireless Networks: Introduction - The wireless channel - Link level design - Channel access - Network design - Wireless Networks - Future and standards

Unit V

Optical Networks: Optical Links - DWDM Systems - Optical Cross Connects – Optical LANs-Optical paths and Networks

Text Book

1. Jean Walrand and Pravin Varaiya ,"High Performance Communication Networks", 2nd Edition, Harcourt and Morgan Kauffman,London,2000.

Reference Books

1. Sumit Kasera, Pankaj Sethi, “ATM Networks ", Tata McGraw-Hill, New Delhi, 2000.
2. Rainer Handel, Manfred N.Huber and Stefan Schroder, “ATM Networks”, 3rd Edition, Pearson Education Asia, 2002.

12EC309 MEMS AND NANO TECHNOLOGY

Credit: 4:0:0

Course Objective:

- To learn about the emerging fields of MEMS and Nanotechnology
- To understand the concepts involved in realizing various types of Micro and nano-devices and their applications.

Course Outcome:

- Students are expected to learn physical principles involved in micro and nano-sensors
- Will be able to design a suitable sensor for a given application.

UNIT I
Introduction to MEMS and Micro Systems
Microsystems and Microelectronics – Miniaturization – Microsensors: Chemical Sensors- Optical Sensors- Pressure Sensors- Thermal Sensors – Microactuators and Micromotors.

UNIT II
Microsystem Materials
Molecular Theory and Intermolecular Forces – Silicon Piezo Resistors – Electrochemistry – Substrates and Wafers – Silicon Compounds – Polymers – Packaging Materials.

UNIT III
Microsystem Fabrication Process
Photolithography – Ion Implantation – Diffusion – Oxidation – Chemical Vapor Deposition – Etching – Applications Of MEMS in Automatic- Telecom and Other Industries.

UNIT IV
Nanotechnology Basics
Nanobuilding Blocks – Atoms and Molecular Structure – Molecular Recognition – Tools For Measuring Nanostructures – Electron Microscopy – Spectroscopy – Molecular Synthesis and Polymerisation – Encapsulation.

UNIT V
Applications of Nanotechnology In Medicines
Nanobiosensors – Electronic Nose – Photo Dynamic Therapy – Molecular Motors – Protein Engineering.

Text Books

1 Tai,Ran Hsu, “MEMS & Microsystems Design & Manufacture”, Tata Mc Graw Hill,2002.
2 Richard Booker, Earl Boysen,”Nanotechnology”, Wiley Dreamtech(p) Ltd, 2006.

Reference Books

1 Mart Ratner, Daniel Ratner, “Nanotechnology”, Pearson Education, 2003.
2 Charles P.Poole. “Introduction to Nanotechnology", Wiley publications, 2003.

12EC310 SOFT COMPUTING

Credits: 4:0:0

Course Objective:

- To learn Artificial neural networks- Fuzzy sytems- Neuro Fuzzy modeling and Genetic Algorithm

Course Outcome:

- To understand the concepts of soft computational techniques.
- They will be able to apply soft computational techniques to solve various problems.

Unit I

Artificial Neural Networks: Basic concepts-single layer perceptron-Multi layer perceptron-Adaline-Madaline-Learning rules- Supervised learning-Back propagation networks-Training algorithm- Practical difficulties- Advanced algorithms-Adaptive network- Radial basis network-modular network-Applications

Unit II

Unsupervised Networks: Introduction- unsupervised learning -Competitive learning networks-Kohonen self organizing networks- Learning vector Quantisation - Hebbian learning - Hopfield network-Content addressable nature- Binary Hopfield network-Continuous Hopfield network Traveling Salesperson problem - Adaptive resonance theory – Bidirectional Associative Memory-Principle component Analysis

Unit III

Fuzzy Systems: Fuzzy sets-Fuzzy rules: Extension principle- Fuzzy relation- Fuzzy reasoning – Fuzzy inference systems: Mamdani model- Sugeno model. Tsukamoto model - Fuzzy decision making- Multiobjective Decision Making--Fuzzy classification-Fuzzy control methods –Application

Unit IV

Neuro-Fuzzy Modeling: Adaptive Neuro Fuzzy based inference systems – classification and regression trees: decision tress- CART algorithm – Data clustering algorithms: K means clustering- Fuzzy C means clustering- Mountain clustering- Subtractive clustering – rule base structure identification – Neuro fuzzy control: Feedback Control Systems- Expert Control-Inverse Learning- Specialized Learning- Back propagation through Real Time Recurrent Learning.

Unit V

Genetic Algorithm: Fundamentals of genetic algorithm-Mathematical foundations-Genetic modeling-Survival of the fittest - crossover- Inversion and Deletion-mutation-reproduction-

Generational cycle-rank method-rank space method- Other derivative free optimization simulated annealing- Random search- Downhill simplex search- Applications.

Text Book

1. R. A. Aliev and R. R. Aliev, "Soft Computing and its Applications", World Scientific Publishing, Singapore, 2001.

Reference Books

1. Jang J.S.R., Sun C.T and Mizutani E, "Neuro Fuzzy and Soft Computing: A Computational Approach to Learning Machine Intelligence", Prentice Hall, 1997.
2. Laurene Fausett, "Fundamentals of Neural Networks: Architectures, Algorithms and Applications ", Pearson Education India, 2006
3. S.N. Sivanandam, S.N. Deepa, "Introduction to Genetic Algorithm", Springer, 2008.

12EC311 ANALYSIS AND DESIGN OF ANALOG INTEGRATED CIRCUITS

Credits: 4:0:0

Course Objective:

- To learn about Integrated Circuit Active Devices -opamps-analog multipliers -PLL and Analog Design with MOS Technology.

Course Outcome:

- Students will be able to understand the concepts of active devices
- They will be able to design various analog circuits.

Unit I

Analysis of Integrated Circuit Active Devices: Depletion Region Of A PN Junction – Large Signal Behaviour Of Bipolar Transistors- Small Signal Model Of Bipolar Transistor- Large Signal Behaviour Of MOSFET- Small Signal Model Of The MOS Transistors- Short Channel Effects In MOS Transistors – Weak Inversion In MOS Transistors- Substrate Current Flow In MOS Transistor.

Unit II

Circuit Configuration for Linear IC: Analysis Of Difference Amplifiers With Active Load Using FET Supply And Temperature Independent Biasing Techniques- Voltage References-Output Stages: Emitter Follower- Source Follower- CMOS Class B And Class AB Push Pull Output Stages.

Unit III

Operational Amplifiers: Analysis Of Operational Amplifiers Circuit- Slew Rate Model And High Frequency Analysis- Frequency Response Of Integrated Circuits: Single Stage Amplifier And Multistage Amplifiers Using ZVT And SCT

Unit IV

Analog Multiplier and PLL: Analysis Of Four Quadrant And Variable Trans Conductance Multiplier- Voltage Controlled Oscillator- Closed Loop Analysis Of PLL- Monolithic PLL Design In Integrated Circuits: Sources Of Noise- Noise Models Of Integrated-Circuit Components – Circuit Noise Calculations – Noise Bandwidth – Noise Figure And Noise Temperature

Unit V

Analog Design with MOS Technology: MOS Current Mirrors – Simple- Cascode- Current sources: Wilson and Widlar current source – Two stage MOS Operational Amplifiers- with Cascode- MOS Telescopic-Cascode Operational Amplifier – MOS Folded Cascode and MOS Active Cascode Operational Amplifiers

Text Books

1. Gray, Meyer, Lewis, Hurst, "Analysis and design of Analog IC's", 4th Edition,Wiley International, 2002.
2. Behzad Razavi, "Design of Analog CMOS Integrated Circuits", S.Chand and company ltd,2000.

Reference Books

1. Nandita Dasgupata, Amitava Dasgupta,"Semiconductor Devices, Modelling and Technology",Prentice Hall of India Pvt.ltd,2004.
2. Grebene, Bipolar and MOS Analog Integrated circuit design", John Wiley & sons,Inc.,2003.
3. Phillip E.Allen Douglas R. Holberg, "CMOS Analog Circuit Design", Second Edition, Oxford University Press, 2003.

12EC312 ANALOG VLSI DESIGN

Credits: 4:0:0

Course Objective:

- To learn about Device Modeling- Various types of analog systems- CMOS amplifiers and
  Comparators.

Course Outcome:

- Students will be able to understand the concepts of analog design
- They will be able to design various analog systems

Unit I

Device Modeling

Analog Integrated Circuit Design-Analog Signal Processing-Example of Analog VLSI Mixed –Signal Circuit Design- Modeling-MOS Models: DC- Small Signal and High Frequency Model-Measurement of MOSFET Parameters- Diode Models: DC- Small Signal And High Frequency Diode Model – Bipolar Models: DC- Small Signal and High Frequency BJT Model- Measurement of BJT Model Parameters.

Unit II

Analog Systems

Analog Signal Processing-Digital-to- Analog Converters; Current Scaling- Voltage Scaling And Charge Scaling-Serial D/A Converters-Analog-To Digital Converters: Serial A/D Converters- Successive Approximation A/D –Parallel-High Performance A/D Converters – Continuous TimeFilters: Low Pass Filters- High Pass Filters- Band Pass Filters.

Unit III
CMOS Amplifiers
Inverters-Differential Amplifiers-Cascode Amplifiers-Current Amplifiers-Output Amplifiers-High-Gain Amplifier Architectures.

Unit IV
Comparators
Characterization of a Comparator-Two Stage- Open-Loop Comparators-Other Open-Loop Comparators-Improving the Performance of Open-Loop Comparators –Discrete Time Comparators- High –Speed Comparators.

Unit V
Switched Capacitor Circuits
Switched Capacitor Circuits- Switched Capacitor Amplifiers- Switched Capacitor Integrators-z- Domain Models of Two-Phase Switched Capacitor Circuits-First-Order Switched Capacitor Circuits- Second-Order Switched Capacitor Circuits- Switched Capacitor Filters.

Text Book
1. Philip E. Allen, Douglas R. Halberg, "CMOS Analog Circuit Design", Oxford University Press, 2nd Edition, 2003.

Reference Books
1. Randall L.Geiger, Philip E.Allen, Noel K.Strader, "VLSI Design Techniques for Analog and Digital Circuits", McGraw Hill International Co, 1990.
2. YannisTsividis, "Mixed Analog – Digital VLSI Device and Technology" World scientific publishing Co. Pvt. Ltd., 2002

12EC313 CMOS VLSI DESIGN

Credits: 4:0:0

Course Objective:
- To study the basic concepts of MOS transistor
- To know various circuit design processes and design any Combinational Logic Circuits or Sequential Logic Circuits.

Course Outcome:
- Students are expected to design circuits using different CMOS styles and also to do analysis on CMOS structures.

Unit I
MOS Transistor Theory: The MOS Structure – The MOS System under External Bias – Structure and Operation of MOS Transistor (MOSFET) – I_{ds} Versus V_{ds} Relationships – MOSFET Scaling and Small-Geometry Effects – MOSFET Capacitances-CMOS Inverter Characteristics.

Unit II

Circuit design processes and characterization: Stick Diagrams – Design Rules and Layout – Delay Approach Estimation – Logical Effort and Transistor Sizing – Power Dissipation – Design Margin –Interconnect.

Unit III

Combinational Logic Design: Static CMOS Design –Complementary CMOS-Ratioed Logic-Pass Transistor Logic- Dynamic CMOS Design –Basic Principles-Speed and Power Dissipation of Dynamic Logic-Signal Integrity Issues in Dynamic Design-Cascading Dynamic Gates.

Unit IV

Sequential Logic Design: Static Latches and Registers – Multiplexer based Latches-Master –Slave Edge Triggered Register-Low voltage Static Latches- Dynamic Latches and Registers –Dynamic Transmission Gate Edge-triggered Registers-C_2MOS-A clock skew Insensitive Approach-True Single Phase Clocked Register-Pulse Registers-Sense Amplifier based Registers –Pipelining.

Unit V

Arithmetic Building Blocks and Memory Design: Binary Adder-Full Adder Circuit Design Considerations-Binary Adder: Logic Design Considerations-Array Multipliers – Carry Save Multipliers-Tree Multipliers-Barrel Shifters – Read –Only Memories- EPROM - E_2 PROM-Flash Memory- SRAM Operation-Dynamic RAM Operation –Contents-Addressable Memory.

Text Books

1. Kang ,Leblebigi "CMOS Digital IC Circuit Analysis & Design", McGraw Hill, 2003.
2. Jan.M.Rabaey, Anantha Chandrakasan, Borivoje Nikolic**, "**Digital Integrated Circuits – A Design Perspective", Pearson Education, 2nd Edition 2003.

References Books

1. Neil H.E. Weste, David Harris, Ayan Banerjee, "A Ciruits and Systems Perspective",Pearson Education India, 3rd Edition, 2006.
2. Kamran Eshraghian, Douglas A.Pucknell, Sholeh Eshraghian, "Essentials of VLSI Circuits and Systems", Eastern Economy Prentice Hall of India, New Delhi, 2005.

12EC314 SEMICONDUCTOR DEVICES AND MODELING

Credits: 4:0:0

Course Objective:

- To learn the physics behind the semiconductor devices
- To study the various device models.
- To understand the BJT, MOSFET and other semiconductor devices from the device perspective.

Course Outcome:

- Clear understanding of semiconductor devices which will help the students in learning the advanced semiconductor devices.

Unit I

Semiconductor Physics

Semiconductor Materials and Structures- Band Structures – Electron-Hole Statistics – Carrier Mobility and Conductivity– Carrier Diffusion, Generation/Recombination – Avalanche Multiplication – Hall Effect, P-N Junction Theory – Built-In Potential – P-N Electrostatics – Abrupt And Linearly Graded P-N Junction Depletion Layers – Current-Voltage Relation In P-N Junction – Generation/Recombination Current – Diffusion Capacitance – Diode Equivalent Circuit – Breakdown Voltage – Junction Curvature Effect – Transient Behavior – Noise. Tunnel Diode – Metal-Semiconductor Junctions – Schottky Diode and Ohmic Contact – Hetero- Junctions.

Unit II

BJT Device Analysis: BJT Current- Voltage Relation – Current Gain – Band Gap Narrowing – Auger Recombination – Early Effect – Punch-Through In BJT – Breakdown Voltage In BJT – Small Signal Equivalent Circuit – Cut-Off Frequency – Switching Behavior – HBT.

Unit III

BJT Models: Basic Ebers-Moll Model – Basic Gummel-Poon Model – Model Derivation – Moll-Ross Equation – High Injection Effect – Knee Current – Early Effect – Base Widening Effects.

Unit IV

MOSFET Device Analysis: Basic Concepts Of MOSFET – Capacitance-Voltage Characteristics – Threshold Voltage of MOS Capacitor – Flat-Band Voltage – Gate Oxide Charges And Transport Through Gate Oxide– Current-Voltage Relation of Long Channel MOSFETS – Drain Conductance – Transconductance – Drain Current Saturation – Body Effect – Drift- Diffusion Model – Sub-Threshold Conduction, Slope And Mobility Models in MOSFETS – Temperature Effect – Equivalent Circuit of MOSFETS- Tailoring of MOSFET Parameters – Scaling of MOSFETs and Short- Channel Effects – Charge Sharing Model – Narrow Width Effect – Channel Length Modulation – Hot Carrier Effects. LDD MOSFET – VMOS, FAMOS – MESFET – MODFET.

Unit V

MOSFET models: Level-1 model of MOSFET – Level-2 model of MOSFET: Mobility modeling, Sub-threshold current- Channel length modulation- Short channel effect- Velocity saturation- Narrow width Effect- Gate capacitance- Junction capacitances – Level-3 model of MOSFET: Slope discontinuity Gate capacitances, BSIM model.

Text Book

1. S.M. Sze, K. N. Kwok, “Physics of Semiconductor Devices”, 3rd Edition, John Wiley & Sons, 2008.

Reference Books

1. S. M. Sze, “Semiconductor Devices: Pioneering Papers”, World Scientific Publishing Company, 2004.
2. D. P. Foty, “MOSFET Modeling with SPICE, Principles and Practices”, Prentice Hall PTR, 1997.
3. H. C. deGraff and F. M. Klaassen, “Compact Transistor Modelling for Circuit Design”, Springer-Verlog Wein, New York, 1990.
4. E. Getreu, “Modeling the Bipolar Transistor”, Elsevier Scientific Publishing Company, 1978.

5. P.E. Gray et al., “Physical Electronics and Circuit Models for Transistors”, John Wiley & Sons, 1964.

12EC315 COMPUTER AIDED DESIGN FOR VLSI CIRCUITS

Credits 4:0:0

Course Objective:

- To study the Physical design cycle of VLSI

Course Outcome:

- Knowledge of Placement, Routing ,Simulation ,Synthesis and MCMs is obtained

Unit I

Introduction to VLSI Design: Introduction to VLSI Methodologies – Types of ASICs – Design flow -VLSI Physical Design Automation – Fabrication process and its impact on Physical Design.

Unit II

Automation Tools and Algorithms

A quick tour of VLSI Design Automation Tools – Data structures and Basic Algorithms - Algorithmic graph theory and computational complexity – Tractable and Intractable problems.

Unit III

Simulation and Synthesis

Simulation – Logic synthesis – Verification – High level synthesis – Compaction.

Unit IV

ASIC Construction, Floorplanning, Placement and Routing

Partitioning methods – floor planning – placement – global routing –detailed routing- circuit extraction –DRC.

Unit V

Design Automation

Physical Design Automation of FPGAs – MCMS –Implementation of Simple Algorithms using VHDL & Verilog onto FPGA’s.

Text Books

1. N.A. Sherwari, “Algorithms for VLSI Physical Design Automation”, John Wiley, 2003.
2. Sabih H. Gerez,” Algorithms for VLSI design automation”, John Wiley, 2004.

Reference Book

1. M.J.S.Smith, “Application – Specific Integrated Circuits”, Addison, Wesly Longman Inc.,1997.

12EC316 VLSI TECHNOLOGY

Credits: 4:0:0

Course Objective:

- To learn in detail about the fabrication of BJT and MOSFET transistors.

Course Outcome:

- Students are expected to design VLSI circuits by keeping technological process constraints in mind.

Unit I

Introduction: Introduction to VLSI fabrication – BJT and CMOS Fabrication Process a Brief Overview – Unit Process Steps in Planar Process. Environment for VLSI Technology: Clean Room and Safety Requirements. Wafer Cleaning Processes and Wet Chemical Etching Techniques, Silicon Crystal Growth, Epitaxy – VPE and MBE.

Unit II

Oxidation and Diffusion: Oxidation: Kinetics of Silicon Dioxide Growth for Thick and Thin Films – Oxidation Rate Constants- Dopant Redistribution and Oxide Charges - Characterization of Oxide Films - Impurity Diffusion: Solid State Diffusion Modelling and Technology - Characterization of Impurity Profiles- Diffusion Systems - Ion Implantation Modeling and Technology – Damage Annealing – Masking during Implantation.

Unit III

Lithography and Etching: Basic Process Explaining Lithography – Positive and Negative Resist and their Comparison –Light Sources – Mask Making Process – Layout Generation using Software Tools – Optical Lithography - Issues in Optical Lithography – X-ray Lithography – E-beam Lithography. Wet Chemical Etching- Dry Etching, Plasma Etching System – Etching of Various Materials Used in VLSI Fabrication.

Unit IV

Deposition Techniques: Physical Vapor Deposition – Thermal Evaporation and Sputtering – Metallization –Failure Mechanisms in Metal Interconnects - Silicides and Copper Metallization, Chemical Vapor Deposition Techniques: CVD Techniques for Deposition of Polysilicon, Silicon Dioxide, Silicon Nitride and Metal Films – Comparison of CVD techniques.

Unit V

Integrated Device Fabrication: BJT fabrication – Isolation techniques; Junction Isolation, LOCOS, Trench Isolation – Realization of ECL and I^2L Circuits. MOSFET fabrication – Metal Gate to Self-Aligned Poly- Gate – Tailoring of Device Parameters – CMOS Fabrication – Latch-up in CMOS – Bi-CMOS Technology – MESFET Technology,VLSI Assembly And Packaging.

Text Book

1. S. A. Campbell, “The Science and Engineering of Microelectronic Fabrication”, 2nd Edition, Oxford University Press, 2001.

Reference Books

1. G. S. May and S. M. Sze, " Fundamentals of Semiconductor Fabrication", John Wiley Inc., 2004.
2. C.Y. Chang and S.M.Sze (Ed), "ULSI Technology", McGraw Hill Companies Inc, 1996.
3. S.M. Sze (Ed), "VLSI Technology", 2nd Edition, McGraw Hill, 1988.
4. S.K. Ghandhi, "VLSI Fabrication Principles", 2nd Edition, John Wiley Inc., New York,Reprint 2004.

12EC317 VLSI DIGITAL SIGNAL PROCESSING

Credits 3:1:0

Course Objective:

- This paper integrates VLSI architecture theory and algorithms,
- It addresses various architectures at the implementation level, and presents several approaches to analysis, estimation, and reduction of power consumption.
- Explains how to design high-speed, low-area, and low-power VLSI systems for a broad range of DSP applications

Course Outcome:

- The students will be able to apply several optimization techniques to improve implementations of several DSP algorithms, using digital signal processors.

Unit I

Iteration Bound & Pipelining / Parallel Processing: Introduction to DSP systems-representations of DSP Algorithms- loop bound and iteration bound- algorithms for computing iteration bound- iteration bound for MRDFG- pipelining and parallel processing of FIR filters- pipelining and parallel processing for low power applications.

Unit II

Retiming & Unfolding: Definition and properties of retiming -solving system inequalities-retiming techniques-algorithm and properties of unfolding -applications-Algorithmic strength reduction in filters and transforms- parallel FIR filters- fast FIR algorithms.

Unit III

Systolic Array & Fast Convolution Algorithm: Design Methodology- FIR systolic Arrays-Selection of Scheduling Vector- Cook-Toom Algorithm-Winograd Algorithm- Iterated Convolution – Cyclic Convolution.

Unit IV

Scaling And Round Off Noise: State Variable Description of digital filters- Scaling and roundoff noise computation- Bit level arithmetic architectures- parallel multipliers- bit serial multipliers- Canonic Signed Digit Arithmetic- distributed arithmetic

Unit V

Numerical Strength Reducing Techniques: Redundant Arithmetic- Redundant Number Representations- Carry Free Radix-2 Addition and Subtraction-Hybrid Radix 4 Addition-Data Format Conversion- Redundant To Nonredundant Converter- Subexpression Elimination- Multiple Constant Multiplication- Subexpression Sharing In Digital Filters-

Additive and Multiplicative Number Splitting- Synchronous Pipeling and Clocking Styles- Wave Pipelining- Asynchronous Pipeling- Signal Transition Graphs.

Text Book

1. Keshab K.Parhi, "VLSI Digital Signal Processing Systems, Design and implementation",Wiley, Inter Science, 1999.

Reference Books

1. Mohammed Isamail and Terri Fiez, "Analog VLSI Signal and Information Processing", McGraw Hill, 1994
2. Jose E. France, Yannis Tsividis,"Design of Analog-Digital VLSI Circuits for Telecommunication and Signal Processing", Prentice Hall, 1994.

12EC318 TESTING OF VLSI CIRCUITS

Credits: 4:0:0

Course Objective:

- To know about the various test Generation Algorithms and Fault Simulation Techniques.

Course Outcome:

- Testing of various Memory Modules and Combinational logic Circuits.

Unit I

Introduction: Motivation for testing and design for testability – Faults in digital circuits - Modeling of faults -Logical Fault Models - Fault detection - Fault location - Fault dominance

Unit II

CMOS Testing: Need for testing – Manufacturing test principles – Design Strategies for test – chip level testtechniques - System level test techniques- Testability features for board test.

Unit III

Test Generation Algorithms and Fault Simulation Techniques: Introduction - Fault - Table, Boolean difference – Path sensitization, D algorithm –Sequential circuits – Random test vectors.

Serial, Single-fault propagation, Deductive, Parallel and Concurrent Simulation.

Unit IV

Built In Self Test: Scan-in Scan-out design – Signature analysis - Built-In Self Test - Test pattern generation for BIST - Circular BIST – BIST Architectures - Testable Memory Design - Test algorithms – Test generation for Embedded RAMs

Unit V

Fault Diagnosis: Logic Level Diagnosis - Diagnosis by UUT reduction - Fault Diagnosis for Combinational Circuits - Self-checking design - System Level Diagnosis.

Text Book

1. M. Abramovici M.A, Breuer and A.D Friedman, "Digital Systems Testing and Testable Design", Computer Sciences Press, 2002

Reference Books

1. P.K. Lala, "Digital Circuit Testing and Testability", Academic Press, 2002
2. Robert J.Feuguate, Jr. Steven M.Mcintyre, "Introduction to VLSI testing', Prentice Hall, Englewood Cliffs, 1998.

12EC319 LOW POWER VLSI DESIGN

Credits 4:0:0

Course Objective:

- To study the concepts on different levels of power estimation and optimization techniques.

Course Outcome:

- To design chips used for battery-powered systems and high-performance circuits not exceeding power limits.

Unit I

Simulation Power Analysis: Need For Low Power VLSI Chips- Charging And Discharging Capacitance- Short Circuit Current- Leakage Current- Static Current- Basic Principles of Low Power Design- Gate Level Logic Simulation- Architectural Level Analysis

Unit II

Circuit and logic level power Estimation: Transistor and Gate Sizing- Equivalent Pin Ordering- Network Reconstructing and Reorganization- Gate Reorganization- Signal Gating- Logic Encoding- State Machine Encoding- Pre-Computation Logic- Power Reduction in Clock Networks- CMOS Floating Node- Low Power Bus- Delay Balancing

Unit III

Power Estimation: Architecture and System- Power and Performance Management- Switching Activity Reduction- Parallel Architecture- Flow Graph Transformation. Modeling of Signals- Signal Probability Calculation- Probabilistic Techniques for Signal Activity Estimation- Statistical Techniques- Estimation of Glitching Power.

Unit IV

Circuit Design techniques and SRAM Architecture: Circuit Design Style- Leakage Current in Deep Sub-Micrometer Transistors- Deep Sub- Micrometer Device Design Issues- Low Voltage Circuit Design Techniques- Multiple Supply Voltages- MOS Static RAM- Memory Cell- Banked SRAM- Reducing Voltage Swing on Bit Lines- Reducing Power in the Write Driver and Sense Amplifier Circuits.

Unit V

Energy recovery and low power latches and Flip Flops: Energy Recovery Circuit Design- Design with Partially Reversible Logic- Need for Low Power Latches and Flip Flops- Evolution of Latches and Flip Flops- Quality Measures for Latches and Flip Flops.

Text Books

1. Gary yeap, "Practical Low Power Digital VLSI Design", Kluwer academic publishers,2001.
2. Kaushik Roy, Sharat prasad, "Low Power CMOS VLSI Circuit Design", John Wiley & Sons Inc., 2000.

Reference Books

1. Anantha Chadrasekaran and Robert Broderson, "Low Power CMOS Design", Standard Publishers, 2000.
2. Kiat,Seng Yeo, Samir S.Rofail, Wang,Ling Goh, "CMOS/BiCMOS ULSI Low Voltage, Low Power", Pearson edition, Second Indian reprint, 2003.

12EC320 ADVANCED RADIATION SYSTEMS

Credits: 4:0:0

Course Objective:

- To learn the fundamental of antenna radiation, different types of antenna and its design methodology.

Course Outcome:

- Able to design any type of antenna

Unit I

Concepts of Radiation: Retarded vector potentials – Heuristic approach and Maxwell's equation approach- The Lorentz gauge condition - Vector potential in Phasor form- Fields radiated by an alternating current element. Total power radiated and radiation resistance- Radiation from Half wave dipole from assumed current distribution- Power radiated in the farfield - Electric vector potential F for a magnetic current source M- Far zone fields due to magnetic source M.

Unit II

Antenna Arrays: N element linear arrays – uniform amplitude and spacing- Phased arrays - Directivity of Broadside and End fire arrays- Three dimensional characteristics- Binomial arrays and Dolph-Tchebycheff arrays- Circular array- Antenna Synthesis- Line source and discretization of continuous sources- Schelkunoff polynomial method-Fourier transform method.

Unit III

Aperture Antennas: Magnetic current – Duality- Electric and Magnetic current sheets as sources- Huyghens source. Radiation through an aperture in an absorbing screen- Fraunhoffer and Fresnel diffraction- Cornu Spira- Complimentary screens and slot antenna- Slot and dipoles as dual antennas- Babinets principle- Fourier transform in aperture antenna theory.

Unit IV

Horn , Microstrip , Reflector Antennas: E and H plane sectoral Horns- Pyramidal horns- Conical and corrugated Horns- Multimode horns. Phase center.
Microstrip antennas – feeding methods. Rectangular patch- Transmission line model.
Parabolic Reflector antennas – Prime focus and cassegrain reflectors. Equivalent focal length of Cassegrain antennas. Spillover and taper efficiencies. Optimum illumination.

Unit V
Antenna Polarization: Simple relationship involving spherical triangles. Linear, Elliptical and circular polarization. Development of the Poincare sphere. Representation of the state of polarization in the Poincare sphere. Random polarization – Stokes parameters.

Text Book
1. Balanis, C.A., "Antenna Theory" Wiley,2003

Reference Books
1. Jordan, E.C., " Electromagnetic waves and Radiating systems". PHI 2003
2. Krauss, J.D., " Radio Astronomy" McGraw-Hill 1966, (reprints available)
3. Krauss, J.D.,, Fleisch,D.A., "Electromagnetics" McGraw-Hill,1999.

12EC321 OPTICAL FIBER COMMUNICATION

Credits: 4:0:0

Course Objective:
- To learn various types of optical fibers- transmitter and receiver section- and fiber amplifiers

Course Outcome:
- Able to establish an efficient optical link.

Unit I
Fiber Optic Guides: Light wave generation systems- system components- optical fibers- SI-GI fibers- modes- Dispersion in fibers- limitations due to dispersion- Fiber loss- Non linear effects. Dispersion shifted and Dispersion flattened fibers.

Unit II
Optical Transmitters and Receivers: Basic concepts- LED's structures spectral distribution-semiconductor lasers- gain coefficientsmodes- Transmitter design- Reciever PIN and APD diodes design- noise sensitivity and degradation.

Unit III
Light Wave System: Coherent- homodyne and heterodyne keying formats- BER in synchronous and asynchronous receivers- sensitivity degradation- system performance-Multichannel- WDM multiple access networks- WDM components- TDM- Subcarrier and Code division multiplexing.

Unit IV
Amplifiers: Basic concepts- Semiconductor laser amplifiers- Raman - and Brillouin - fiber amplifiers- Erbium doped – fiber amplifiers- pumping phenomenon- LAN and cascaded in-line amplifiers.

Unit V
Dispersion Compensation: Limitations- Post-and Pre-compensation techniques- Equalizing filters- fiber based gratings- Broad band compensation- soliton communication system- fiber

soliton- Soliton based communication system design- High capacity and WDM soliton system.

Text Book

1. G.Keiser, “Optical fiber communication” 4th Edition, McGraw,Hill, New York, 2008.

Reference Books

1. G.P. Agarwal, "Fiber optic communication systems" 4th Edition, John Wiley & Sons, New York,2010.
2. John Senior, " Optical Fiber Communications: Principles and Practices", Prentice Hall Publications, New Delhi, 2008.

12EC322 MULTIMEDIA COMPRESSION TECHNIQUES

Credits: 4:0:0

Course Objective:

- To learn about the various compression techniques for audio signals- video signals and text data.

Course Outcome:

- Able to understand the concept of requirement for memory space reduction and motivated to develop efficient algorithms for compression

Unit I
Introduction
Special features of Multimedia – Graphics and Image Data Representations – Fundamental Concepts in Text-Images-Graphics-Video and Digital Audio – Storage requirements for multimedia applications -Need for Compression - Lossy & Lossless Compression techniques – Overview of source coding- Information theory & source models- vector quantization theory: LGB algorithm– Evaluation techniques – Error analysis and methodologies

Unit II
Text Compression: Compaction techniques – Huffmann coding – Adaptive Huffmann Coding – Arithmatic coding – Shannon-Fano coding – Dictionary techniques – LZW family algorithms.

Unit III
Audio Compression: Audio compression techniques - μ- Law and A- Law companding. Frequency domain and filtering -. Predictive techniques – DM- PCM- DPCM: Optimal Predictors and Optimal Quantization- Formant and CELP Vocoders – Application to speech coding – G.722 – Application to audio coding – MPEG audio- progressive encoding for audio – Silence compression- speech compression techniques.

Unit IV
Image Compression: Contour based compression – Transform Coding – JPEG Standard – Sub-band coding algorithms: Design of Filter banks – Wavelet based compression:

Implementation using filters – EZW- SPIHT coders – JPEG 2000 standards - JBIG- JBIG2 standards. Basic sub-band coding

Unit V

Video Compression: Video compression techniques and standards – MPEG Video Coding I: MPEG – 1 and 2 – MPEG Video Coding II: MPEG – 4 and 7 – Motion estimation and compensation techniques – H.261 Standard – DVI technology – PLV performance – DVI real time compression – Packet Video.

Text Books

1. Khalid Sayood, "Introduction to Data Compression", Morgan Kauffman Harcourt India, 2nd Edition, 2000.
2. David Solomon, "Data Compression, The complete reference", Springer Verlag New York INC, 2nd edition 2001.

Reference Books

1. Peter Symes, "Digital Video Compression", McGraw Hill Pub., 2004.
2. Mark Nelson, "Data compression", BPB Publishers, New Delhi,1998.
3. Mark S.Drew, Ze-Nian Li, "Fundamentals of Multimedia" PHI, 1st Edition, 2003
4. Yun A Shi, Huifang Sun, "Image & Video compression for Multimedia Engineering, Fundamentals, Algorithms & Standards", CRC Press, 2003.

12EC323 MOBILE COMMUNICATION NETWORKS

Credits: 4:0:0

Course Objective:

- To learn the fundamental concepts of mobile communication networks

Course Outcome:

- Will be able to design simple communication network in mobile environment

Unit I

Operation of Mobile Communication Networks: Operation of first, second, and third generation wireless networks: cellular systems, medium access techniques, Mobile networks Elementary Principles of cellular Telephony Channel Division Techniques(TDMA, FDMA, CDMA) Cellular Coverage Methods Network Planning and Resource Allocation,Network Dimensioning ,Mobility Management Procedures.

Unit II

Propagation Models And Air Protocols: Radio propagation models, error control techniques, handoff, power control, Soft handover, Forward link ,Reverse link , common air protocols (AMPS, IS-95, IS-136, GSM, GPRS, EDGE, WCDMA, cdma2000, etc)

Unit III

Mobile Network Architecture: General Architecture definition, Mobile Terminals (MT, SIM)

Radio Section (BTS, BSC) Core Network (MSC, G-MSC, VLR, HLR, AuC)

User and Control Plane Protocol Stack, MAP & SS#7, the Key Role of Signaling Interfaces and Network Entities Relation The Physical Channel, The Logical Channels Terminal, Call and Network Management Procedures, Network Planning.

Unit IV

Wireless Local Area Networks: Wireless Local Area Networks , General Characteristics of the Hyper LAN System, 802.11 Standard, Basic DCF access scheme DCF Access Scheme with Handshaking, PCF Access Scheme, The 802.11a Standard, Mobile Ad Hoc Networks, Wireless Sensor Networks, Routing Energy Efficiency, Localization, Clustering.

Unit V

Security Issues in Wireless Networks: Security in Wireless Networks, Secure routing, Key Pre-distribution and Management, Encryption and Authentication, Security in Group Communication, Trust Establishment and Management, Denial of Service Attacks, Energy-aware security mechanisms, Location verification, Security on Data fusion.

Text Book

1. W. Stallings, "Wireless Communications and Networks", Prentice Hall, 2002.

Reference Books

1. T.S. Rappaport, "Wireless Communications: Principles & Practice", Second Edition, PrenticeHall, 2002.
2. J.Schiller,"Mobile Communications", Addison Wesley, 2000.

12EC324 ERROR CONTROL CODING

Credits 3:1:0

Course Objective:

- To learn about various error control codes
- To know about the mathematical concepts behind that.

Course Outcome:

- To understand life cyclic redundancy codes and convolution codes
- To get a clear concept of different error correcting codes and convolution codes

Unit I

Vector Algebra: Basics of vector algebra - Galois Filed arithmetic in detail- Implementation of Galois Field Arthimetic.

Unit II

Basic of Cyclic Codes: BCH Codes, Decoding of BCH Codes- implementation of error correction- Non binary BCH and Reed-Solomon Codes- error detection of binary BCH codes.

Unit III

Error Correcting Codes

Burst error correcting codes- decoding of single burst error correcting cyclic codes- Fire code interleaved codes- phased burst error correcting codes- Concatenated codes.

Unit IV

Convolutional Codes: Covolutional codes- Maximum likelihood decoding of convolutional codes- sequential decoding convolutional codes - stack and fano algorithm- Application of Viterbi decoding.

Unit V

Turbo Codes: Turbo codes - Coding - Performance - BCJR algorithm - Applications

Text Book

1. Shu Lin & D.J. Costello - "Error Control Coding", 2nd edition ,PHI, 2004.

Reference Books

1. Shu Lin "Application of error control", 1974
2. Simon Haykin, "Digital Communication", John Wiley and Sons, 1988
3. Bernard Sklar, Digital Communications, fundamentals and Applications, Pearson Education, 2001

12EC325 MICROWAVE INTEGRATED CIRCUITS

Credits: 4:0:0

Course Objective:

- To study the different technologies of microwave integrated circuits and to analyze the microstrip line.

Course Outcome:

- It will be helpful to design and fabricate different lumped elements and nonreciprocal components.

Unit I

Technology of Hybrid Mics & Monolithic Mics: Hybrid MICs: Dielectric substrates - thick film technology and materials - thin film technology and materials – methods of testing – encapsulation of devices for MICs – mounting of active devices. MMICs: Processes involved in fabrication – epitaxial growth of semiconductor layer – growth of dielectric layer – diffusion-ion implantation – electron beam technology.

Unit II

Analysis of Microstrip Line: Methods of conformal transformation – numerical method for analysis – hybrid mode analysis – coupled mode analysis- method of images – losses in miscrostrips.

Unit III

Coupled Microstrips- Slot Line and Coplanar Waveguides: Coupled microstrips – even and odd mode analysis – microstrip directional couplers – branch lines couplers – periodic branch line couplers – synchronous branch line couplers.

Unit IV

Lumped Elements and Non-Reciprocal Components: Design and fabrication using microstrips – flat resistors – flat inductors – interdigital capacitors – sandwich capacitors –

ferromagnetic substrates for non-reciprocal devices – microstrip circulators –latching circulators – isolators – phase shifters.

Unit V

Microwave Circuit Design: Microwave amplifier Design – Two port power gain- stability - single stage transistor amplifier design- low noise amplifier design- broad band amplifier design. Microwave Oscillator Design negative resistance oscillator- transistor oscillators design- dielectric resonator oscillator design oscillator phase noise- Periodic structures- Analysis of infinite- terminated periodic structures – filter design by image parameter method- insertion loss method -Distributed element (transmission line/TEM) filters.

Text Books

1. D. M. Pozar, Microwave Engineering, 3rd Edition, John Wiley & Sons, 2005.
2. Robert E.Collin, Foundations for Microwave Engg., 2nd ed., McGraw Hill, 2001

Reference Books

1. Gupta,K.C, and Amarjit singh , "Microwave Integrated Circuits", John Wiley and sons, Wiley Eastern Reprint, 1978.
2. Samuel Y. Liao, "Microwave Devices and Circuits", 3rd Edition, Prentice Hall, 1996.
3. Hoffmann, R.K , "Handbook of Microwave Integrated Circuits", Artec House, 1987.

12EC326 SATELLITE COMMUNICATION

Credits: 4:0:0

Course Objective:

- To learn about the science behind the orbiting satellites, various multiplexing schemes and earth station parameters used for satellite communication.

Course Outcome:

- Able to make one global village.

Unit I

Orbital Parameters: Orbital parameters- Orbital perturbations - Geo stationary orbits- Low Earth and Medium orbits. Frequency selection- Frequency co-ordination and regulatory services- Sun transit outages- Limits of visibility- Attitude and orientation control- Spin stabilisation techniques- Gimbal platform.

Unit II

Link Calculations: Space craft configuration- Payload and supporting subsystems- Satelite uplink -down link power Budget- C/No- G/T- Noise temperature - System noise- Propagation factors- Rain and ice effects- Polarization calculations

Unit III

Access Techniques: Modulation and Multiplexing: Voice- Data- Video- Analog and Digital transmission systems- multiple access techniques: FDMA- TDMA- T1-T2 carrier systems- SPADE- SS- TDMA- CDMA-Assignment Methods- Spread spectrum communication- Compression-Encryption and Decryption techniques.

Unit IV

Earth Station Parameters: Earth station location- propagation effects of ground- High power transmitters-Klystron Crossed field devices- Cassegrania feeds- Measurements on G/T and Eb/No.

Unit V

Satelite Applications: INTELSAT Series- INSAT- VSAT- Remote sensing- Mobile satellite service: GSM. GPS- INMARSAT- Satellite Navigation System- Direct to Home service (DTH)- Special services- Email- Video conferencing and Internet connectivity.

Text Books

1. Dennis Rody," Satellite Communication", McGraw Hill, 2006.
2. Bruce R. Elbert, "The Satellite Communication Applications Hand Book" Artech House Boston,1997
3. Wilbur L. Pritchard, Hendri G.Suyderhood, Robert A. Nelson," Satellite Communication Systems Engineering", II Edition,Prentice Hall,New Jersey.1993.

Reference Books

1. Tri T.Ha,"Digital satellite communication",2nd Edition,McGraw Hill,New york.1990.
2. K.Feher,"Digital communication satellite / Earth Station Engineering", Prentice Hall Inc, New Jersey,1983

12EC327 APPLIED ELECTRONICS LAB – I

Credits: 0:0:2

Course Objective:

- To provide hands on Training on software related to HDL in Digital System Design
- Use of MATLAB towards communication and signal processing related topics.

Course Outcome:

- To get familiarity in the software.
- Can be applied for project and research.

(Experiments related to signal processing- communication and digital system design. Using Matlab- Xilinx and ModelSim softwares)

1. Digital Modulation Techniques
2. Spread spectrum estimation
3. Multirate signal processing
4. Power spectrum analysis
5. LMS Algorithm
6. Design of FIR filter
7. Design of combinational circuits inVHDL using packages
8. Design of Counters and shift registers inVHDL using packages
9. Design of ALU inVHDL using packages
10. Design of 4 bit adder using Verilog
11. Design of state diagram using Verilog
12. Design of combinational and sequential circuits using Verilog

12EC328 APPLIED ELECTRONICS LAB - II

Credits: 0:0:2

Course Objective:

- To provide hands on Training on image processing tool on MATLAB.
- Use of GNU software for embedded based design.

Course Outcome:

- To get familiarity in the software,which can be applied for project and research.
- Students will be able to apply these software to covert C to assembly language coding

(Experiments related to image processing and Embedded system. Using Matlab- ARM processor
- LINUX platform)

1. Image enhancement in spatial domain
2. Image enhancement in frequency domain
3. Image restoration
4. Edge based segmentation
5. Region based segmentation
6. Wavelet processing
7. Image compression
8. Addition and Subtraction of two Hexadecimal numbers.
9. Multiplication and division of two Hexadecimal numbers.
10. Logical Operations and swapping.
11. ARM-THUMB Interworking.
12. Software Interrupt handler.

12EC329 HDL LABORATORY

Credits 0:0:2

Course Objective:

- To synthesize and simulate various combinational and sequential circuits using Xilinx and Model Sim Software.
- To implement the design in Virtex Kits.

Course Outcome:

- Students are able to design various digital circuits using VHDL and Verilog language and verify the design.
- Students are also equipped to implement the design in various FPGA Kits like Virtex II,Virtex IV kits.

1. Design and Simulation Half adder and Fulladder.
2. Design & Simulation simple ALU
3. Design & Simulation of 4x1 Multiplexer
4. Design & Simulation of Combinational Circuits

    a. Magnitude Comparator

b. 3x8 Encoder

c. Demultiplexer

5. Design and Simulation of up-down counter
6. Design & Simulation of flip-flops.

   a. JK Flip-flop
   b. RS Flip-flop
   c. T Flip-flop
   d. D Flip-flop
7. Design & Simulation of 32byte Memory Module.

VERILOG PROGRAMS

8. Design and Simulation Half adder and Fulladder
9. Design & Simulation of the following switch level modules:

   a. CMOS Inverter

   b. CMOS NAND Gate

10. Design & Simulation of Combinational Circuits

    a. 8*3 Decoder
    b. 4*1 Multiplexer
11. Design and Simulation of up-down counter
12. Design and Simulation of Clock Generator

12EC330 ASIC DESIGN LABORATORY

Credits: 0:0:2

Course Objective:

- To design digital and analog circuits with aspect ratio for each transistors using Tanner EDA and Mentor Graphics Software.
- To Perform Transient, AC and DC analysis for Analog circuits.
- To verify the backend design by drawing Layout using L-Edit.

Course Outcome:

- Students gain enough skills to choose aspect ratio for each transistor and complete the front end design for digital and analog circuit and this is also useful for their project works.
- After front end verification students are able to perform back end design by drawing Layout.

1. Design and simulation of CMOS logic gates
2. Design and simulation of NMOS inverters and multiplexers..
3. Design and simulation of BICMOS logic gates.
4. Design and simulation of half adders and full adders.
5. Design and simulation of emitter follower and differential amplifier.
6. Design and simulation of switched capacitor circuits.
7. Design and simulation of single stage VCO.
8. Design and simulation of Schmitt trigger.
9. Design and simulation of level shifters.
10. Design and simulation of full ASIC Design flow of an inverter.

11. Design and simulation of full ASIC Design flow of a counter.
12. Layout design for CMOS inverter, NAND Gate and nor gate.

Required software tools:
Mentor graphics- design architect, IC station, ELDO simulator, tanner EDA tool-S –edit, S-edit, L-edit.

12EC331 COMMUNICATION LAB-1

Credits: 0:0:2

Course Objective:

- To learn practically about different DSP algorithms- (LMS- RLS- QMF etc) Digital Modulation schemes & antenna design procedures.

Course Outcome:

- Able to understand the DSP algorithms used in communication field.
- It will be helpful to design different antennas.

Using Matlab(7 experiments)

1. Design and implementation of LMS-RLS and Kalman adaptive filters
    a. to remove noise
    b. estimation of channel
2. Design and implementation of QMF
3. Design and implementation of multistage/multirate system
4. Design and implementation of Digital Modulation Schemes (BPSK-GMSK-QPSKOFDM)
5. Design and implementation of spread spectrum concepts
6. Implementation of linear, Convolutional and Cyclic codes
7. Simulation of Audio/Speech/Image Compression algorithms using Matlab/DSP Processor.

Using Hardware (2 experiments)

8. OTDR
9. Connecterization & Splicing

Using FEKO(3 experiments)

10. Design and simulation of Dipole antenna
11. Design and simulation of Horn antenna
12. Study of $\lambda/4$ and $\lambda 2$ transmission lines

12EC332 COMMUNICATION LAB-II

Credits: 0:0:2

Course Objective:

- To learn practically about different microwave components- Routing methods.
- To Understand Satellite- GSM mobile communication & Software defined radio concepts.

Course Outcome:

- Able to develop different microwave devices and antennas.
- Able to understand the communication concepts behind satellite communication and Mobile communication.

- Able to understand network routing procedures.

Using FEKO(3 experiments)
1. S parameter estimation of microwave devices
2. Simulation and implementation of microstrip antennas.
3. Design- implementation and testing of a microstrip coupler .

Using NS-2(3 experiments)
4. Creating topology in wireless using CBR and UDP
5. Routing –Unicast and multicast routing
6. Performance analysis in wireless networks

Using Hardware (2 experiments)
7. MIC characteristics of couplers and filters
8. MIC radiation pattern of antennas

Using Hardware (4 experiments)
9. Study of CDMA & GPS
10. Satellite Communication
11. GSM Mobile Communication
12. SDR

12EC333 C++ AND DATA STRUCTURES

Credits: 3:1:0

Course Objectives:
- To learn the C++ programming language fundamentals: its syntax, properties and styles
- To learn object oriented programming concepts
- To learn the data structures in C++

Course Outcome:
- The students will be trained to write their own programs using object oriented programming and data structures.

Unit I

Objects and Classes: A Simple class- C++ objects as physical objects- C++ Objects and Data types- Object as function argument- constructors- Overloaded Constructors- Copy Constructors- Returning objects from functions- structures and classes- Static class data-const and classes- Array fundamentals-Initializing arrays-Multidimensional arrays-Array as function arguments-Strings-string variables-String constants-Reading Embedded blanks-Reading multiple lines-Arrays of strings.

Unit II

Principles of object oriented programming: Overloading Unary and Binary Operator-Data type conversion and its Pitfalls - Inheritance:Derived class and Base class- derived class constructors- Overloading member functions-class hierarchies- public and private inheritance- level of inheritance- multiple inheritance.Pointers: address and pointers- pointers and arrays- pointer and c-type strings- new and delete operator- pointers to pointer.

Unit III

Advanced object oriented programming: Virtual functions and Polymorphism - Friend functions- Static functions- this pointer- Streams and files:stream classes-Stream errors- Disk file I/O with streams- File pointers- Error handling in file I/O. Templates and exception: function templates- class templates- exceptions.

Unit IV

Introduction to Data Structures: Linked List Introduction-Implementation of Linked Lists Using Arrays-Linear Linked List-Basic Operations on linear linked List-Searching-Reversing-Concatenating-Disposing on linear linked Lists- Doubly linked List- Basic Operations on Doubly Linked List- Circular Linked List- Basic Operations on Circular Linked List-Stack- Queue.

Unit V

Sorting and Searching Techniques: Sorting - Bubble Sort- Insertion Sort- Selection Sort- Quick Sort- Heap Sort- Merge Sort. Searching- Linear Search- Binary Search.

Text Books

1. Robert Lafore, "Object Oriented Programming in C++", 3rd Edition, Galgotia Publishers, Pune, Reprint, 2006.
2. Abhishek Daya Sagar, "Expert Data Structures using C/C++", BPB Publications, New Delhi 2004.

Reference Books

1. Herbert Schmidt, " C++, The Complete Reference" , Mc Graw-Hill Publishing Company Limited, New Delhi, 3rd Edition, 2002
2. Owen L. Astrachan, "Programming with C++ - A Computer Science Tapestry", Tata McGraw-Hill, 2nd Reprint, 2008.

12EC334 HARDWARE-SOFTWARE CO-DESIGN

Credits: 4:0:0

Course Objective:

- To present techniques for the concurrent design, or co-design, of hardware and software.
- Special emphasis will be placed upon methods used for the development of embedded systems that are dedicated to specific applications.

Course Outcome:

- Students will have through knowledge on co-synthesis of Hardware and Software for Embedded Systems.

Unit I

HARDWARE AND SOFTWARE CONCEPTS: Motivation hardware & software co-design- system design consideration- Embedded systems- models of design representation- the virtual machine hierarchy- the performance modeling- Hardware Software development.

Unit II

HARDWARE SOFTWARE CO-DESIGN: An informal view of co-design- Hardware Software tradeoffs- cross fertilization- typical co-design process- co-design environments- limitation of existing approaches- ADEPT modeling environment- Co-design concepts- Functions- functional decomposition- virtual machines- Hardware Software partitioning- Hardware Software partitions- Hardware Software alternatives - co-design.

Unit III

METHODOLOGY FOR CO-DESIGN:Amount of unification- general considerations & basic philosophies- a framework for co-design- Unified representation for Hardware & Software - Benefits of unified representation- modeling concepts-a unified representation.

Unit IV

AN ABSTRACT HARDWARE & SOFTWARE MODEL : Requirements & applications of the models- models of Hardware Software system- an abstract Hardware Software models- Model implementation in ADEPT- generality of the model.

Unit V

PERFORMANCE EVALUATION:Applications of the abstract Hardware & Software model- examples of performance evaluation-object oriented techniques in hardware design- Motivation for object oriented technique- data types- modeling hardware components as classes- designing specialized components- data decomposition- Processor example.

Text Book

1. Sanjaya Kumar, James H. Ayler, "The Co-design of Embedded Systems: A Unified Hardware Software Representation", Kluwer Academic Publisher, 2002.

Reference Books

1. R. Gupta, "Co-synthesis of Hardware and Software for Embedded Systems", Kluwer Academic Publisher 1995.
2. Giovanni De Micheli, Rolf Ernst, Wayne Hendrix Wolf, "Readings in Hardware/Software co-design", Morgan Kaufmann Publishers, 2002.
3. Arnold s. Berger, "Embedded Systems Design: An Introduction to Processes, Tools and Techniques", Elsevier Science, 2001.

12EC335 RISC PROCESSOR ARCHITECTURE AND PROGRAMMING

Credits: 4:0:0

Course Objective:

- To expose the students to the fundamentals of AVR, ARM Architecture and Programming.
- To know about various peripherals of the AVR, ARM processors.

Course Outcome:

- To have thorough knowledge to program RISC Processors .
- To design systems for various applications.

Unit I

AVR MICROCONTROLLER ARCHITECTURE: Architecture – memory organization – addressing modes – instruction set – programming techniques –Assembly language & programming- Development Tools – Cross Compilers – Hardware Design Issues

Unit II

PERIPHERAL OF AVR MICROCONTROLLER:I/O Memory – EEPROM – I/O Ports – SRAM –Timer –UART – Interrupt Structure- Serial Communication with PC – ADC/DAC Interfacing .

Unit III

ARM ARCHITECTURE AND PROGRAMMING:Arcon RISC Machine – Architectural Inheritance – Core & Architectures -Registers – Pipeline - Interrupts – ARM organization - ARM processor family – Co-processors. Instruction set – Thumb instruction set – Instruction cycle timings - The ARM Programmer's model – ARM Development tools – ARM Assembly Language Programming and 'C'compiler programming.

Unit IV

ARM APPLICATION DEVELOPMENT :Introduction to DSP on ARM –FIR Filter – IIR Filter – Discrete fourier transform – Exception Handling – Interrupts – Interrupt handling schemes- Firmware and bootloader – Example: Standalone - Embedded Operating Systems – Fundamental Components - Example Simple little Operating System

Unit V

DESIGN WITH ARM MICROCONTROLLERS:Integrated development environment - STDIO Libraries - User Peripheral Devices – Application of ARM processor: Wireless Sensor Networks, Robotics.

Text Books

1. Dhananjay V. Gadre, "Programming and Customizing the AVR Microcontroller", TMH 2003
2. Steve Furber, 'ARM system on chip architecture', Addision Wesley, 2nd Edition, 2000.

Reference Books

1. Andrew N. Sloss, Dominic Symes, Chris Wright, John Rayfield "ARM System Developer's Guide Designing and Optimizing System Software", Elsevier, 2007.
2. Trevor Martin, "The Insider's Guide to the Philips ARM7-Based Microcontrollers, An Engineer's Introduction To The LPC2100 Series" Hitex (UK) Ltd.,2005.
3. Andrew N. Sloss, Dominic Symes, Chris Wright, John Rayfield "ARM System Developer's Guide Designing and Optimizing System Software", Elsevier, 2007.
4. ARM Architecture Reference Manual

12EC336 VLSI FOR WIRELESS COMMUNICATION

Credits: 4:0:0

Course Objective:

- To expose the students to the fundamentals of wireless concept and coding algorithms.
- To impart knowledge on the Transceiver Architecture and OFDM systems.

Course Outcome:

- Students can design VLSI circuits for modern Wireless systems.

Unit I

BASIC COMMUNICATION CONCEPTS: Introduction- Modulation schemes- Classical channels- Wireless channel description- Path loss- Multipath fading- channel model & envelope fading- frequency selective.

Unit II

CODING THEORY ALGORITHMS AND ARCHITECTURE: Convolution codes- trellis diagram- viterbi algorithm- soft input decoding- soft output decoding- Turbo codes- LDPC coding- concatenated convolution codes- weight distribution- Space-Time codes- spatial channels- performance measure- Orthogonal space-time block codes- spatial multiplexing.

Unit III

TRANSCIEVER ARCHITECTURE AND ISSUES : Receiver Architectures- Superheterodyne receiver- Image rejection receiver--Hartley and Weaver- Zero IF receiver- Low IF receiver- Transmitter architecture- Superheterodyne transmitter- Direct up transmitter- Two-step-up transmitter- Transceiever architectures for modern wireless systems- Case study- LNA- comparison of narrowband and wideband LNA- Wideband LNA design- Narrow band LNA- impedence matching and core amplifier.

Unit IV

OFDM SYSYTEM: Principle- propagation characteristics-principle- mathematical model- OFDM baseband signal processing-receiver design- Automatic gain control and DC offset compensation- codesign of Automatic gain control and timing synchronization- codesign of filtering and timing synchronization- Transmit chain setup.

Unit V

ANALOG IMPAIRMENT AND ISSUES : Receiver sensitivity and noise figure- DC offsets- LO leakage- Receiver interferers and intermodulation distortion- Image rejection- Quadrature balance and relation to Image rejection- relation to EVM, Peak to average power ratio- Local oscillator pulling in PLL- effect of phase noise in PLL- Effect of phase noise on OFDM systems- Effect of frequency errors on OFDM systems.

Text Book

1. Bosco Leung, "VLSI for Wireless Communication", Pearson Education Limited, 2005.

Reference Books

1. Pui-In Mak, Seng-Pan U, Rui Paulo Martins, "Analog-Baseband Architectures and Circuits for Multistandard and Low Voltage Wireless transceivers", Springer, 2007.
2. Emad N. Farag, Mohamed I. Elmasry, "Mixed signal VLSI Wireless Design Circuits and Systems", Kluwer Academic Publishers, 2002.
3. Andre Neubauer, Jurgen Freudenberger, Volker Kuhn, "Coding Theory, Algorithms, Architectures and Applications", John Wiley & Sons, 2007.
4. Wolfgang Eberle, "Wireless Transceiver Systems Design",Springer, 2008.

12EC337 ANALYSIS AND DESIGN OF MULTIGATE TRANSISTORS

Credits: 4:0:0

Course Objective:

- To impart knowledge on FinFETs and multi-gate transistors in terms of electrostatic integrity and short channel control
- To give knowledge on thin-fin formation techniques and source/drain resistance reduction techniques.
- To discuss radiation effects in advanced single and multi-gate SOI MOSFETs.

Course Outcome:

- Able to design circuits in nanometer range using these multigate devices.

Unit I

THE SOI MOSFET FROM SINGLE GATE TO MULTI-GATE: MOSFET Scaling - Short channel effects- history of multiple gate MOSFETS- multigate MOSFET physics- Multi-gate MOSFET technology-active area: fins - gate stack- source/drain resistance & capacitance- mobility & strain engineering.

Unit II

A COMPACT MODEL FOR MULTI-GATE TRANSISTORS: Framework for multigates FET modeling- multigate models- BSIM-CMG –core model-modeling physical effects of real devices- BSIM-IMG model.

Unit III

PHYSICS OF THE MULTIGATE MOS SYSTEM: Device electrostatic- double gate MOS system- gate voltage effects-semiconductor thickness effect- asymmetry effects-oxide thickness effect-electron tunnel current-two-dimensional confinement- Silicon multiple gate nanowires.

Unit IV

MOBILITY IN MULTIGATE MOSFETS: Introduction -double gate MOSFETS & FinFETs-. Radiation effects in advanced single & multiple SOI MOSFETS- history of radiation effects in SOI -Total ionzing dose effects - single event effects.

Unit V

MULTIGATE MOSFET CIRCUIT DESIGN: Introduction – digital circuit design – analog circuit design - design of analog building blocks – mixed signal aspects –RF circuit design- SOC design & technology aspects.

Text Book

1. Jean-Pierre Colinge, " FINFETS & other multigate transistors" , Springer, 2008.

Reference Book

1. Alexi Nazarov, J. P.Colinge, Francis Balestra, "Semiconductor-on Insulator Materials for Nano Electronics Application", Springer 2011.

12EC338 VLSI CIRCUITS FOR BIO-MEDICAL APPLICATIONS

Credits: 4:0:0

Course Objective:

- To give the essential knowledge and techniques for designing VLSI systems for biomedical applications.

Course Outcome:

- Able to design VLSI systems for biomedical applications.

Unit I

INTRODUCTION: Neuro chemical sensing- Neuro potential sensing-Telemetry system-Architecture and VLSI Design-Multimodal electrical and chemical sensing-Prothesis exterior body Unit and wireless link- Body Implantable Unit.

Unit II

CMOS CIRCUITS FOR IMPLANTABLE DEVICES: Inductive link to deliver power to implants-High data rate transmission through inductive links- Energy and bandwidth issues in multi channel-Bio potential recording-Fundamentals of Piezo electric transduction and power delivery-Sub microwatt Piezo powered VLSI circuits-Design and calibration of a complete floating gate sensor array.

Unit III

CMOS CIRCUITS FOR WIRELESS MEDICAL APPLICATIONS:Spectrum regulations for medical use-integrated receiver architecture-Integrated transmit architectures-Radio architecture selection-low noise amplifiers-Mixers-Polyphase filter-Power amplifiers-Phase locked loop-Power dissipation model for RF link with error-correcting codes-encoder implementations and power savings for error correcting codes.

Unit IV

INTEGRATED CIRCUITS FOR NEURAL INTERFACING: Introduction to neural recording-the nature of neural signals-neural signal amplification-neuro chemical recording-Sensor and circuit technologies-neural stimulation- Bio amplifier Circuits.

Unit V

NEURO MIMETIC INTEGRATED CIRCUITS: Neuron model for different computation levels of SNNS- Hardware based SNN-Criteria for design strategies of neuro mimetic Ics-Neuro mimetic ASICs.

Text Book

1. Krzyszt of Iniewslei, “VLSI Circuits for Bio Medical Applications”, Artech House Publishers, 2008.

Reference Books

1. Rahul Sarpeshkar, "Ultra Low Power Bioelectronics: Fundamentals, Biomedical Applications, and Bio-inspired Systems", Cambridge University Press, 2010 .

2. Lee T.H., “The design of CMOS Radio-frequency Integrated Circuits”, ISBN publication, 2004.

12EC339 EMBEDDED SYSTEMS LABORATORY

Credits: 0:0:2

Course Objective:

- To learn practically about different softwares like (ARM, Microvision 4, Keil C) used for Embedded Systems Design.

Course Outcome:

- Students will be able to design and implement their project and research works using these softwares

1. Arithmetic operation on AVR microcontroller.
2. Square wave generation using AVR timers.
3. Serial communication using AVR serial interrupts.
4. Interfacing LCD display Unit to AVR microcontroller
5. Interfacing Stepper motor to AVR micro controller.
6. Interfacing DC motor to AVR micro controller.
7. Arithmetic operation on ARM microcontroller.
8. Matrix multiplication on ARM microcontroller.
9. Serial communication using ARM microcontroller.
10. Programs using ADC/DAC of ARM microcontroller
11. Simulate an I^2C master or slave device.
12. Program and verify I^2C-based memory devices.

12EC340 ADVANCED SEMICONDUCTOR MEMORIES

Credits: 4:0:0

Course Objective:

- Study of recent developments in advanced semiconductor memories like (BSRAM-TSRAMSDRAM- EDRAM- Floating gate- FRAM- MRAM- Single-electron memory).

Course Outcome:

- Help the students in doing research in advanced memories and its designs.

Unit I

Static Random Access Memory Technologies: Basic SRAM Architecture And Cell Structures-SRAM Selection Considerations-High Performance SRAMS-Advanced SRAM Architectures Low Voltage SRAM-Bicmos Technology SRAMS-SOI SRAMS-Specialty SRAMs.

Unit II

High-Performance Dynamic Random Access Memories: DRAM Timing Specifications And Operations-DRAM cell capacitor –ESDRAM – Cache DRAM-Virtual Channel Memory (VCM)DRAM-Multilevel Storage DRAMS.

Unit III

Application-Specific DRAM Architectures and Designs: Video RAMS (VRAM)-Synchronous Graphic RAMS (SGRAMS)-Synchronous Link DRAMS- 3-D RAMS-Memory Design Considerations.

Unit IV

Advanced Non-Volatile Memory Designs and Technologies: Floating Gate Cell Theory-Flash Memory Architectures-Flash Memory Reliability Issues- Ferroelectric Memories-Magneto Resistive Random Access Memories-Resonant Tunneling Diode-Based Memories-Single-Electron Memories -Phase-Change Non-Volatile Memories.

Unit V

Embedded Memories Designs And Its Applications: Embedded Memory Developments-Cache Memory Designs-Embedded SRAM Designs- Embedded DRAM Designs-DRAM Process With Embedded Logic Architectures-Memory Cards
And Multimedia Applications.

Text Books

1. Ashok K.Sharma, “Advanced Semiconductor Memories Architectures, Designs and Applications", Wiley Interscience, 2003.
2. Tegze P.Haraszti, “CMOS Memory Circuits”, Kluwer Academic publishers, 2001.
3. Betty Prince, “Emerging Memories: Technologies and Trends”, Kluwer Academic Publishers, 2002.

Reference Book

1. Ashok K.Sharma, " Semiconductor Memories Technology, Testing and Reliability", Prentice,Hall of India Private Limited, New Delhi, 1997.

12EC341 HIGH SPEED SEMICONDUCTOR DEVICES

Credits: 4:0:0

Course Objective:

- To learn about various high speed devices

Course Outcome:

- To analyse different materials used in various high speed devices and the factors affecting the performance of high speed devices.

Unit I

Silicon Based MOSFET and BJT Circuits for High Speed Operation - Important Parameters of High Speed Performance of Devices: Transit Time of Charge Carriers- Junction Capacitances- ON-Resistances and Their Dependence on The Device Geometry and Size-Carrier Mobility- Doping Concentration and Temperature - Contact Resistance and Interconnection/Interlayer Capacitances in the Integrated Electronic Circuits- Emitter Coupled Logic (ECL) and CMOS Logic Circuits with Scaled Down Devices- Silicon on Insulator (SOI) Wafer Preparation Methods - SOI Based Devices - SOICMOS Circuits for High Speed Low Power Applications.

Unit II

Materials for High Speed Devices and Circuits: Merits of III –V Binary and Ternary Compound Semiconductors (Gaas- Inp- Ingaas- Algaas ETC.)- Silicon-Germanium Alloys and Silicon Carbide for High Speed Devices- as Compared to Silicon Based Devices. Brief Outline of the Crystal Structure- Dopants and Electrical Properties- Carrier Mobility-Velocity Versus Electric Field Characteristics -Material and Device Process Technique with III-V and IV – IV Semiconductors.

Unit III
MISFET- MESFET and III – V Semiconductor Devices: Metal Semiconductor Contacts-Schottky Barrier Diode- Thermionic Emission Model for Current Transport and Current-Voltage (I-V) Characteristics- Effect of Interface States and Interfacial Thin Electric Layer on the Schottky Barrier Height and I-V Characteristics – Pinch off Voltage - Threshold Voltage of MESFETS- D.C. Characteristics and Analysis of Drain Current- Velocity Overshoot Effects - Advantages of GaAs- InP and GaN Based devices for High Speed Operation-Sub Threshold Characteristics- Short Channel Effects - Performance of Scaled Down Devices.

Unit IV
High Electron Mobility Transistors (HEMT) & Hetero Junction Bipolar Transistors (HBTS): Hetero-Junction Devices - The Generic Modulation Doped FET(MODFET) - Structure for High Electron Mobility Realization - Principle of Operation and the Unique Features of HEMT- Ingaas/Inp HEMT Structure- Principle of Operation - Benefits of Hetero Junction BJT for High Speed Applications - GaAs and InP Based HBT Device Structure – Surface Passivation for Stable High Gain High Frequency Performance - Sige HBTS - Strained Layer Devices.

Unit V
High Speed Circuits: GaAs Digital Integrated Circuits for High Speed Operation- Direct Coupled Field Effect Transistor Logic (DCFL)- Schottky Diode FET Logic (SDFL)- Buffered FET Logic(BFL)- GaAs FET Amplifiers-Monolithic Microwave Integrated Circuits (MMICS)- Resonant-Tunneling Hot Electron Transistors and Circuits.

Text Books

1. S.M Sze, “High Speed Semiconductor Devices” Wiley,2008
2. S.Ghandhi “VLSI Fabrication Principles”, Wiley, 2003

Reference Books

1. C.Y Chang & F.Kat “GaAs High speed devices : Physics Technologies and Circuit applications”Wilney,N.Y,1994.
2. H.Beneki9ng “High Speed Semiconductor Devices: Circuit Aspects and Fundamental Behaviour” Chapman and Hall, London,1994.
3. Michael Shur “GaAS Devices and Circuits”,Plenum press,NY,1989.
4. N.G Einsprush and R.Weisseman “VLSI Electronics: GaAs Microelectronics”, Academic Press,NY, 1985.

12EC342 NANO CMOS DEVICE ARCHITECTURE

Credits: 4:0:0

Course Objective:

- To study the concepts of the nano devices and analyze their characteristics.

Course Outcome:

- Successful understanding of the concepts and emerging researchers.

Unit I

Introduction: Physics of Scaling-Device Parameters for Superior Performance-Threshold Voltage-Historical Trends-International Technology Roadmap for Semiconductors-Different Scaling Methods- Ballistic Transistors

Unit II

Short Channel Effects: Short Channel Effects-Threshold Voltage Roll-off-Drain Induced Barrier Lowering-Punch through-Hot Carrier Degradation Velocity Saturation-Reverse Short Channel Effects- Interconnects.

Unit III

VLSI Devices: Break through solutions-Source/Drain Engineering-Channel Engineering-Vertical Substrate Engineering-Halo Implants-Gate Oxide Engineering-High K Dielectrics-Gate Engineering-DMG MOSFETS

Unit IV

SOI Devices: Partially Depleted SOI MOSFETs- Fully Depleted SOI MOSFETs -Fully Depleted Collector Mode- Partially Depleted Collector Mode-Accumulation Collector Mode –An Analytic Drain Current Model for Symmetric DG MOSFETS-The Scale Length of Double –Gate MOSFETS- Fabrication Requirements and Challenges of DG MOSFETS-Multiple Gate MOSFETS.

Unit V

Emerging Devices: Resonant Tunneling Diodes-Single-Electron Transistor Logic- other SET and FET Structures- Quantum Dots and Arrays-Carbon Nanotube Transistors (FETS and SETS)- Semiconductor Nanowire (FETS and SETS)- Molecular SETS.

Text Books

1. Donald A.Neamen, “Semiconductor physics and devices”, McGraw,Hill,3rd edition,2007.
2. Yuan Taur,T H.Ning, “Fundamentals of modern VLSI devices”, Cambridge university, Newyork,2nd ed.,2009.

Reference Books

1. Jean Pierre Colinge, “FinFETs and other Multi,gate Transistors”, Springer Publishers, 2008.
2. Simon Deleonibus, “Electronic Device Architectures for the Nano,CMOS Era.From Ultimate CMOS Scaling to beyond CMOS devices”, Pan Stanford Publishing Pte.Ltd. Singapore, 2009.

12EC343 EMBEDDED SYSTEM DESIGN

Credits: 4: 0: 0

Course Objective:

- To learn the method of designing a real time systems

Course Outcome:

- The course would help to develop a new embedded real system design

Unit I

Embedded Architecture: Embedded Computers- Characteristics of Embedded Computing Applications- Challenges in Embedded Computing system design- Embedded system design process- Requirements- Specification- Architectural Design- Designing Hardware and Software Components- System Integration- Formalism for System Design- Structural Description- Behavioral Description- Design Example: Model Train Controller

Unit II

Embedded Processor and Computing Platform: ARM processor- processor and memory organization- Data operations- Flow of Control SHARC processor- Memory organization- Data operations- Flow of Control- parallelism with instructions- CPU Bus configuration- ARM Bus- SHARC Bus- Memory devices- Input/output devices- Component interfacing- designing with microprocessor development and debugging- Design Example : Alarm Clock.

Unit III

Networks: Distributed Embedded Architecture- Hardware and Software Architectures- Networks for embedded systems- I2C- CAN Bus- SHARC link ports- Ethernet- Myrinet- Internet- Network Based design- Communication Analysis- system performance Analysis- Hardware platform design- Allocation and scheduling- Design Example: Elevator Controller.

Unit IV

Real Time Characteristics: Clock driven Approach- weighted round robin Approach- Priority driven Approach- Dynamic Versus Static systems- effective release times and deadlines- Optimality of the Earliest deadline first (EDF) algorithm- challenges in validating timing constraints in priority driven systems- Offline Versus On-line scheduling**.**

Unit V

System Design Techniques: Design Methodologies- Requirement Analysis- Specification- System Analysis and Architecture Design- Quality Assurance- Design Example: Telephone PBX- System Architecture- Ink jet printer- Hardware Design and Software Design- Personal Digital Assistants- Set-top Boxes.

Text Book

1. Wayne Wolf, "Computers as Components: Principles of Embedded Computing System Design", Morgan Kaufman Publishers, 2001.

Reference Books

1. Jane.W.S. Liu, "Real,Time systems", Pearson Education Asia, 2000
2. Frank Vahid, Tony Givargi, "Embedded System Design: A Unified Hardware/Software Introductions", John Wiley & Sons, 2000.

12EC344 SMART ANTENNAS

Credits: 4:0:0

Course Objective:

- To introduce the Smart antenna concepts

- To discuss its various array signal processing techniques and methodologies.

Course Outcome:

- Students able to gain Good knowledge about smart antenna and its various processing techniques.

Unit I

Introduction: Antenna gain- Phased array antenna- power pattern- beam steering- degree of freedom- optimal antenna- adaptive antennas- smart antenna -key benefits of smart antenna technology- wide band smart antennas- Digital radio receiver techniques and software radio for smart antennas.

Unit II

Narrow and Broad Band Processing: Signal model conventional beamformer- null steering beamformer- optimal beamformer- Optimization using reference signal- beam space processing. Tapped delay line structure- Partitioned realization- Derivative constrained processor- Digital beam forming- Broad band processing using DFT method.

Unit III

Adaptive Processing: Sample matrix inversion algorithm- unconstrained LMS algorithm-normalized LMS algorithm- Constrained LMS algorithm- Perturbation algorithms- Neural network approach- Adaptive beam space processing- Implementation issues.

Unit IV

Direction of Arrival Estimation Methods: Spectral estimation methods- linear prediction method- Maximum entropy method- Maximum likelihood method- Eigen structure methods-Music algorithm -root music and cyclic music algorithm- the ESPRIT algorithm.

Unit V

Diversity Combining: Spatial diversity selection combiner- switched diversity combiner-equal gain combiner- maximum ratio combiner- optical combiner.

Text Books

1. Lal Chand Godara, "Smart Antennas" CRC press, 2004
2. A. Balanis, "Antenna Theory: Analysis and Design", John Wiley and Sons, 2005

Reference Books

1 Joseph C Liberti, Theodore S Rappaport, "Smart Antennas for Wireless Communication: IS-95 and Third Generation CDMA Applications", Prentice Hall 1999

12EC345 INTEGRATED A/D AND D/A CONVERTERS

Credits: 4:0:0

Course Objective:

- To learn the various techniques& architectures of D/A & A/D Converters

Course Outcome:

- Will be used to develop low power- low voltage- high speed A/D & D/A Converters

Unit I

Data Converter Fundamentals & Specifications of Converters: Analog Versus Discrete Time Signals-Converting Analog Signals to Digital Signals-Sample – and –Hold(S/H) Characteristics-Digital data coding-Digital coding schemes-Ideal and Non-ideal converters-DC specifications-Dynamic specifications-Figure of Merit.

Unit II

High Speed A/D Converters & D/A converters: Design problems in high-speed converters-Full-flash converters-Interpolation-Averaging- Twostep flash converters-Pipeline converter architecture-Folding converter system- High speed D/A converter architecture- Voltage weighting based architecture- High speed segmented converter architecture.

Unit III

High Resolution A/D & D/A converters: Introduction-Single slope A/D converter system-Dual-slope A/D converter system-Dual ramp single-slope A/D converter system-Algorithmic A/D converter-Cyclic redundant signed digitA/D converter-Self-calibrating capacitor A/D converter- Pulse width modulation D/A converters- Integrating D/A converters- Current weighting using ladder networks- Self calibrating D/A converter system- Current calibration principle.

Unit IV

Sample and hold amplifiers: Introduction-Basic Sample –and –Hold Configuration-Signal Bandwidth –Acquisition Time- Aperture Time Accuracy-Sampling Moment Distortion Calculation-Differential Sample and Hold Circuit-Types of Bootstrapping System-Generalized Non-Inverting Configurations- Inverting Sample -and -Hold Circuit-Operational Range of Simple Sample and Hold Amplifiers

Unit V

Sigma-delta A/D conversion & Testing of D/A and A/D converters: General Form of Sigma-Delta A/D Converters-General Filter Architectures-Discussion of Basic Converter Architectures-Multi Stage Sigma-Delta Converter (MASH)-Nth Order Sigma Delta Architecture- Sigma-Delta Digital Voltmeter- DC Testing of D/A Converters **-** Dynamic Testing of A/D Converters- Testing Very High-Speed A/D Converters

Text Book

1. Rudy van de Plassche, "CMOS Integrated Analog to Digital and Digital to Analog Converters", Springer International Edition, Second Edition, 2007.

Reference Books

1. Jacob Baker. R, Harry W. Li, David E. Boyce, "CMOS Circuit Design, Layout and Simulation", IEEE Press, Fifth Edition, 2003.

2. Randall L.Geiger, Philip E.Allen, Noel K.Strader, "VLSI Design Techniques for Analog and Digital Circuits", McGraw Hill International Co, 1990.

12EC346 VLSI ARCHITECTURES FOR IMAGE AND VIDEO PROCESSING

Credits: 4:0:0

Course Objective:

- To learn about the image and video compression algorithms and their hardware implementation in VLSI.

Course Outcome:

- Will be able to design practically feasible VLSI chips for image and video algorithms.

Unit I

Fundamentals of Image and Video: Light and Spectra-Human Vision-Image Formation-Camera Systems- Block diagram of Digital Image Processing – Image Data Types and Image Formats - Chromaticity Diagram-Color Models in Images-Color Models in Video- Types of Video Signals – Video Standards – Coding Techniques for Images and Videos : Huffman Coding- Arithmetic Coding & Dictionary Techniques

Unit II

Spatio- Temporal Video Sampling and Two-dimensional Motion Estimation: Digital Video Concepts- Sampling Structures for Digital Video – Two- Dimensional Rectangular Sampling - Two- Dimensional Periodic Sampling - Sampling on 3-D Structures – Reconstruction from Samples - Sampling Structure Conversion-Two-dimensional Motion Estimation-Optical Flow Methods - Block-based Methods -Pixel-based Methods -Bayesian and Mesh Based Methods .

Unit III

VLSI Architecture for DWT & JPEG 2000: VLSI Architecture for Convolution Approach-Mapping the DWT in a Semi-Systolic Architecture- JPEG 2000 Architecture for VLSI Implementation – VLSI Architecture for EBCOT- VLSI Architecture for Binary Arithmetic Coding- MQ-Coder –Decoder Architecture for JPEG 2000.

Unit IV

Motion Estimation Algorithms and Analysis of Fast Motion Estimation Algorithms:
VLSI Design Methodology for MPEG-4 - MPEG – 4 Motion Estimation - Rate/distortion – Optimized Motion Estimation- Fast Motion Estimation Algorithms- Fast Motion Estimation for MPEG -4 - Analysıs of PSNR/bit rate and Complexity.

Unit V

Design Space Motion Estimation Architectures and VLSI Implementation: Introduction-General Design Space Evaluation - Design Space Motion Estimation Architectures - Motion Estimation Architecture for MPEG-4 —VLSI Architecture Search Engine I – Algorithm Architecture Mapping - Processor Element Array – Result Analysis – VLSI Architecture Search Engine II – Algorithm Architecture Mapping – Memory Configurations –
Result Analysis.

Text Books

1. Wang Y., Ostermann J.and.Zhang Y.Q., “Digital video processing and communications”, Prentice,Hall, 2002.
2. Tinku Acharya, Ping,Sing Tsai,”JPEG 2000 Standard for Image Compression: Concepts, Algorithms and VLSI Architectures, John Wiley Publishers, 2005.

Reference Books

1. Peter Kuhn, "Algorithms, Complexity Analysis and VLSI Architectures for MPEG,4 Motion Estimation", Kluwer Academic Publishers,1999.
2. Watkinson J. "The MPEG Handbook – MPEG-1, MPEG-2, MPEG-4," Oxford, UK:Focal Press, II Edition, 2005.
3. Richardson I.E.G.,"H.264 and MPEG-4 video compression", Hoboken, NJ: Wiley, 2003.
4. Khalid Sayood, "Introduction to Data Compression", Morgan Kaufmann Publishers, 3RD Edition, 2006.
5. Ze,Nian Li, Mark S.Drew, "Fundamentals of multimedia", Prentice,Hall of India, 2004.

12EC347 NETWORK ROUTING ALGORITHMS

Credits: 4:0:0

Course Objective:

- To review the routing concept in circuit switching & packet switching networks in
- general and high speed networks in particular
- To study the routing algorithms of mobile networks in detail

Course Outcome:

- To explore the functionalities of routing algorithms of Wired and Wireless Networks

Unit I

Multi Access Communication: Basic classifications of routing, Routing in circuit switching networks - Dynamic Non - Hierarchical Routing and Dynamic Alternative Routing - Routing in packet switching networks -
characteristics and design elements -Routing strategies - Routing in ATM networks - Self and Table Controlled routing.

Unit II

Single User Matched Filter: Distance Vector Routing - Routing Information Protocol - Link State Routing - Open Shortest Path First Protocol - Inter Domain Routing - EGP, BGP and IDRP Protocols - Apple Talk Routing

Unit III

Optimum Multi User Detection: Routing based taxonomy of optical networks, Deflection routing algorithm, Routing in PlaNET - modes, options, packet and call level routing.

Unit IV

Non De-Correlating Linear Multi User Detection: Mobility management in Internet - Mobile IP - Routing in cellular networks - hand off and roaming - Introduction to packet radio networks - Routing in small and large sized packet radio networks - Tier and hierarchical routing - Applications and other issues of Mobile Adhoc Networks

Unit V

Decision - Driven Multiuser Detectors: Table driven and On-demand routing protocols- Desitination Sequenced Distance Vector protocol- Clusterhead Gateway Switch Routing protocol- Wireless Routing Protocol - Adhoc Ondemand Distance Vector protocol- Dynamic

Source Routing protocol - Multicast routing – Link reversal routing - Temporally Ordered Routing Algorithm - Associativity Based Routing
Protocol- Signal Stability Routing protocol - Comparison.

Text Books
1. M C.E. Perkins, "AdHoc Networking", Addison - Wesley Publication, Singapore, 2001.
2. S. Keshav, "An Engineering Approach to Computer Networking", Addison - Wesley, New Delhi, 2001.

Reference Books
1. Steen Strub, "Routing in Communication Networks", Prentice Hall International, New York, 1995.
2. A.S. Tanenbaum, " Computer Networks", PHI, New Delhi, 2003.
3. William Stallings, "Data and Computer Communications", 6th Edition, Pearson Education, 2002.

12EC348 NETWORK MANAGEMENT

Credits: 4:0:0

Course Objective:
- Understand the fundamental concepts of network management
- Exposure to network security aspects

Course Outcome:
- Network Management is a course designed to familiarize the student with the design, analysis operation and management of modern data communications networks.
- The course will provide the student with a working knowledge of the types of communications network management systems and their strengths and weaknesses in solving various information network management problems

Unit I
OSI Network Management: OSI Network management model-Organizational model-Information model, Communication model. Abstract Syntax Notation - Encoding Structure-Macros Functional Model CMIP/ CMIS

Unit II
Internet Management (SNMP): SNMP-organizational model-system overview- The information model-communication model- Functional model- SNMP proxy server-Management information- Protocol remote monitoring

Unit III
Broadband Network Management: Broadband networks and services, ATM Technology - VP, VC, ATM Packet- Integrated service- ATMLAN emulation-Virtual Lan-ATM Network Management - ATM Network reference model- Integrated local Management Interface. ATM Management Information base- Role of SNMD and II. MIin ATM Management, M1, M2, M3, M4 interface- ATM Digital Exchange Interface Management.

Unit IV

Network Management Protocols: HTTP-History and standards development-HTTP Session-Request message-Request methods- Status Codes- persistent connections-Secure HTTP-POP4-SDPS-server implementations-SMTP mail processing model-protocol review-outgoing mail SMTP server-FTP/IP-IMAP-original imap2- imap4-advantages over POP-disadvantages of IMAP

Unit V

Network Management Applications: Configuration management-Fault management-performance management- Event Correlation Techniques security management- Accounting management- Report Management- Policy Based Management Services Level Management.

Text Books

1. Mani Subramanian, "Network Management Principles and Practice", Addison Wisely, New York, 2000
2. W. Richard Stevens, TCP/IP Illustrated Volume-I, the protocols, Pearson Education,2000.

Reference Books

1. Salah Aiidarons, Thomas Plevayk, "Telecommunications Network Technologies and Implementations", Eastern Economy Edition IEEE press, New Delhi, 1998.
2. Lakshmi G Raman, "Fundamentals of Telecommunication Network Management", Eastern Economy Edition IEEE Press, New Delhi,1999.

12EC349 GLOBAL POSITIONING SYSTEM

Credits: 4:0:0

Course Objective:

- Introduction to global positioning
- Types of signals used in the GPS systems and accuracy limits
- Latest versions of GPS and its application

Course Outcome:

- The purpose of this course is to develop a strong foundation in the field of Global Positioning Systems.
- The subject gives the students an in-depth knowledge about working of Global positioning receivers.
- Students are exposed to various errors occurring in GPS and latest variant DGPS receivers and GPS applications.

Unit I

Introduction: GPS and GLONASS Overview - Satellite Navigation -Time and GPS - User position and velocity calculations - GPS - Satellite Constellation - Operation Segment - User receiving Equipment - Space Segment Phased development

Unit II

Signal Characteristics: GPS signal components - purpose, properties and power level - signal acquisition and tracking - Navigation information extraction - pseudorange estimation - frequency estimation – GPS satellite position calculation

Unit III
GPS Receivers & Data Errors: Receiver Architecture - receiver design options - Antenna design - SA errors - propagation errors - Methods of multipath mitigation - Ephemeris data errors - clock errors.

Unit IV
Differential GPS: Introduction - LADGPS - WADGPS, Wide Area Augmentation systems - GEO Uplink subsystem - GEO downlink systems - Geo Orbit determination - Geometric analysis – covariance analysis - GPS /INS Integration Architectures.

Unit V
GPS Applications: GPS in surveying, Mapping and Navigation - Precision approach Aircraft landing system - Military and Space application - Intelligent transportation system

Text Book

1. Mohinder S.Grewal , Lawrence R.Weill, Angus P.Andrews, "Global positioning systems - Inertial Navigation and Integration", John wiley & sons , 2002

Reference Book

1. E.D.Kaplan, ""Global positioning systems - Inertial Navigation and Integration", John wiley & sons , 2001

12EC350 DIGITAL COMMUNICATION RECEIVERS

Credits: 4:0:0

Course Objective:

- To learn about base band and band pass communication.
- To study the different types of receivers used in Additive white Gaussian noise channels and Fading channels.
- To study the extraction methods of the signal from AWGN and Fading channel.

Course Outcome:

- The student learns to design a receiver for any given communication channel.

Unit I
Review of Digital Communication Techniques: Base band and band pass communication - signal space representation - linear and nonlinear modulation techniques - and Spectral characteristics of digital modulation.

Unit II
Optimum Receivers for AWGN Channel: Correlation demodulator matched filter - maximum likelihood sequence detector - optimum receiver for CPM signals - M-ary orthogonal signals - envelope detectors for M-ary and correlated binary signals.

Unit III

Receivers For Fading Channels: Characterization of fading multiple channels - statistical models - slow fading - frequency selective fading - diversity technique - RAKE demodulator - coded waveform for fading channel.

Unit IV
Synchronization Techniques: Carrier and signal synchronization - carrier phase estimation-PLL - Decision directed loops - symbol timing estimation - maximum likelihood and non-decision directed timing estimation - joint estimation.

Unit V
Adaptive Equalization: Zero forcing algorithm -LMS algorithm - adaptive decision-feedback equalizer and Equalization of Trellis-coded signals- Kalman algorithm - blind equalizers and stochastic gradient algorithm.
Echo cancellation

Text Book

1. John.G.Proakis, " Digital communication " 4th Edition, McGraw-Hill, New York, 2001.

Reference Books

1. Simon Marvin, " Digital communication over fading channel; An unified approach to performance Analysis ", John Wiley, New York, 2000.
2. Heinrich Meyer, Mare Moeneclacy, Stefan.A.Fechtel, " Digital communication receivers", Vol I & Vol II, John Wiley, New York, 1997.
3. E.A.Lee and D.G.Messerschmitt, " Digital communication ", 2nd Edition, Allied Publishers, New Delhi, 1994.

12EC351 OPTICAL NETWORKS & PHOTONIC SWITCHING

Credits: 4:0:0

Course Objective:

- Various components of optical networks
- First generation and broadcast optical network
- Wavelength routed optical networks also various photonic switches

Course Outcome:

- The main purpose of this course is to introduce students the important areas of communication networks, mainly optical networks and photonic switching.
- This will enable the students to acquire a solid understanding of foundations of optical networks technologies, systems, networks issues as well as economic deployment considerations and also photonic switching

Unit I
Networks: Introduction : first and second generation optical networks : system network evaluation.

Unit II
Technology: Propagation of light energy in optical fibers dispersion and non linear effects; components - couplers - isolators - circulators - multiplexers - filters and optical amplifiers; switches and wavelength converters.

Unit III
First Generation Optical Networks: SONET / SDH - MAN layered architecture - broadcast and select networks MAC protocols - test beds - wavelength routing networks

Unit IV
Control and Management: Configuration - performance and fault management - optical safety - service interface; testbeds; access networks - HFC - FTTC - architecture

Unit V
Photonic Packet Switching: OTDM - MUX & DEMUX synchronization; broadcast OTDM networks - switch - ban networks: OTDM testbeds.

Text Book

1. Rajiv Ramaswamy, "Optical Networks", Harcourt Asia Private Limited, Singapore, 2001

Reference Books

1. D.W.Smith, Ed., "Optical Network Technology", Chapman and Hall, London, 1995.
2. Biswanath Mukherjee, "Optical Communication Networks", McGraw-Hill,1997

12EC352 WIRELESS SENSOR NETWORKS

Credits: 4:0:0

Course Objective:

- To introduce the basic concepts of Sensor Networks.
- To introduce the overview of communication Protocols
- To introduce the Energy management and Security.

Course Outcome:

- Students will be able to understand the concepts of sensor networks, applications and different types of protocols in WSN.

Unit I
Basics Concepts about Sensor Networks: Introduction –Difference between sensor networks and traditional networks-Need for sensor network programmability- Functional architecture of sensor networks—Individual components of WSN-Sensor network node--Applications-Habitat monitoring-Tracking chemical plumps- Smart transportation.

Unit II
Communication Protocols: Time synchronization protocols-Transport Layer protocol-Network layer protocol-Data link protocol-medium access control-The S-MAC protocol-IEEE 802.15.4 standard and Zigbee - Error Control

Unit III
Tracking Technologies: Tracking scenario –Problem formulation –Sensing model-Fundamentals-ToA, TDoA, and AoA Positioning by signal strength-positioning ang location

tracking algorithms-Trilateration- Multilateration-Pattern matching-Nearest neighbor algorithms - probability based algorithms location tracking-network based tracking

Unit IV

Sensor Network Data Bases: Sensor data base chalanges- Queying the physical environment-High level data base organization-Data aggregation-types of aggregation-Packet level aggregation-total aggregation-Geographic aggregation-selection of the best aggregation points-Problem with high data rate.

Unit V

Energy Management And Security: Idle power manage ment-Active power management-Design challenges in energy efficient medium access control –IEEE 802.11-operation-power saving mode –merits-drawback simplications in WSN.Blue tooth –operation-Merits-implications. Security: Security architecture-Cell based WSNs- Privacy of local information.

Text Book

1. Mohammad Ilyas and Imad Mahgoub, "Handbook of Sensor Networks: Compact Wireless and Wired Sensing Systems" CRC Press, 2009.

Reference Books

1. Feng Zhao, Leonidas J. Guibas, "Wireless Sensor Networks: An Information Processing Approach" Morgan Kaufmann Publishers, 2004.
2. Michel Banatre, Pedro Jose Marron, Anibal Ollero and Adam Wolisz, "Cooperating Embedded Systems and Wireless Sensor Networks", ISTE Ltd,2008.

12EC353 HIGH SPEED SWITCHING ARCHITECTURE

Credits: 4:0:0

Course Objective:

- To understand the types of switch fabrics for high-speed applications.
- To get a clear idea about the traffic and Queuing systems

Course Outcome:

- Students will be able to design switch architectures suitable for high speed application.

Unit I

LAN Switching Technology: Switch Forwarding Techniques - Switch Path Control - LAN Switching - Cut through Forwarding - Store and forward - and Virtual LANs

Unit II

Architectures: Switching architectures - Issues and performance analysis - Banyan and knockout switches - Single & Multistage networks - Shuffle switch tandem banyan.

Unit III

Packet Switching Architectures: Architectures of Internet Switches and Routers- Bufferless and buffered Crossbar switches - Multi-stage switching - Optical Packet switching; Switching fabric on a chip; internally buffered Crossbars.

Unit IV
Signaling Standards and Queuing Concepts: Signaling - SS7 Signaling - Traffic and queuing models - Performance analysis of Input – Output & Multiple shared Queuing.

Unit V
IP Switching: Addressing Model - IP switching types - Flow driven and topology driven solutions - IP over ATM - Address and next hop resolution - Multicasting - IP v6 over ATM

Text Books

1. Achille Pattavina, Switching Theory Architectures and performance in Broadband ATM Networks, John wiley & sons Ltd, New York, 1998
2. Elhanany M. Hamdi, "High Performance Packet Switching architectures", Springer Publications, 2007.

Reference Books

1. Ranier Handel. Manfred N Huber, Stefab Schrodder, ATM Networks - Concepts, Protocols, Applications, 3rd edition, Adisson Wesley, New York ,1999.
2. Thiggarajan Viswanathan, "Tele Communication Switching System and Networks", Prentice Hall of India, Pvt.Ltd., New Delhi, 1995.
3. Christopher Y Metz, "Switching protocols & Architectures", McGraw Hill Professional Publishing, New York, 1998.

12EC354 HIGH SPEED VLSI DESIGN

Credits: 4:0:0

Course Objective:
- To learn in detail about Non clocked and Clocked Logic Styles, Latching Strategies and Asynchronous Clocking Techniques.

Course Outcome:
- Design of various High speed VLSI Circuits.

Unit I
Non-Clocked and Clocked Logic Styles: Static CMOS Structure – DCVS Logic – Non-Clocked Pass-Gate Families – Single Rail Domino Logic Styles – Alternating-Polarity Domino Approaches – Dual-Rail Domino Structures – Latched Domino Structures – Clocked Pass-Gate Logic.

Unit II
Circuit Design Margin and Design Variability: Process Induced Variation – Design Induced Variation – Application Induced variation – Noise.

Unit III
Latching Strategies: Basic Latch Design – Latching Single-Ended Logic – Latching Differential Logic – Race Free Latches for Precharged Logic – Asynchronous Latch Techniques.

Unit IV
Interface Techniques: Signaling Standards – Chip-to-chip Communication Networks – ESD Protection – Driver Design Techniques – Receiver Design Techniques.

Unit V
Clocking Styles: Clock Jitter and Skew – Clock Generation – Clock Distribution – Single Phase Clocking – Multi-Phase Clocking – Asynchronous Techniques.

Text Book

1. Kerry Bernstein & et.al, "High Speed CMOS Design Styles", Kluwer Academic Publishers, 2001.

Reference Book

1. Evan Sutherland, Bob Stroll, David Harris, "Logical Efforts, Designing Fast CMOS Circuits", Kluwer Academic Publishers, 1999.

12EC355 MIXED SIGNAL PROCESSING

Credits: 4:0:0

Course Objective:

- To know about the various analog and mixed signal concepts and Behavioral Generic Model of Operational amplifiers.

Course Outcome:

- Knowledge in Analog and Mixed Signal Extensions to VHDL and VERILOG HDL
- Knowledge in Behavioral Generic Model of Operational amplifiers.

Unit I
Introduction: Introduction – Modeling Basic Analog Concepts – Analog Circuit Analysis – Network Independent- Dependent Data Sampled Analog Systems, Loading Effects.

Unit II
Analog and Mixed Signal Extensions To VHDL: Introduction – Language Design Objectives – Theory of Differential Algebraic Equation – The 1076.1 Language – Tolerance Groups – Conservative Systems – Time and The Simulation Cycle – A/D And D/A Interaction – Quiescent Point – Frequency Domain Modeling and Examples.

Unit III
Analog Extensions to Verilog: Introduction – Equation Construction – Solution – Waveform Filter Functions – Simulator –Control Analysis – Multi Disciplinary Model.

Unit IV
Behavioral Generic Model of Operational amplifiers: Introduction – Description of Generic Opamp Model – Structure – Configuration – Functional Specification – Auxillary Block – Conflict Resolution – Application Examples.

Unit V
Non-Linear State Space Averaged Modeling of 3-State Digital Phase – Frequency Detector: Introduction – Model – Resetable Integrator – AC Analysis – Sample Application.

Text Book
1. Alain Vachoux, Jean – Michael Bergi, "Analog and Mixed signal Hardware Description Language", Kluwer Academic publishers, 2007.

Reference Books
1. Philip E. Allen, "CMOS Analog Circuit Design", Oxford University Press, New Delhi 2009.
2. Behzad Razavi, "Design of Analog CMOS Integrated Circuits", Tata McGraw Hill Edition 14th reprint 2008.

12EC356 RF SYSTEM DESIGN

Credits: 4:0:0

Course Objective::
- To know about the RF issues, RF components and applications.

Course Outcome:
- Knowledge in RF Filter Design and RF Amplifier Design
- Knowledge in High frequency Oscillator configuration, Mixers and Phase Locked Loops.

Unit I
RF Issues: Importance of RF Design – Electromagnetic Spectrum – RF Behavior of Passive Components –Chip Components and Circuit Board Considerations – Scattering Parameters – Smith Chart And Applications.

Unit II
RF Filter Design: Overview – Basic Resonator and Filter Configuration – Special Filter Realizations – Filter Implementations – Coupled Filter.

Unit III
Active RF Components & Applications: RF Diodes – BJT – RF FETs – High Electron Mobility Transistors – Matching and Biasing Networks – Impedance Matching Using Discrete Components – Microstripline- Matching Networks – Amplifier Classes of Operation and Biasing Networks.

Unit IV
RF Amplifier Designs: Characteristics – Amplifier Power Relations – Stability Considerations – Constant Gain Circles –Constant VSWR Circles – Low Noise Circuits – Broadband – High Power and Multistage Amplifiers.

Unit V

Oscillators, Mixers & Applications: Basic Oscillator Model – High Frequency Oscillator Configuration – Basic Characteristics of Mixers – Phase Locked Loops – RF Directional Couplers and Hybrid Couplers – Detector and Demodulator Circuits – Microwave Integrated Circuits.

Text Book

1. Reinhold Ludwig and Powel Bretchko, " RF Circuit Design – Theory and Applications", Pearson Education Asia, Mc Graw Hill Publishers 5th edition, 2003.

Reference Books

1. Joseph. J. Carr," Secrets of RF Circuit Design", Mc Graw Hill Publishers, Third Edition 2000.
2. Matthew M. Radmanesh," Radio Frequency & Microwave Electronics", Pearson Education Asia, Second Edition, 2002.

12EC357 GENETIC ALGORITHM FOR VLSI DESIGN

Credits: 4:0:0

Course Objective:

- To study about Implementation of VLSI Design in GA.

Course Outcome:

- Design of GA Based Design and Testing.

Unit I

Introduction to GA: Introduction- GA Technology-Steady State Algorithm-Fitness Scaling-Inversion.

Unit II

Design Analysis in GA: GA for VLSI Design- Layout and Test automation- partitioning-Automatic Placement – Routing Technology - Mapping for FPGA- Automatic Test Generation- Partitioning Algorithm Taxonomy-Multiway Partitioning

Unit III

Algorithms: Hybrid genetic – Genetic Encoding-Local Improvement-WDFR-Comparison Of GAS – Standard Cell Placement-GASP Algorithm-Unified Algorithm.

Unit IV

FPGA Technology Mapping and Test Generation in GA: Global routing-FPGA technology mapping-Circuit Generation-Test Generation in a GA Frame Work-Test Generation Procedures.

Unit V

Peak power Estimation using GA: Power estimation-application of GA-Standard cell placement-GA for ATG-problem encoding fitness function-GA Vs Conventional algorithm.

Text Book

1. Pinaki Mazumder, E.M Rudnick,"Genetic Algorithm for VLSI Design, Layout and Test Automation", Pearson Education, 2007.

Reference Books

1. Ricardo Sal Zebulum, Macro Aurelio Pacheco, Marley Maria B.R. Vellasco, Marley Maria Bernard Vellasco "Evolution Electronics: Automatic Design of electronic Circuits and Systems Genetic Algorithms", CRC press, 1st Edition Dec 2001.
2. Melanie Mitchell, "An Introduction to Genetic Algorithms" Prentice Hall India, 2002.
3. John R.Koza, Forrest H.Bennett III, David Andre , Morgan Kufmann, "Genetic Programming Automatic programming and Automatic Circuit Synthesis", 1st Edition May 1999.

12EC358 MEMS AND MICRO SYSTEMS

Credits: 4:0:0

Course Objective:

- To learn about the emerging field of MEMS and Microsystems
- To understand the concepts involved in realizing various types of Microsensors and actuators using MEMS technology.

Course Outcome:

- Students are expected to learn physical principles involved in micro sensors and design a suitable sensor for a given application.

Unit I

Introduction to MEMS and Microsystems: Introduction to MEMS and Microsystems- Evolution of MEMS- Market survey – Applications of MEMS - various types of MEMS devices – MEMS materials and properties.

Unit II

Microelectronic Technology Applicable to MEMS: Oxidation – Diffusion- Ion-Implantation - Physical Vapor Deposition- Chemical Vapor Deposition-Lithography-Etching- Difference Between Microelectronic Fabrication And MEMS Fabrication - Wafer Bonding - Electroplating - MEMS Packaging - Micromachining.

Unit III

Bulk Micromachining and Surface Micromachining: Bulk Micromachining: Crystal Silicon Properties- Wet Etching- Isotropic and Anisotropic Etching- Issues In Wet Anisotropic Etching- Corner Undercutting Problem and Compensation Structures-Real Estate Consumption Issue - Dry Etching. Surface Micromachining: Sacrificial Layer Process - Surface Micromachining Requirements - Polysilicon Surface Micromachining - Other Compatible Materials - Silicon Dioxide - Silicon Nitride - Piezoelectric Materials - Surface Micro Machined Systems : Micro Motors - Gear Trains - Mechanisms - Introduction To LIGA.

Unit IV

Scaling and Power in Miniaturized Systems: Scaling of Length - Surface Area and Volume – Scaling and Diffusion – Scaling and Surface Tension – Scaling in Flying and Swimming- Scaling in Electrochemistry- Scaling of Minimal Analytical Sample Size-

Scaling in Optics MEMS Batteries And Capacitors- Beam Energy to MEMS- Heat-Powered MEMS- Kinetic Energy Driven MEMS- Combustion Engines in MEMS.

Unit V

MEMS devices: Physical Properties Used For Sensing- Thermal Sensors - Electrical Sensors - Mechanical Sensors - Chemical And Bio-Sensors - **Case Study:** Pressure And Acceleration Sensors Based on Piezoresistive And Capacitive Sensing Techniques. Micro Actuators: Electromagnetic And Thermal Micro Actuation - Mechanical Design Of Micro Actuators - Micro Actuator Examples - Micro Valves - Micro Pumps - Micromotors - Microactuator Systems: Ink-Jet Printer Heads - Micro Mirror - TV Projector.

Text Book

1. Marc Madou, “Fundamentals of Microfabrication: The Science of Miniaturization” CRC Press, 2002.

Reference Books

1. Stephen Beeby, Graham Ensell, Michael Kraft and Neil White, “MEMS Mechanical Sensors”, Artech House Inc.,London, 2004.
2. Nadim Maluf and Kirt Williams, “An Introduction to Micro electro mechanical Systems Engineering”, 2nd Edition, Artech House, 2004.
3. Mohamed Gad-el-Hak, “The MEMS Handbook-MEMS Introduction and Fundamentals”,2nd Edition, CRC Press, 2006.
4. Stephen D. Senturia, "Microsystem Design", Kluwer Academic Publishers, 2001.
5. M.-H. Bao, “Micromechanical Transducers: Pressure sensors, accelerometers and gyroscopes”, Elsevier, New York, 2000.

12EC359 NANOELECTRONICS

Credits: 4:0:0

Course Objective:

- To learn about the various aspects of nanoelectronics.
- To understand the journey from microelectronics to nanoelectronics, various approaches of achieving nano-scale devices.

Course Outcome:

- Students are expected to understand the physics behind nano-scale devices and various approaches of realizing nanoscale devices.

Unit I

Introduction to Nanoelectronics: Basics Of Nanoelectronics – Capabilities Of Nanoelectronics – Physical Fundamentals of Nano- Electronics – Microelectronic Circuits – MOSFET Characteristics – Advantages and Issues with MOSFET Scaling – Microelectronics to Nanoelectronics.

Unit II

Shrink-Down Approaches: CMOS Scaling – Traditional Scaling And Equivalent Scaling – The Nanoscale MOSFET- Vertical MOSFETs –Limits To Traditional Scaling: Technological Limits; Issues In Optical, XRay and E- Beam Lithography- Emerging Lithographic Techniques for Nanoscale Fabrication - Device Limits ; Leakage Current- Floating Body-

Parasitic Signals-Mobility- Equivalent Scaling– High-K Materials – Strained Silicon – FinFETs.

Unit III: Nanoelectronics with Tunneling Devices And Superconducting Device
Tunnel Effect and Tunneling Elements – Tunneling Diode – Resonant Tunneling Diode – Three Terminal RTD – Technology Of RTD – Digital Circuit Design Based On RTD Super Conducting Switching Devices – Cryotron – The Josephson Tunneling Device.

Unit IV
Molecular Electronics and Single Electron Transistor: Molecular Electronics Overview – Switches Based On Nanotubes, Polymer Electronics, Self- Assembling Circuits, Single Electron Devices and Their Applications – The Coulomb Blockade – Performance of Single-Electron Transistor – SET Circuit Design – Fabrication Challenges In SET.

Unit V
Nano-Memory Architectures: Single Electron Memory for Terabit Storage – Single Island and Multiple Island Memories – FeRAM – MRAM – NOVORAM.

Text Books

1. Karl Goser, Peter Glosekotter, Jan Dienstuhl., "Nanoelectronics and Nanosystems" , Springer, 2004.
2. A.M. Ionescu and K. Banerjee (ed.), "Emerging Nanoelectronics, Life with and after CMOS", Kluwer Academic Publishers, 2004.

Reference Books

1. Rainer Waser (ed.) , "Nanoelectronics and Information Technology : Advanced Electronic Materials and Novel Devices" ,2nd Edition, Wiley VCH Verlag Weiheim,2005.
2. Mick Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons and Burkhard Raguse, "Nanotechnology: Basic Science and Emerging Technologies",Overseas Press,2005.

12EC360 ADVANCED SEMICONDUCTOR MEMORIES

Credits: 4:0:0

Course Objective:

- This subject deals with the study of recent developments in advanced semiconductor memories like (BSRAM, TSRAM, SDRAM, EDRAM, Floating gate, FRAM, MRAM, Single-electron memory)

Course Outcome:

- This subject will help in doing research in advanced memories and its designs

Unit I
Introduction to Advanced Semiconductor Memories: Semiconductor Memories Overview- Advanced Semiconductor Memories Development- Future Memory Direction-

Static Random Access Memory Technologies: Basic SRAM Architecture And Cell Structures-SRAM Selection Considerations-High Performance Srams-Advanced SRAM Architectures-Low Voltage SRAM-Bicmos Technology SRAMS-SOI SRAMS-Specialty SRAMs.

Unit II

High-Performance Dynamic Random Access Memories: DRAM Technology Evolution and Trends-DRAM Timing Specifications and Operations Extended Data-Out Drams-Enhanced DRAM(EDRAM)-Enhanced Synchronous DRAMS-Cache DRAM-Virtual Channel Memory (VCM) DRAM-Multilevel Storage Drams.

Unit II

Application-Specific DRAM Architectures And Designs: Video Rams (VRAM)-Synchronous Graphic RAMS (SGRAMS)-Synchronous Link DRAMS- 3D Rams-Memory Design Considerations.

Unit IV

Advanced Non-Volatile Memory Designs And Technologies: Non-Volatile Memory Advances- Floating Gate Cell Theory-Flash Memory Architectures-Flash Memory Reliability Issues-Ferroelectric Memories- Magneto Resistive Random Access Memories-Resonant Tunneling Diode-Based Memories-Single-Electron Memories -Phase-Change Non-Volatile Memories-Miscellaneous Memory Technology Development.

Unit V

Embedded Memories Designs And Its Applications: Embedded Memory Developments-Cache Memory Designs-Embedded SRAM/DRAM Designs-DRAM Process with Embedded Logic Architectures-Embedded EEPROM and Flash Memories-Memory Cards and Multimedia Applications.

Text Book

1. Ashok K.Sharma, “Advanced Semiconductor Memories Architectures, Designs and Applications", Wiley Interscience, 2003.

Reference Books

1. Ashok K.Sharma, " Semiconductor Memories Technology, Testing and Reliability ", Prentice-Hall of India Private Limited, New Delhi, 1997.
2. Tegze P.Haraszti, “CMOS Memory Circuits”, Kluwer Academic publishers, 2001.
3. Betty Prince, “Emerging Memories: Technologies and Trends”, Kluwer Academic publishers, 2002.

12EC361 DESIGNING WITH PLD AND ASICs

Credits: 4:0:0

Course Objective:

- To know about different types of PLDs ,various families of Xilinx and Physical design of ASICs.

Course Outcome:

- Design of Xilinx Series, Application Specific Devices and State Machines

Unit I

Hardware and Mixed Logic Convention: Gate Hardware – mixed logic as design tools and descriptive convention – Uses of mixed logic in trouble shooting. **MSI & LSI Elements** Multiplexes – Decoders and demultiplexers – ROM

Unit II

Timing Diagram: Introduction – micro timing diagrams – Hazards – macro timing diagrams- timing simulations - Feedback in combinational circuits

Unit III

PLDs: Introduction – Programmable Logic – Programmable Logic –Programmable Logic Device - Simple PLDs – CPLD – FPGA – PREP Benchmarks – Future Direction of Programmable Logic

Unit IV

Designing with Field Programmable Gate Arrays: Implementing Functions in FPGAs – Implementing Functions Using Shannon's Decomposition – Carry Chains in FPGAs – Cascade Chains in FPGAs – Examples of Logic Blocks in Commercial FPGAs – Dedicated Memory in FPGAs – Dedicated Multipliers in FPGAs – Cost of Programmability – FPGAs and One –Hot State Assignment – FPGA Capacity: Maximum Gates Versus Usable Gates – Design Translation (Synthesis) – Mapping, Placement and Routing.

Unit V

State Charts and Microprogramming: State Machine Charts – Derivation of SM Charts – Realization of SM Charts – Implementation of the Dice Game – Microprogramming - Linked State Machines.

Text Book

1. James E. Palmer, David E Perlman, " Introduction to Digital Systems", Tata Mcgraw Hill,2004

Reference Books

1. Kevin Skahill, "VHDL for Programmable Logic", Pearson Education, First Indian Reprint, 2004.
2. Roth John, "Principles of Digital Systems Design Using VHDL", India Edition, Second Indian Reprint, 2009.

12EC362 ASIC DESIGN

Credits: 4:0:0

Course Objective:

- To study types of programmable ASICs , ASIC interconnects and Physical design of ASICs.

Course Outcome:

- Knowledge in the complete design flow of ASICs.

Unit I

Introduction to ASICS,CMOS Logic and ASIC Library Design: Types of ASICs – Economics of ASICs – ASIC Cell Libraries - Design flow – Combinational Logic Cell – Sequential logic cell – Data path logic cell – I/O Cells – Cell Compilers – Logical effort.

Unit II

Programmable ASICS, Programmable ASIC Logic Cells And Programmable ASIC I/O Cells: Anti fuse – static RAM – EPROM and EEPROM technology – PREP Benchmarks – Actel ACT – Xilinx LCA – Altera FLEX –Altera MAX – DC Output – AC Output –DC Input –AC Input – Clock Input – Power Input -Xilinx I/O blocks

Unit III

Programmble ASIC Interconnect, Programmable ASIC Design Software and Low Level Design Entry: Actel ACT – Xilinx LCA – Xilinx EPLD – Altera MAX 5000 and 7000 – Altera MAX 9000 – Altera FLEX – Schematic entry - Low level design language – PLA tools – EDIF – CFI design representation**.**

Unit IV

Simulation and ASIC Construction: Types of simulation – Switch Level Simulation – Transistor Level Simulation – Physical Design – CAD Tools – System Partitioning – FPGA Partitioning – Partitioning Methods.

Unit V

Floorplanning, Placement and Routing: Floor Planning – Placement – Global Routing – Detailed Routing- Circuit Extraction –DRC.

Text Book

1. M.J.S.Smith, "Application Specific Integrated Circuits", Addison, Wesly Longman Inc., 2006.

Reference Book

1. S.D. Brown R.J. Francis, J.Rox, Z.G. Urumesic, "Field Programmable Gate Arrays", Kluwer Academic Publishers, 2007.

12EC363 COMMUNICATION NETWORK SECURITY

Credits: 4:0:0

Course Objective:

- To learn about various network attacks.
- To study about security mechanisms such as encryption algorithms and security services to recover the network from attacks.

Course Outcome:

- The student learns to design a better internet security system to detect and correct security violations that involve in the transmission of information.

Unit I

Conventional Encryption: Introduction - Conventional encryption model - Steganography - Data Encryption Standard - block cipher - Encryption algorithms - confidentiality - Key distribution.

Unit II

Public Key Encryption And Hashing: Principles of public key cryptosystems - RSA algorithm - Diffie-Hellman Key Exchange- Elliptic curve cryptology - message authentification and Hash functions - Hash and Mac algorithms - Digital signatures.

Unit III

IP Security: IP Security Overview - IP Security Architecture - Authentification Header - Security Payload - Security Associations - Key Management.

Unit IV

Web Security: Web security requirement - secure sockets layer - transport layer security - secure electronic Transaction - dual signature

Unit V

System Security: Intruders - Viruses - Worms - firewall design - Trusted systems - antivirus techniques – digital Immune systems.

Text Book

1. Stallings,W, "Cryptography and Network security", Principles and Practice, 3rd Edition, Prentice Hall, 2002.

Reference Book

1. Baldwin.R and Rivest.R."TheRC5,RC5-CBC,TC5-CBC-PAD and RC5-CT5 Algorithms,RFC2040",October 1996.

12EC364 ADVANCED DIGITAL SYSTEM DESIGN

Credits 4:0:0

Course Objective:

- Advanced digital system concepts are introduced. Various PLD's are discussed

Course Outcome:

- Good knowledge to design digital circuit. Architectures of various families of PLD's enables good understanding of FPGA

Unit I

Advanced Topics in Boolean Algebra: Shannon's expansion theorem - Consensus theorem - Octal Designation - Run measure - INHIBIT / INCLUSION / AOI / Driver / Buffer Gates - Gate Expander - Reed Muller Expansion - Synthesis of multiple output combinational logic circuits by product map method - Design of static hazard free and dynamic hazard free logic circuits.

Unit II

Threshold Logic: Linear seperability – Unateness - Physical implementation - Dual comparability – Reduced functions - Various theorems in threshold logic - Synthesis of single gate and multigate threshold Network.

Unit III

Sequential Logic Circuits: Mealy machine - Moore machine - Trivial / Reversible / Isomorphic sequential machines – State diagrams - State table minimization - Incompletely specified sequential machines – State assignments – Design - of synchronous and asynchronous sequential logic circuits working in the Fundamental mode and pulse mode - Essential hazards Unger's theorem.

Unit IV

Symmetric Functions: Elementary symmetric functions - partially symmetric and totally symmetric functions – Mc Cluskey de-composition method - Synthesis of symmetric function by contact networks.

Unit V

Programmable Logic Devices: Anti fuse – static RAM -Basic concepts - Programming techniques - Programmable Logic Element (PLE) - Programmable Logic Array (PLA), Programmable Array Logic (PAL) Structure of Standard PLD's, Complex PLD's (CPLD) - Altera Max-7000 Series - Design of combination and sequential circuits using PLD's. Type of FPGA – Xilinx XC3000 Series – Logic Cell Array (LCA) – Configurable Logic Blocks (CLB) Input/Output Blocks (I/OB) – Programmable Interconnection Points (PIP) –Xilinx XC4000 families – Design examples.

Text Books

1. William I. Fletcher, "An Engineering Approach to Digital Design", Prentice Hall of India, 2004.
2. James E. Palmer, David E. Perlman, "Introduction to Digital Systems", TataMcGraw Hill, 1996.

Reference Books

1. N.N. Biswas, "Logic Design Theory", Prentice Hall of India, 2002.
2. Charles N. Roth, "Fundamentals of Logic Design", Pearson Education,2003.
3. Bhutiyani, "Digital Logic Design", Prentice Hall International, Simon & Schuster (Asia) Ptd., Ltd, 1996.

12EC365 FPGA DESIGN USING VHDL & VERILOG

Credits 4:0:0

Course Objective:

- To know about the various flow of VHDL and verilog programming techniques

Course Outcome:

- Knowledge in VHDL Programming and Verilog Programming and implementation of circuits in FPGA will be obtained

Unit I

Introduction to VHDL & Dataflow modeling: VHDL Overview – FPGA Design flow Process – Software tools - Xilinx Tool Flow – Libraries – Data objects - Data types – Data operators – Entities – Architectures. Basic Concurrent Statements – Signal assignment statements – Conditional Signal assignment – Selected signal assignment – Usage of Blocks in Dataflow modeling – Implementations of different digital circuits in Dataflow modeling

Unit II
Behavioral Modeling & Packages: Process – Delays – Basic Sequential Statements – if, if else statements, case statements – Loops– for loop, while loop, next, exit, null statements – Usage of Variables inside the process – Implementation of digital circuits using Sequential statements Multi Process statements – Generics – Operator Overloading – Conversion functions – Attributes – File Concepts - Packages – Functions & Procedures – Predefined & User defined library implementations.

Unit III
Structural Modeling & FPGA Implementations: Component Declarations – Component Instantiation – Types of Component Instantiation- Examples – Packages with Components declaration & Instantiation – FSM implementation – Moore & Mealy Machines – Implementations of Basic digital circuit using structural modeling – Test benches – Combinational & Sequential Test benches – Examples – Traffic Light Controller – Toll both controller.

Unit IV
Introduction to Verilog & Modeling: Design Methodology – Module – Ports – Basic concepts – Operators – Number specification – Data types – Arrays – Parameters – Gate delays – Operator types – Conditional statements – Multiway branches - Loops - Switch – Modeling elements – Implementation of Basic circuit using Dataflow & Behavioral Modeling

Unit V
Structural & Switch Level Modeling: Component Assignments – Switch level modeling – Applications of all dataflow, behavioral and Structural modeling in FPGA – FSM Implementation – Test Benches.

Text Books

1. J. Bhaskar, "A VHDL Synthesis Primer", BS Publications, III Edition, 2004.
2. Samir Palnitkar, "Verilog HDL", Pearson Publication", II Edition. 2003.

Reference Book

1. Navabi. Z, "VHDL: Analysis and Modeling of Digital Systems", Prentice Hall Inc.,2nd Edition, 1998.

12EC366 GENETIC PROGRAMMING AND PARTICLE SWARM OPTIMIZATION

Credits: 4:0:0

Course Objective:

- To learn the various concepts and techniques of optimization techniques

Course Outcome:

- Will be able to apply these algorithms to obtain optimal solutions in various applications.
- Will be able to develop new hybrid algorithms.
- Will be able to improve the performance of the existing artificial intelligence technique.

Unit I

Evolutionary Computation: Genetic Algorithms – Evolution Strategy – Genetic Programming – Variants in Genetic Programming. Architecture of Gene Expression Programming – Chromosome Domains – Cells and creation. Evolving Intrusion detection systems – Intrusion Detection – Evolving IDS using Genetic Programming – Machine Learning Techniques.

Unit II

Genetic Programming Applications: Evolutionary Pattern matching – Adaptive Pattern matching – Heuristics of good Traversal orders – Genetically Programmed Matching Automata – Genetic Programming in Data Modeling – Genetic Programming in mathematical modeling – Decision models for classification tasks – Genetic programming for Prediction task - Stock Market modeling using Genetic Programming ensembles – Modelling stock market Prediction – Intelligent Paradigms.

Unit III

Swarm Intelligence: Foundations, Perspectives and Applications – Canonical Particle Swarm Optimization – Extended Models of PSO for Discrete problems – Applications of Particle Swarm Optimization – Ant Colony Optimization – Ant Colony Algorithms and its Applications.

Unit IV

Swarm Intelligence – Searchers, Cleaners And Hunters: Dynamic Cooperative Definition – Cleaning Protocol – Dynamic Cooperative Cleaners – Cooperative hunters – Physical K-Clique – Physical graphs – Physical Clique finding Protocol – Exploration in Physical Environments.

Unit V

Swarm Intelligence Applications: Ant Colony Optimization for Fast Modular Exponentiation using Sliding Window Method- Window based methods – Additional chains and additional sequences – Ant Systems and Algorithms – Chain Sequence Minimization using Ant System- Particle Swarm for Fuzzy Models Identification- Fuzzy models - Methodolgy for Fuzzy models Identification through
PSO.

Text Books

1. Nadia Nedja, Ajith Abraham, Luiza de Macedo Mourelle ,” Genetic Systems Programming” Springer Publication,Newyork, 2005.
2. Nadia Nedja , Luiza de Macedo Mourelle,”Swarm Intelligent systems” Springer,NewYork, 2006.

Reference Books

1. David E. Goldberg, “Genetic algorithms in search, optimizing and machine learning”,Addison Wesley, Boston, 1989.
2. Eric. Bonabeau, Marco Dorigo, and Guy Theraulaz ,”Swarm Intelligence: From Natural to Artificial Systems”, Oxford University Press, England, 1999.
3. Andries P.Engelbrecht ,”Fundamentals of computational swarm Intelligence”, Wiley Publishers, New York, 2007.
4. Russell C. Eberhart , Yuhui Shi , James Kennedy ,”Swarm Intelligence”, Kaufmann Publishers, San Francisco, 2001.

12EC367 ADVANCED DIGITAL IMAGE PROCESSING

Credits: 4:0:0

Course Objective:

- To learn the various advanced techniques of image processing with applications

Course Outcome:

- Will be used to develop hybrid techniques to solve the segmentation and classification problems
- Will be able to apply these techniques for real time applications.
- Will be able to form new image processing algorithms.

Unit I

Image Enhancement: Fundamental steps in Digital Image Processing – Basic Gray Level Transformations – Histogram Equalization & Matching –Image Subtraction & Averaging - Introduction to Fourier Transform – Filtering In The Frequency Domain - Smoothing & Sharpening Frequency Domain filters- Homomorphic filtering.

Unit II

Image Restoration: Model Of Image Degradation/Restoration Process - Noise Models – Filters for Restoration in the Presence of Noise, Periodic Noise Reduction by Frequency Domain Filtering - Inverse Filtering -
Wiener Filtering - Constrained Least Square Filtering - Geometric Mean Filter.

Unit III

Colour Image Processing & Wavelets & Multiresolution Processing.: Colour Models - Pseudo Colour Image Processing - Colour Transformation – Smoothing – Sharpening - Colour Segmentation & Noise in Colour Images - Image Pyramids – Subband Coding - Haar Transform - Multiresolution Expansion - Wavelet Transform in 1D and 2D - Fast
Wavelet Transform & Wavelet Packets.

Unit IV

Image Compression and Morphological Image Processing: Image Compression Models - Error Free Compression - Variable Length Coding - LZW Coding - Bit-Plane Coding - Lossless Predictive Coding – Lossy Compression – Lossy Predictive Coding – Transform Coding – Wavelet Coding - Morphological Operations - Dilation & Erosion - Hit or Miss Transformation - Morphological Algorithms and Extension to Gray Scale Images.

Unit V

Image Segmentation & Description: Detection of Discontinuities - Edge Linking & Boundary Detection – Thresholding – Region Based Segmentation & Segmentation by Morphological Watersheds - Use of Motion in Segmentation - Representations- Boundary Descriptions - Regional Descriptions - Use of Principal Components for Description.

Text Books

1. Rafael.C. Gonzalez, Richard E.Woods, "Digital Image Processing", 2nd Edition, Pearson Education Asia, 2002.
2. Anil.K.Jain, "Fundamentals Of Digital Image Processing",PHI,India,1997,

Reference Books

1. S.Annadurai, R.Shanmugalakshmi, " Fundamentals of Digital Image Processing", Pearson Education ,New Delhi,2007.
2. B.Chanda, D Dutta Majumdar, "Digital Image Processing and Analysis",Prentice Hall Edition, New Delhi,2000.
3. W. K. Pratt, ``Digital Image Processing," 2nd Edition, John Wiley and Sons, 1991

12EC368 NEURO-FUZZY MODELLING

Credits: 4:0:0

Course Objective:

- To learn the concepts and techniques of hybrid neuro fuzzy systems

Course Outcome:

- Will be able to develop new algorithms for real – time classification problems
- Will be able to improve the performance of the existing techniques.
- Will be able to design systems for practical applications.

Unit I

Introduction to Neural Networks: Introduction - Action Potential - Biological Prototype - Artificial Neuron - Activation Functions - Single Layer Neural Network - Multi Layer Neural Network – Training – Supervised Methodology - Unsupervised Methodology - Back Propagation Neural Network – Architecture and Algorithm - Kohonen Neural Network – Architecture and Algorithm.

Unit II

Adaptive Neuro-Fuzzy Inference Systems: Introduction - ANFIS Architecture - Hybrid Learning Algorithm - ANFIS as an Universal Approximator -CANFIS Framework - Neuron Functions for Adaptive Network - Neuro Fuzzy Spectrum - Analysis of Adaptive Learning Capability - Evolution of Antecedents - Evolution of Consequents - Evolving Partitions.

Unit III

Classification and Regression Trees: Introduction – Decision Trees – CART Algorithm for Tree Induction – Tree Growing – Classification Trees – Regression Trees – Tree Pruning – CART Algorithm for Structure Identification in Adaptive Neuro Fuzzy Inference Systems.

Unit IV

Data Clustering Algorithms: Introduction – Types of Clustering Algorithms – K-means Clustering Algorithm – Fuzzy CMeans Clustering Algorithm – Mountain Clustering Method – Subtractive Clustering – KNearest Neighbour Algorithm – Minimum Distance Classifier Algorithm.

Unit V

Rule base Structure Identification: Introduction – Input Selection – Input Space Partitioning – Fuzzy Clustering Objective Functions– Flow Diagram of Structure Identification – Flow Diagram of Parameter Identification – Rule Base Organization – Binary Box Tree - Application of ANFIS for Printed Character Recognition.

Text Books

1. Rojer Jang, T.Sun and E.Mizutani, "Neuro-fuzzy and soft computing", Prentice Hall of India Private Limited, 2003.
2. L.Fausett, "Fundamentals of Neural Networks", Pearson Education, New Jersey, 2004.

Reference Books

1. P.D.Wasserman, "Neural Computing-Theory and Practice", Van Nostrand Reinhold, New York, 1989.
2. J.A.Freeman and D.M.Skapura, "Neural Algorithm Applications & Programming Techniques", Prentice Hall India, 2002.
3. Jacek M. Zurada, "Introduction to Artificial Neural Systems", Jaico Publication House, Mumbai, 1995.

12EC369 PATTERN RECOGNITION

Credits: 4:0:0

Course Objective:

- To learn the fundamental pattern recognition techniques for image processing applications

Course Outcome:

- Will be able to apply these techniques to solve recognition problems in real-time applications
- Will be able to form novel pattern recognition algorithm.
- Will be able to analyse the pros and cons of existing algorithms.

Unit I

Statistical Pattern Recognition: Overview of Pattern Recognition- Introduction to Statistical Pattern Recognition – Parametric Estimation and Supervised Learning – Approaches to Parameter Estimation – Maximum Likelihood Estimation – Formulation – Use of the Training Set – Bayesian Parameter Estimation Approach.

Unit II

Non Parametric Approaches for Pattern Recognition: Introduction– Parzen Windows – Unit Step Function – Extension to Interpolation Functions – K– NN Nonparametric

Estimation – Direct Estimation of Probabilities – Direct Classification using the Training Set –Nearest Neighbour Rule – NNR Approach.

Unit III

Discrete and Binary Classification Problems: Introduction – Linear Discriminant Functions – Fisher's Linear Discriminant – Discrete and Binary Classification Problems – Techniques to directly obtain Linear Classifiers – Linear Separability – Design of Linear Classifiers-Introduction to Support Vector Machines.

Unit IV

Neural Networks for Pattern Recognition: Introduction – Neural Network Structures for Pattern Recognition Applications – Neural Network Based Pattern Associator – Black Box Structure – Properties – Unsupervised Learning in Neural Pattern Recognition – Self Organizing Networks – Adaptive Resonance Theory Networks – Pattern Associator for Character Classification.

Unit V

Image Analysis: Introduction – Scene Segmentation and Labelling – Region Labelling Algorithm – Counting Objects – Perimeter Measurement – Following and Representing Boundaries – Freeman Chain Code - Morphological Operations – Texture – Statistical Significance of Image Features.

Text Books

1. Robert Schalkoff, "Pattern Recognition-Statistical, Structural and Neural Approaches", John Wiley & sons, Inc, New York, 2005.
2. Earl Gose, R.Johnsonbaugh and Steve Jost, "Pattern Recognition and Image Analysis", Prentice Hall of India Private Limited, 1999.

Reference Books

1. Rojer Jang, T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", Prentice Hall of India Private Limited, 2003.
2. Duda, R. O., Hart, P. E., and Stork, D. G,"Pattern Classification", 2nd edition, John Wiley & Sons, NewYork,2001.
3. Tou and Gonzales,"Pattern Recognition Principles", Wesley Publication Company,London,1974

12EC370 ARTIFICIAL NEURAL NETWORKS

Credits: 4:0:0

Course Objective:

- To learn the various techniques and methodologies of artificial neural networks

Course Outcome:

- Will be able to develop hybrid methodologies for solving engineering applications
- Will be able to develop hardware systems for Artificial Intelligence techniques.
- Will be able to form new machine learning techniques.

Unit I

Basic Concepts: Biological Neurons – Artificial Models – Neural Processing – Learning and Adaptation – Neural Network Learning Rules – Hebbian Rule – Perception Rule – Delta Learning Rule – Widrow – Hoff Rule – Winner -Takes – All Rule – Outstar Rule.

Unit II
Perceptrons: Classification – Features – Decision Region – Discriminant Function – Linear Classifier – Minimum Distance Classification – Training and Classification using Discrete Perceptron – Single Layer Continuous Perceptron – Single Layer Multicategory Perceptron – Multi layer Feedforward Network – Linearity Non Seperable Classification – Feed Forward Recall and Error Back Propagation Training – Learning Factors – Network Architecture – Necessary Number of Hidden Nodes –Application to Character Recognition.

Unit III
Feedback Networks: Dynamical Systems – Discrete Time Hopfield Networks – Gradient Type Hopfield Network –Solution of Optimisation Problems- Associative Memory – Linear Associator – Recurrent Auto Associative Memory – Bidirectional Associative Memory – Associative Memory of Spatiotemporal patterns.

Unit IV
Self Organising Networks: Unsupervised Learning of Clusters – Hamming Net & MAX NET winner – take-All – Learning – Counter Propagation Network – Feature Mapping – Self Organising Feature Maps – Art Network Cognitron & Neo-Cognitron.

Unit V
ANN Implementation: Neuro computing Hardware Requirements – IC Synaptic Connections – Analog Storage of Adjustable Weights – Digitally Programmable Weights.
Circuits for Neural Networks: Invertor Based Neuron – Scalar Product & Averaging Circuits – Template Matching Circuit – Analog Multipliers with Weight Storage – Associative Memory Implementations.

Text Books

1. J. A.Freeman and D.M.Skapura, "Neural Algorithm Applications & Programming Techniques", Prentice Hall,New Delhi, 2002.
2. L.Fausett, "Fundamentals of Neural Networks", Pearson Education, New Jersey, 1994.

Reference Books

1. Jacek M. Zurada, "Introduction to Artificial Neural Systems", Jaico Publication House,Mumbai, 1995.
2. Robert Schalkoff, "Pattern Recognition-Statistical, Structural and Neural Approaches", John Wiley & sons, Inc,New York, 2005
3. P.D.Wasserman, "Neural Computing-Theory and Practice", Van Nostrand Reinhold, New York, 1989

12EC371 OPTICAL SIGNAL PROCESSING
Credits: 4:0:0

Course Objective:
- To provide fundamentals of geometrical and physical optics

- To discuss on propagation in anisotropic media; noise and stochastic processes; and two-dimensional signal processing

Course Outcome:

- The students can understand in a better manner about the concepts of the modern optical signal processing.

Unit I

Basic signal parameters: Characterization- Sample function- geometrical optics- basic laws-Refraction by prisms- lens formula- imaging condition- optical invariants- physical optics-Transforms: Fresnel- Fourier- Inverse Fourier and Extended Fourier.

Unit II

Spectral Analysis: Spatial light modulation- spatial light modulators- detection process-system performance process- dynamic range- raster format- spectral analysis

Unit III

Spatial Filtering and Filtering System: Types of spatial filters- optical signal processing and filter generation- read out module- orientation and sequential search- applications of optical spatial filter

Unit IV

Acousto-Optic devices and power spectrum analysis: Acousto-optic cells- spatial light modulators- Raman – Nath and Bragg mode - basic spectrum analyzer - aperture weighting-dynamic range and SNR- photo detector- geometric considerations - radiometer

Unit V

Homodyne and Heterodyne Spectrum Analysers: Overlapping of waves- photo detector size- and optimum photo detector size for 1D and 2D structure- Optical radio- spatial and temporal frequencies- Distributed and local oscillator - Dynamic range comparison of heterodyne and power spectrum analyzers.

Text Books

1 Vanderlught, "Optical Signal Processing", John Wiley & Sons, New York, 2005
2 Mahlke Gunther, Goessing Peter, "Fiber optic cables: Fundamentals, Cable Engineering, System planning", John Wiley, 3rd Edition, 2001

Reference Books

1 Hiroshi Murata, "Handbook of Optical Fibers and Cables" Marcel Dekker Inc., New York, 1998.
2 P.K. Das, "Optical Signal Processing Fundamentals", Narosa Publishing New Delhi, 1991.
3 Bradley G. Boone, "Signal Processing Wing Optics", Oxford University Press, 1998.

12EC372 RF MEMS

Credits: 4:0:0

Course Objective:

- To know about various electronic components of which moving sub-millimeter-sized parts provide RF functionality

Course Outcome:

- To identify the main characteristics of each MEMs.

Unit I

RF MEMs Relays and Switches: Introduction-Switch parameters Action Mechanisms of RF MEMS Switches –Electro Static, Magnetic & electromagnetic Bi-stable Relays and micro actuators –Dynamics of Switching Operation MEMS Switch Modeling, design evaluation.

UnitII

MEMS Inductors and Capacitors: Introduction –Micromachined Passive elements pros and cons-MEMS Inductors-Micromachined inductor-Effect of inductor layout-Approaches for Improving quality factor-Modeling and design issues of planar inductor-Polymer based inductor-MEMS capacitors gap tuning and area tuning capacitors-Dielectric tunable capacitors.

Unit III:

Micro-Machined RF Filters: Introduction-Modeling of Mechanical Filters-Micro-machined filters-Electrostatic comb drive-Micromechanical filters using comb drives, electrostatic coupled beam structures –SAW filters Basics–Design of Inter Digital Transducers-Capabilities, Limitations and applications-Micromachined filters for mmwave frequencies.

Unit IV

MEMs Phase Shifters: Introduction-Types of Phase shifters-Limitations-MEMS phase shifters-Switched delay line, Distributed and polymer based-Ferro electric Phase shifters-Distributed and bilateral Interdigitated-Micromachined transmission lines: Losses in Transmission Lines-Coplanar lines-Microshield and membrance supported transmission lines-Micromachined directional; coupler & Mixer. Design, Fabrication and evaluation.

Unit V

Micromachined Antennas: Introduction-Overview of Microstrip antenna-Design parameters-Micromachining to improve antenna performance-Micromachining as a Fabrication process –Reconfigurable antennas, Packaging for Plastic multilayer-Embedded overlay and self-packaging-Flipchip assembly-Multichip module packaging –Reliability issues Thermal issues.

Text Book

1. V.K. Varadan, K.J. Vinoy and K.A. Jose, "RF MEMS and their Applications", John Wiley & Sons Inc, 2002.

Reference Books

1. G.M. Rebeiz, "RF MEMS: Theory, Design and Technology", John Wiley & Sons Inc., 2003.
2. Hector J. De Santos, "RF MEMS Circuit Design for Wireless Communications" Artech House, 2002.

12EC373 WAVELETS AND MULTI-RESOLUTION PROCESSING

Credits: 4:0:0

Course Objective:

- This course provides student a practical understanding of wavelet transforms and their properties.

Course Outcome:

- Students can identify problems for which wavelet transform techniques are well-suited
- They will understand how to implement wavelet transforms efficiently
- They will be able to choose or design appropriate wavelets for a given application.

Unit I

Introduction to Vector space and signal Space: Vector Spaces - properties - dot product - basis - dimension, orthogonality and orthonormality - relationship between vectors and signals - Signal spaces - concept of Convergence - Hilbert spaces for energy signals - Generalised Fourier Expansion.

Unit II

Multi Resolution Analysis: Definition of Multi Resolution Analysis (MRA) – Haar basis - Construction of general orthonormal MRA-Wavelet basis for MRA – Continuous time MRA interpretation for the DTWT – Discrete time MRA- Basis functions for the DTWT – PRQMF filter banks

Unit III

Continuous Wavelet Transform: Wavelet Transform - definition and properties - concept of scale and its relation with frequency - Continuous Wavelet Transform (CWT) - Scaling function and wavelet functions (Daubechies, Coiflet, Mexican Hat, Sinc, Gaussian, Bi-Orthogonal) - Tiling of time -scale plane for CWT.

Unit IV

Discrete Wavelet Transform: Filter Bank and sub band coding principles - Wavelet Filters - Inverse DWT computation by Filter banks -Basic Properties of Filter coefficients - Choice of wavelet function coefficients - Derivations of Daubechies Wavelets -Mallat's algorithm for DWT – Multi-band Wavelet transforms.

Lifting Scheme: Wavelet Transform using Polyphase matrix Factorization - Geometrical foundations of lifting scheme - Lifting scheme in Z –domain.

Unit V

Applications of Wavelet : Signal Compression – Image Compression techniques: EZW-SPHIT Coding - Image denoising techniques: Noise estimation - Shrinkage rules -. Shrinkage Functions - Edge detection and object Isolation - Image Fusion - Object Detection. Curve and Surface Editing- Variational modeling and finite element method using wavelets.

Text Books

1. Rao .R.M, Bopardikar.A.S, "Wavelet Transforms: Introduction to Theory and Applications", Pearson Education Asia Pte. Ltd., 2000.
2. Soman.K.P, Ramachandran. K.I, "Insight into Wavelets from Theory to Practice", Prentice Hall, 2004.

Reference Books

1. Strang G, Nguyen T, "Wavelets and Filter Banks," Wellesley Cambridge Press, 1996
2. Vetterli M, Kovacevic J., "Wavelets and Sub-band Coding," Prentice Hall, 1995
3. Mallat S., "Wavelet Signal Processing", Academic Press, 1999

12EC374 NEURAL NETWORK FOR RF AND MICROWAVE DESIGN

Credits: 4:0:0

Course Objective:

- To focus new, unconventional alternatives for conquering RF and microwave design and modeling problems using neural networks.

Course Outcome:

- The students will able to create models with neural networks
- Will learn, how quick model evaluation can be done, plus other opportUnities presented by neural networks for conquering the toughest RF and microwave CAD problems.

Unit I

Neural Network Structures: Neural network modeling approach – Multilayer perception (MLP) – MP structure - Activation functions, effect bias – Neural feed forward –Universal approximation theorem –Back propagation -2D training process –Radial Basis function networks –structure –two step training of PBF networks – comparison of MLP and RBF networks –recurrent Neural Network.

Unit II

Training of Neural Networks: Key issues in Neural model Development –Data Generation –Data Splitting & scaling –initialization of neural model weight parameters – over learning and under learning –neural network training –Gradient based methods –Back propagation algorithm –training algorithms using gradient based optimization techniques.

Unit III

Genetic Algorithms for Neural Network Training: Optimization problem –Algorithms – The schema theorem –effect of crossover, Mutation – Building Block Hypothesis – Walsh Schema transform, chromosomal representation-fitness function –setting the GA parameters and operators – Normal, Mutation and crossover operations –Avoiding the loss of useful genetic material- Royal Road function –hitch hilling phenomenon –training neural networks.

Unit IV

Models for RF and Microwave Components: Modeling procedure –selection of input and outputs –training data generation-error measures –models for mcirstrip transmission lines –microstrip via- to stripline interconnect –models for CPW transmission line –CPW continuities –CPW opens and short –CPW Symmetric T Junctions**.**

Unit V

Design and Optimization Using Neural Network Models: Optimization of Component structure –circuit optimization –CPW folded double stub filter –power divider –Multilayer circuit design and optimization -CPW patch antenna design –yield optimization.

Text Book

1. Q.J Zhang, K.C. Gupta, "Neural Networks for RF and Microwave Design" Artech house 2000.

Reference Book

1. A.J.F. Van Rooji, L.C Jain, R.P. Johnson, "Neural Network Training Using Genetic Algorithms" World Scientific Pub, 1997.

LIST OF SUBJECTS

Code	Subject Name	Credits
12EC375	Semiconductor Memory Design and Testing	4:0:0
13EC101	Basic Electronics Engineering	3:0:0

12EC375 SEMICONDUCTOR MEMORY DESIGN AND TESTING

Credits: 4:0:0

Objective:
To learn the concepts behind designing the semiconductor memories and to test the memories for any defect. To understand the reliability and radiation effects on semiconductor memories.

Outcome:
Students will be able to design a semiconductor memory and perform testing and will be able to provide solutions for reliability and radiation issues in semiconductor memories.

Unit I
STATIC RANDOM ACCESS MEMORY TECHNOLOGIES: Static Random Access Memories (SRAM) - SRAM cell structures - MOS SRAM Architecture - MOS SRAM cell and peripheral Circuit Operation - Bipolar SRAM Technologies - Silicon on insulator (SOI) Technology - Advanced SRAM Architectures and Technologies - Application Specific SRAMs.

Unit II
DYNAMIC RANDOM ACCESS MEMORY TECHNOLOGIES: Dynamic Random Access Memories (DRAM) - DRAM Technology Development - CMOS DRAM - DRAM cell theory and advanced cell structures - BiCMOS DRAM - soft error failures in DRAM - Advanced DRAM Design and Architecture - Application Specific DRAM.

Unit III
NON-VOLATILE MEMORIES: Masked Read only Memories (ROM) - High Density ROMs - Programmable ROM - Bipolar ROMs - CMOS PROMs - Erasable(UV) Programmable ROM(EPROM) - Floating Gate EPROM Cell - One time Programmable EPROM (OTPEPROM) - Electrically Erasable PROMS - EEPROM Technology and Architecture - Non volatile SRAM - Flash Memories (EPROM or EEPROM) - Advanced Flash Memory Architecture.

Unit IV
MEMORY FAULT MODELING TESTING AND MEMORY DESIGN FOR TESTABILITY AND FAULT TOLERANCE: RAM Fault Modeling - Electrical Testing - Pseudo Random Testing - Megabit DRAM Testing-Nonvolatile Memory Modeling and Testing - IDDQ Fault Modeling and Testing - Application Specific Memory Testing - RAM Fault Modeling.

Unit V
SEMICONDUCTOR MEMORY RELIABILITY AND RADIATION EFFECTS AND ADVANCED MEMORY TECHNOLOGIES: General Reliability Issues - RAM Failure Modes and Mechanism - Nonvolatile Memory Reliability - Reliability Modeling and Failure Rate Prediction-Design for Reliability - Radiation Effects-Single Event Phenomenon (SEP) - Radiation Hardening Techniques -

Ferroelectric Random Access Memories (FRAMs) - Gallium Arsenide (GaAs) FRAMs - Analog Memories - Magnetoresistive Random Access Memories (MRAMs).

Text Book

1. Ashok K.Sharma, "Semiconductor Memories Technology, Testing and Reliability", wiley, 2002.

Reference Books

1. R.Dean Adams, “High Performance memory Testing, Design principles, Fault Modeling and Self-Test”, Kluwer Academic Publishers, 2002.
2. Ashok K.Sharma, “Advanced semiconductor memories –Architecture,design and applications” ,Wiley , 2002.
3. Bernard Courtois, Thomas Wik, Yervant Zorian, “Memory Technology, Design and Testing”, IEEE Computer Society Press, 2002.
4. Pinaki Mazumder, Kanad Chakraborty, “Testing and Testable Design of High-Density Random-Access Memories”, Kluwer Academic Publishers, 1996.
5. Parag K.Lala, “Digital Circuit Testing and Testability”, Academic Press, 1997.

13EC101 BASIC ELECTRONICS ENGINEERING

Credits: 3:0:0

Objective:

- To impart the basic knowledge about the passive components.
- To know about the fundamentals of electronics and some electronic devices.
- To get the knowledge about the various analog communication techniques.

Outcome:

- Student get an overview about the basics of electronics.
- Able to get an idea about the communication and some applications in communication.

Unit I

INTRODUCTION TO PASSIVE COMPONENTS AND SEMICONDUCTOR: Resistors – Types of resistors – colour coding, Capacitors – Types of capacitors, Inductors – Types of inductors. Covalent bond – N type & P type semiconductor – conduction in semiconductor.

Unit II

ELECTRONIC DEVICES: PN diode –Application: Half wave rectifier, Zener diode - Application: Zener Voltage Regulator-Bipolar Junction Transistor - Field Effect Transistors (JFET, MOSFET) - UJT.

Unit III

DIGITAL ELECTRONICS: Number system – Boolean algebra – logic gates –truth table - simplification of logic functions using karnaugh map (4 variables), combinational circuit -4 x 1 multiplexer – 1 x 4 demultiplexer

Unit IV

COMMUNICATION SYSTEMS: Basic block of communication system – need for modulation – types of analog modulation,Derivation of AM and FM signal-Block diagram of AM and FM transmitter - Superheterodyne receiver.

Unit V

APPLICATION: (Block diagram description only**):** Principle of Television - Satellite communication – Radar System - Fibre optic communication- ISDN

Text Book

1. Muthusubramanian ,R, Salivahanan S, Muraleedharan K.A, "Basic Electrical Electronics & Computer Engineering "Tata Mc.Graw Hill, 2009

Reference Books

1. Robert Boylestad and Louis Nashelsky, "Electronic Devices & Circuit Theory", 9th Pearson Education Edition, 2009.
2. Anokh Singh, "Principles of Communication Engineering" S.Chand Co., 2001
3. V.K.Metha."Principles of Electronics",Chand Publications,2008.