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| **Course Code** | **09EC224 / 14EC2014 / EC228 / EC245 / 12EC216** | **Duration** | **3hrs** |
| **Course Name** | **DIGITAL SIGNAL PROCESSING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Identify the number of zeros to be padded to perform circular convolution between and Length of 5 and the length of 3. | | CO1 | R | 1 |
| 2. | Identify the number of additions required to compute N-point DFT using direct calculation. | | CO1 | R | 1 |
| 3. | List the two methods of sectioned convolution. | | CO1 | R | 1 |
| 4. | List any two analog filters. | | CO2 | R | 1 |
| 5. | List the methods to design a FIR filter. | | CO2 | R | 1 |
| 6. | State the disadvantage of Rectangular window. | | CO2 | R | 1 |
| 7. | Identify the categories of Digital Signal Processors. | | CO3 | R | 1 |
| 8. | List the different quantization methods. | | CO3 | R | 1 |
| 9. | Define Dead band. | | CO3 | R | 1 |
| 10. | List any two features of PDSPs. | | CO3 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Sketch the basic butterfly flow graph for the DIF-FFT algorithm. | | CO1 | A | 3 |
| 12. | Compare Linear convolution with Circular convolution. | | CO1 | U | 3 |
| 13. | List the conditions to be satisfied when an analog filter is transformed into an IIR filter. | | CO2 | R | 3 |
| 14. | Explain overflow oscillations. | | CO3 | U | 3 |
| 15. | Sketch the block diagram of an Adaptive filter. | | CO3 | A | 3 |
| 16. | Explain Replication. | | CO3 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Compute the output of a DTLTI system whose input  and impulse response  using overlap add method | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Compute the DFT of using radix2 DIT-FFT algorithm | CO1 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Construct a Butterworth filter using Bilinear transformation for the specifications. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Develop the Direct form I and Direct form II structures for an IIR filter with system response, | CO2 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Determine the coefficients of a FIR filter whose specification is given below  N=7. Use Rectangular window. | CO2 | A | 8 |
|  | b. | Compute the frequency response of the FIR filter given in the question (21.a) and realize the same using minimum number of multipliers. | CO2 | A | 4 |
|  |  |  |  |  |  |
| 22. | a. | Explain Coefficient quantization in detail. | CO3 | U | 6 |
|  | b. | Define Limit cycles. Discuss Limit cycles due to product round - off. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 23. | a. | Explain the design of FIR filter using Frequency sampling technique. | CO2 | U | 6 |
|  | b. | Explain an application of DSP. | CO3 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the implementation of the LMS adaptive algorithm with a Flow chart | CO3 | U | 6 |
|  | b. | Explain the key architectural features of the DSP processors. | CO3 | U | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the importance and basics of digital signal processing. |
| CO2 | Understand Digital (IIR and FIR) filter design procedures. |
| CO3 | Apply the signal processing concepts practically with the help of finite word length effects and PDSPs |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 3 | 3 | 27 |  |  |  | 33 |
| CO2 | 6 | 6 | 36 |  |  |  | 48 |
| CO3 | 4 | 36 | 3 |  |  |  | 43 |
|  | | | | | | | **124** |



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| **Course Code** | **13EC101/14EC1001/17EC1001** | **Duration** | **3hrs** |
| **Course Name** | **BASIC ELECTRONICS ENGINEERING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | State the difference between ionic bond and covalent bond. | | CO1 | R | 1 |
| 2. | Compare N type and P type semiconductor. | | CO1 | U | 1 |
| 3. | List any two applications of transistor. | | CO2 | R | 1 |
| 4. | Infer the configurations of transistor. | | CO2 | U | 1 |
| 5. | Name the gate which produces high output only when both the inputs are high. | | CO3 | R | 1 |
| 6. | State Demorgan’s theorem. | | CO3 | R | 1 |
| 7. | State the different types of modulation. | | CO4 | R | 1 |
| 8. | Define Modulation. | | CO4 | R | 1 |
| 9. | List out the elements in the embedded system. | | CO5 | R | 1 |
| 10. | Compare active and passive satellites. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Compare active and passive components. | | CO1 | U | 3 |
| 12. | Discuss the types of transistors. | | CO2 | U | 3 |
| 13. | Sketch the logic circuit of half adder. | | CO3 | A | 3 |
| 14. | State the need for modulation. | | CO4 | R | 3 |
| 15. | Interpret the applications of IoT. | | CO5 | A | 3 |
| 16. | Compare 3G and 4G technologies. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | |
| 17. |  | Describe the process of color coding in resistor with suitable example. | CO1 | R | 12 |
|  |  |  |  |  |  |
| 18. |  | Explain the biasing of PN Junction diode with its characteristics. Mention its applications with necessary diagram. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. |  | Illustrate a 4x1 Multiplexer and draw its logic circuit. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Derive the expression for Amplitude modulation with necessary waveforms. | CO4 | R | 12 |
|  |  |  |  |  |  |
| 21. |  | Explain the 2G, 3G, 4G and 5G wireless communication. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. |  | Discuss the construction of N-channel JFET and explain briefly its characteristics. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 23. |  | Infer the working principle of Super heterodyne receiver. | CO5 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Infer the significance of IoT in smart home and smart health care applications. | CO6 | U | 6 |
|  | b. | Discuss about Satellite communication with relevant diagrams. | CO5 | U | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the difference between active and passive components. |
| CO2 | Comprehend the basic physics behind the semiconductor devices. |
| CO3 | Select the electronics devices based on their characteristics. |
| CO4 | Design basic structures using logic gates. |
| CO5 | Acquire knowledge of basic communication systems. |
| CO6 | Apply the basic electronics concepts in real time systems. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 13 | 4 | - | - | - | - | 17 |
| CO2 | 1 | 4 | 12 | - | - | - | 17 |
| CO3 | 2 | 12 | 15 | - | - | - | 29 |
| CO4 | 17 | - | - | - | - | - | 17 |
| CO5 | 1 | 30 | 3 | - | - | - | 34 |
| CO6 | - | 10 | - | - | - | - | 10 |
|  | | | | | | | **124** |



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| **Course Code** | **14EC2001 / EC209 / 12EC205** | **Duration** | **3hrs** |
| **Course Name** | **DIGITAL ELECTRONICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Identify the base of the hexadecimal number system. | | CO1 | R | 1 |
| 2. | Convert the binary number (011011)2 to octal. | | CO1 | U | 1 |
| 3. | Simplify the Boolean expression XYZ + XY**’**Z. | | CO1 | A | 1 |
| 4. | Identify the additional bit value that should be added to 01000001 to make it an even parity. | | CO1 | U | 1 |
| 5. | Identify the logic circuit that receives information on a single line and transmits this information on 2n output lines. | | CO2 | U | 1 |
| 6. | Identify the combinational circuit that converts binary information from n input lines to 2n output lines. | | CO2 | U | 1 |
| 7. | Define Flip-flop. | | CO2 | R | 1 |
| 8. | Determine the input condition for JK flip flop to toggle. | | CO2 | A | 1 |
| 9. | Identify the IC logic family that consumes less power. | | CO3 | R | 1 |
| 10. | Identify the type of PLD in which AND array is Programmable and OR array is fixed. | | CO3 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Construct the circuit diagram for the Boolean expression  Y=AB+AC**'** | | CO1 | A | 3 |
| 12. | Simplify the following using K-map  F (a, b, c) = m (1,2) + d (0,3) | | CO1 | A | 3 |
| 13. | Design a Half adder circuit. | | CO2 | A | 3 |
| 14. | List the different types of shift registers and mention their differences. | | CO2 | R | 3 |
| 15. | Construct the state diagram and state table for a 2-bit synchronous up counter. | | CO2 | A | 3 |
| 16. | Differentiate TTL logic family from CMOS logic family. | | CO3 | An | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Convert (112)10 into corresponding binary, octal and hexadecimal number system. | CO1 | U | 6 |
|  | b. | Discuss the truth table and symbol of any 6 logic gates. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Simplify the following Boolean expression using K map  F (a, b, c,d) = ∑ m (0,2,6,8,10) + d (4,14). | CO1 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Implement the following Boolean expression with exclusive-OR and AND gates and draw the logic diagram.  F=AB’CD’+A’BCD’+AB’C’D+A’BC’D | CO1 | A | 6 |
|  | b. | Illustrate about different types of non-weighted codes with necessary examples. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Design a Full adder circuit. | CO2 | A | 6 |
|  | b. | Distinguish combinational circuit from sequential circuit with neat block diagram. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 21. | a. | Design a 2-bit magnitude comparator circuit. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Construct the truth table of SR and JK flip-flop. | CO2 | A | 4 |
|  | b. | Differentiate synchronous counters from asynchronous counters and explain the operation of Johnson counter with respect to the clock pulse. | CO2 | An | 8 |
|  |  |  |  |  |  |
| 23. | a. | List the different types of logic families and define the characteristics power dissipation and propagation delay. | CO3 | R | 6 |
|  | b. | Design a 2 input NAND and NOR gate using CMOS logic family. | CO3 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | List the different types of PLD architectures and mention their differences. | CO3 | R | 6 |
|  | b. | Implement the function Y = AB**’**C + BC using PLA architecture. | CO3 | A | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | To learn about number systems, binary codes and the basic postulates of Boolean algebra. |
| CO2 | To study formal procedures for the analysis and design of combinational and sequential circuits |
| CO3 | To learn the implementation of digital circuits in programmable logic devices and about different logic families. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 20 | 25 |  |  |  | 46 |
| CO2 | 4 | 2 | 29 | 14 |  |  | 49 |
| CO3 | 14 |  | 12 | 3 |  |  | 29 |
|  | | | | | | | **124** |



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| **Course Code** | **14EC2009 / 17EC2056** | **Duration** | **3hrs** |
| **Course Name** | **MICROPROCESSOR AND INTERFACING TECHNIQUES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Draw and explain the architecture of 8085 microprocessor. | CO1 | A | 15 |
|  | b. | Explain the arithmetic instructions in 8085. | CO1 | R | 5 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Explain the various addressing modes of 8085 microprocessor with example. | CO1 | U | 15 |
|  | b. | Write Assembly language program for adding two 8 bit numbers. | CO1 | A | 5 |
|  |  |  |  |  |  |
| 3. | a. | Explain different types of instruction sets in 8086. | CO3 | U | 15 |
|  | b. | List the internal registers in 8086 microprocessor and their lengths. | CO2 | R | 5 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Explain the architecture of 8086 with necessary diagram. | CO2 | U | 15 |
|  | b. | Write and explain any 5 instructions in 8086. | CO3 | A | 5 |
|  |  |  |  |  |  |
| 5. | a. | Explain 8259 Programmable Interrupt controller. | CO4 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Explain programmable peripheral interface (PPI) 8255. | CO4 | U | 20 |
|  |  |  |  |  |  |
| 7. | a. | Explain 8275 programmable CRT display controller. | CO4 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Draw the block diagram and explain the functions of DMA controller | CO4 | A | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Explain block diagram of microprocessor based system. | CO5 | U | 15 |
|  | b. | Discuss the types of Pentium Processors. | CO6 | U | 5 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Define the architecture of 8085 microprocessor. |
| CO2 | Describe the architecture of 8086 microprocessor and minimum/maximum modes of operation. |
| CO3 | Discuss 8086 assembly language programs for the given applications. |
| CO4 | Apply the memory and I/O interfacing concepts for any microprocessor design. |
| CO5 | Develop microprocessor and microcontrollers based systems |
| CO6 | Select the Microprocessor with proper specifications for various applications |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 5 | 15 | 20 |  |  |  | 40 |
| CO2 | 5 | 15 |  |  |  |  | 20 |
| CO3 |  | 15 | 5 |  |  |  | 20 |
| CO4 |  | 40 | 40 |  |  |  | 80 |
| CO5 |  | 15 |  |  |  |  | 15 |
| CO6 |  | 5 |  |  |  |  | 5 |
|  | | | | | | | **180** |



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| **Course Code** | **17EC3025** | **Duration** | **3hrs** |
| **Course Name** | **SMART ANTENNAS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Illustrate the implementation of digital radio receiver with different array geometries of smart antennas. | CO1 | U | 14 |
|  | b. | Discuss the elements of smart antenna systems. | CO1 | U | 6 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Explain any two antenna array system in detail. | CO1 | An | 14 |
|  | b. | Examine the effect of separation angle between two sources using an 8-element linear array with a separation of λ/2. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 3. | a. | Explain the principle of Broad band processing using DFT method. | CO3 | U | 12 |
|  | b. | Discuss about beam space processing. | CO3 | U | 8 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Compare constrained and unconstrained optimal beam former and obtain the expression for signal to noise ratio. | CO3 | U | 20 |
|  |  |  |  |  |  |
| 5. | a. | Differentiate constrained LMS algorithm from unconstrained LMS algorithm and illustrate the calculation of excess mean square error in unconstrained LMS algorithm. | CO3 | An | 10 |
|  | b. | Sketch the real and complex beam former structures and list out the implementation issues of a real time beam forming system. | CO2 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Explain in detail the importance of maximum likelihood method with an example. | CO2 | U | 10 |
|  | b. | Discuss the neural network approach adaptive processing. | CO2 | U | 10 |
|  |  |  |  |  |  |
| 7. | a. | Explain in detail about linear prediction method. | CO5 | U | 10 |
|  | b. | Describe how the direction of signal arrival from the source is estimated by maximum entropy method. | CO5 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Estimate the signal parameters estimation of DOA method. | CO5 | E | 10 |
|  | b. | Write the significance of Angle of Arrival estimation in communication systems. Discuss briefly about AOA methods. | CO5 | A | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Explain the performance of an optimal combiner when there are more co-channel interferences than the number of elements in the array in fading conditions. | CO4 | U | 10 |
|  | b. | Examine how maximal ratio combiner works in different fading environment. | CO4 | A | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Suggest necessary signal processing techniques for allocated spectrum in dynamic environments. |
| CO2 | Apply adaptive beamforming algorithm for specific applications |
| CO3 | Analyze the performance metrics of spatial channel model |
| CO4 | Interpret the diversity combining techniques at wireless receiver’s end |
| CO5 | Evaluate the performance of single user and multi user signal processing techniques using software tools |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 20 | 6 | 14 | - | - | 40 |
| CO2 | - | 20 | 10 | - | - | - | 30 |
| CO3 | - | 40 | 10 | - | - | - | 50 |
| CO4 | - | 10 | 10 | - | - | - | 20 |
| CO5 | 10 | 10 | 10 | - | 10 | - | 40 |
|  | | | | | | | **180** |



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| **Course Code** | **17EC3043** | **Duration** | **3hrs** |
| **Course Name** | **RECONFIGURABLE COMPUTING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Analyze the fundamental differences between general-purpose computing and reconfigurable computing. Evaluate the strengths and weaknesses of each approach in terms of adaptability, performance, and energy efficiency. | CO1 | An | 10 |
|  | b. | Compare and contrast simple programmable logic devices (SPLDs), complex programmable logic devices (CPLDs), and Field-Programmable Gate Arrays (FPGAs) in terms of architecture, functionality, and use cases. Discuss how their architectures impact their suitability for specific applications. | CO2 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Summarize the architectural elements of FPGAs, including configurable logic blocks (CLBs), interconnects, and memory resources. Evaluate how these architectural components contribute to the reconfigurability and performance of FPGAs. | CO3 | E | 20 |
|  |  |  |  |  |  |
| 3. | a. | Discuss the principles and strategies of reconfiguration management in reconfigurable computing systems. | CO2 | E | 10 |
|  | b. | Evaluate the trade-offs between reconfigurability, resource utilization, and system performance. | CO2 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Develop a comprehensive architectural plan for your reconfigurable computing system, highlighting the choice of RPF architecture and its integration into traditional computing components. Justify your choices based on the project's requirements. | CO3 | C | 15 |
|  | b. | Describe the fundamental principles and advantages of RPF Architectures. | CO4 | A | 5 |
|  |  |  |  |  |  |
| 5. | a. | Compare and contrast the different compute models used in reconfigurable computing, including SIMD, MIMD, and SPMD. Explain how each model influences the programming of Field-Programmable Gate Arrays (FPGAs). | CO4 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Analyze the process of programming FPGA applications in Hardware Description Languages (HDL) and the advantages and limitations of this approach. Provide examples of when using HDL is advantageous. | CO5 | An | 20 |
|  |  |  |  |  |  |
| 7. | a. | Evaluate the FPGA placement and routing phase in the design flow. Explain how effective placement and routing can impact the performance and efficiency of reconfigurable systems. Provide real-world examples or case studies to illustrate your analysis. | CO5 | E | 20 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Describe how you would design the project's workflow, encompassing the design flow, technology mapping, placement and routing, and configuration bitstream generation. Provide insights into optimizing each phase for efficiency and performance. | CO5 | An | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Select a real-world application where FPGA technology and System on a Programmable Chip (SoPC) design have been implemented. Describe the specific application and how these technologies have been employed to enhance its performance and functionality. | CO6 | E | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Identify the need for reconfigurable architectures. |
| CO2 | Discuss the architecture of FPGAs. |
| CO3 | Point out the salient features of different reconfigurable architectures. |
| CO4 | Build basic modules using any HDL. |
| CO5 | Develop applications using any HDL and appropriate tools. |
| CO6 | Design and build a SoPC for a particular application. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | - | - | 10 | - | - | 10 |
| CO2 | - | - | - | 10 | 20 | - | 30 |
| CO3 | - | - | - | - | 20 | 15 | 35 |
| CO4 | - | - | 5 | 20 | - | - | 25 |
| CO5 | - | - | - | 40 | 20 | - | 60 |
| CO6 | - | - | - | - | 20 | - | 20 |
|  | | | | | | | **180** |



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| **Course Code** | **17EC3074** | **Duration** | **3hrs** |
| **Course Name** | **MEDICAL IMAGE PROCESSING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Explain the single emission tomography and discuss the attenuation compensation. | CO1 | U | 10 |
|  | b. | Appraise the need for medical image processing with suitable examples. | CO1 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Examine the three-dimensional reconstruction of images using projection algorithm. | CO2 | An | 20 |
|  |  |  |  |  |  |
| 3. | a. | Compare SPECT and PET medical imaging techniques. Discuss the procedures and precautions followed. | CO2 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Discuss the following in fMRI: physiological basis, types, resolution, and artifacts. | CO3 | U | 20 |
|  |  |  |  |  |  |
| 5. | a. | Summarize the principle of spectroscopy and its applications in disease diagnosis. | CO3 | U | 10 |
|  | b. | Articulate the limitations of doppler systems. | CO6 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Discuss the doppler shift principle used in detecting the blood flow through non-invasive methods. | CO6 | U | 10 |
|  | b. | Analyze the advantages and disadvantages of neuro magnetic imaging. | CO5 | An | 10 |
|  |  |  |  |  |  |
| 7. | a. | Explain the image reconstruction in ultrasound scanning. Discuss the methods adopted to ensure the quality of ultrasound images. | CO5 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Examine the minimum distance method used in medical image segmentation. | CO4 | A | 10 |
|  | b. | Illustrate the steps followed in edge-based image segmentation. | CO4 | An | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Compare rigid and deformable registration techniques. | CO3 | An | 10 |
|  | b. | Facilitate the need for image fusion in medical image processing. | CO6 | C | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Analyze the physiological events associated with the human system. |
| CO2 | Describe the influences of artifacts in image quality. |
| CO3 | Identification of new developments in health care system. |
| CO4 | Employ reconstruction and segmentation algorithms. |
| CO5 | Interpret medical imaging devices |
| CO6 | Relate the concepts with its practical uses. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 10 | - | - | 10 | - | 20 |
| CO2 | - | - | 20 | 20 | - | - | 40 |
| CO3 | - | 30 | - | 10 | - | - | 40 |
| CO4 | - | - | 10 | 10 | - | - | 20 |
| CO5 | - | 20 | - | 10 | - | - | 30 |
| CO6 | - | 10 | 10 | - | - | 10 | 30 |
|  | | | | | | | **180** |

**Graphical user interface, application

Description automatically generated with medium confidence**

**END SEMESTER EXAMINATION – NOVEMBER 2023**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **18EC2003** | **Duration** | **3hrs** |
| **Course Name** | **DIGITAL SYSTEM DESIGN** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Convert (11001010)2 into gray code. | | CO1 | R | 1 |
| 2. | What is meant by multilevel gates networks? | | CO1 | R | 1 |
| 3. | Define Combinational circuits. | | CO3 | R | 1 |
| 4. | Draw a 2 to 1 multiplexer circuit. | | CO3 | R | 1 |
| 5. | What is meant by triggering of Flip Flop? | | CO4 | R | 1 |
| 6. | What is a Mealy circuit? | | CO4 | U | 1 |
| 7. | Expand TTL. | | CO5 | R | 1 |
| 8. | State propagation delay. | | CO5 | R | 1 |
| 9. | What is a volatile memory? | | CO5 | R | 1 |
| 10. | Define logic synthesis. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Simplify the following expression using Boolean algebra techniques.  AB+A(B+C)+B(B+C) | | CO2 | A | 3 |
| 12. | Implement a single-bit binary comparator using basic gates and write the truth table of it. | | CO3 | A | 3 |
| 13. | Draw the SR latch circuit using NAND gates and give its truth table. | | CO4 | A | 3 |
| 14. | Compare the characteristics of TTL and ECL families. | | CO5 | R | 3 |
| 15. | Discuss the types of memories. | | CO5 | U | 3 |
| 16. | Write a Verilog module for 4x1 MUX. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain AND, OR, and X-OR logic gates with a truth table. | CO1 | R | 6 |
|  | b. | Draw the logic diagram and truth table for the Boolean expression given: Q=AB+AC. | CO2 | E | 6 |
|  |  |  |  |  |  |
| 18. | a. | Design and implement the Full Adder using Half Adder. | CO3 | C | 6 |
|  | b. | Design a 3-bit Even parity generator and checker circuit. | CO3 | C | 6 |
|  |  |  |  |  |  |
| 19. | a. | Derive the characteristic equation of the J-K flip flop. | CO4 | An | 6 |
|  | b. | Explain the operation of the Johnson counter. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Realize T Flip flop using J-K flip-flop. | CO4 | A | 6 |
|  | b. | With a logic diagram, discuss the operation of Serial In Parallel Out shift register. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | What is meant by Tristate logic? Draw the circuit of Tristate TTL logic and explain the functions. | CO5 | U | 6 |
|  | b. | Discuss the operation of Schottky TTL.  Question No.24 from Module 6 | CO5 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Explain the block diagram of the Programmable Logic Array using a neat diagram. | CO5 | U | 8 |
|  | b. | Compare and contrast PROM, PLA, and PAL. | CO5 | U | 4 |
|  |  |  |  |  |  |
| 23. | a. | Write a Verilog HDL structural model for a full sub-tractor using NAND gates. | CO6 | A | 6 |
|  | b. | Write short notes on different types of Modelling in Verilog HDL. | CO6 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Minimize the following Boolean function using the K map  F(A, B, C, D) = Σm(0, 1, 2, 5, 7, 8, 9, 10, 13, 15) | CO2 | E | 8 |
|  | b. | Define the terms: minterm and maxterm. | CO2 | U | 4 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | illustrate the basic postulates of Boolean algebra and the operation of logic gates. |
| CO2 | choose an optimal method for simplification of Boolean expressions. |
| CO3 | design and distinguish various combinational logic circuits. |
| CO4 | design and compare various sequential logic circuits. |
| CO5 | illustrate different logic families; classify memory devices and identify methods for the implementation of logic circuits. |
| CO6 | design simple logic circuits using HDL codes. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 8 |  |  |  |  |  | 8 |
| CO2 |  | 4 | 3 |  | 14 |  | 21 |
| CO3 | 2 |  | 3 |  |  | 12 | 17 |
| CO4 | 1 | 7 | 15 | 6 |  |  | 29 |
| CO5 | 6 | 27 |  |  |  |  | 33 |
| CO6 | 1 | 6 | 9 |  |  |  | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **18EC2006** | **Duration** | **3hrs** |
| **Course Name** | **ANALOG AND DIGITAL COMMUNICATION** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Relate Frequency and Bandwidth. How will you increase the signal Bandwidth? | | CO1 | U | 1 |
| 2. | State the equation of AM wave. | | CO1 | R | 1 |
| 3. | Identify the metric used to determine noise effect in digital systems. | | CO2 | U | 1 |
| 4. | Define SNR. | | CO2 | R | 1 |
| 5. | Name the circuit used to generate flat-top samples. | | CO3 | R | 1 |
| 6. | Identify the two possible errors in delta modulation. | | CO3 | U | 1 |
| 7. | Define Criterion. | | CO4 | R | 1 |
| 8. | Sketch the constellation diagram of QPSK. | | CO5 | A | 1 |
| 9. | Recommend suitable QAM order for higher data rates. | | CO5 | E | 1 |
| 10. | Recall Viterbi algorithm. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Illustrate indirect generation of FM and PM. | | CO1 | U | 3 |
| 12. | Examine the net effect of Pre-emphasis and De-emphasis. | | CO2 | A | 3 |
| 13. | Differential pulse code modulation is efficient than Pulse code modulation- Deduce the reason. | | CO3 | An | 3 |
| 14. | Explain Signal detection theory. | | CO4 | U | 3 |
| 15. | Interpret the tradeoff between bandwidth efficiency and power efficiency. | | CO5 | A | 3 |
| 16. | Describe synchronization and carrier recovery. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Describe and derive the Power Relations of AM wave. | CO1 | U | 6 |
|  | b. | Explain the generation of DSBFC signal using a non-linear device. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Examine and derive FM equation. | CO1 | A | 6 |
|  | b. | Illustrate Phase modulation. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Identify Random process in the context of communications. | CO2 | U | 6 |
|  | b. | Explain the circuits used at the transmitter and the receiver to overcome High frequency noise effects in FM. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Apply the Delta modulation concept to generate the binary pulse stream for the staircase approximation over the message waveform shown in figure. Also identify the slope overload error and discuss the ways to reduce its. | CO3 | A | 6 |
|  | b. | A band limited signal with maximum frequency 2000 Hz is sampled at the Nyquist rate of 4000 samples per second. It is then quantized to 8 levels and 16 levels. Calculate the bit rate of the coded signal? | CO3 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Determine Line encoding in the following formats for the given Data: 0 1 0 0 1 1 1 0   1. NRZ-L 2. NRZ-I 3. RZ 4. Manchester encoding 5. Differential Manchester encoding 6. Bipolar AMI encoding | CO4 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Deduce the three Nyquist Criteria to eliminate ISI. | CO4 | An | 6 |
|  | b. | Sketch the Eye Pattern and identify the performance parameters. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Simulate the Minimum Shift Keying signal for the given Data:  1 0 1 0 0 1 1 | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Illustrate the significance and working of Adaptive equalizer. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Distinguish different analog modulation schemes for their efficiency and bandwidth |
| CO2 | Predict the behavior of a communication system in presence of noise |
| CO3 | Investigate pulsed modulation system and analyze their system performance |
| CO4 | Recognize various optimal detection schemes |
| CO5 | Analyze different digital modulation schemes and can compute the bit error performance |
| CO6 | Relate different digital demodulation techniques |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 22 | 6 | - | - | - | 29 |
| CO2 | 1 | 13 | 3 | - | - | - | 17 |
| CO3 | 1 | 1 | 3 | 12 | - | - | 17 |
| CO4 | 1 | 3 | 18 | 6 | - | - | 28 |
| CO5 | - | - | 16 | - | 1 | - | 17 |
| CO6 | 1 | 3 | 12 | - | - | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **18EC2008** | **Duration** | **3hrs** |
| **Course Name** | **ANALOG CIRCUITS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Identify the rectifier with 0.48 as ripple factor. | | CO1 | R | 1 |
| 2. | Name the factors affecting the output voltage of a dc power supply. | | CO1 | R | 1 |
| 3. | State the maximum collector current that flows through the fixed bias transistor circuit. | | CO2 | R | 1 |
| 4. | Define trans-conductance amplifier. | | CO3 | R | 1 |
| 5. | Name the two types of small signal transistor models. | | CO3 | R | 1 |
| 6. | Express the overall gain of the multistage amplifier, if A1, A2 …An is the corresponding gain of the individual amplifier stages. | | CO3 | U | 1 |
| 7. | Infer the collector efficiency of class B power amplifier. | | CO4 | U | 1 |
| 8. | Define common mode rejection ratio in differential amplifier. | | CO5 | R | 1 |
| 9. | Express the frequency of osicllation of Hartley oscillator. | | CO6 | U | 1 |
| 10. | Discuss the conditions for oscillations in a circuit. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Explain the application of diode in clamper circuit. | | CO1 | U | 3 |
| 12. | Compare the characteristics of BJT and JFET amplifier. | | CO2 | U | 3 |
| 13. | Determine the input impedance, voltage gain and current gain of common emitter re model for which Beta=120, IE=3.2 mA, RL =2KΩ. | | CO3 | A | 3 |
| 14. | Discuss the performance criteria of power amplifiers. | | CO4 | U | 3 |
| 15. | Sketch the voltage shunt feedback connection circuit and derive the gain. | | CO3 | A | 3 |
| 16. | Define current mirror and discuss the limitations and advantages. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the operation of Half wave rectifier and derive the ripple factor, rectifier efficiency and transformer utilization factor for the circuit. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Illustrate the voltage regulation provided by controlled transistor series voltage regulator with neat circuit diagram. | CO1 | U | 7 |
|  | b. | Construct a filter circuit with capacitor for full wave rectifier and explain the process of ripple reduction. | CO1 | A | 5 |
|  |  |  |  |  |  |
| 19. | a. | Discuss the need for biasing? Derive IB, VCE, stability factor with load line analysis for BJT voltage divider bias circuit. | CO2 | U | 8 |
|  | b. | Calculate the base current for a fixed bias circuit with Vcc=12V and RB=100KΩ. | CO2 | An | 4 |
|  |  |  |  |  |  |
| 20. | a. | Determine the following for the FET fixed bias network VGS**Q**, ID**Q**, VDS, with the following specifications. [ VDD = 16 V, RD = 2 KΩ, RG = 1 MΩ, IDSS = 10 mA, VP = -8 V ] | CO2 | A | 8 |
|  | b. | Explain current amplifier and with Thevenin equivalent circuit of two port network define the magnitude of source and load resistance. | CO3 | U | 4 |
|  |  |  |  |  |  |
| 21. | a. | Construct transformer coupled class A power amplifier and trace the output voltage and current swing. Discuss the collector efficiency, power dissipation and distortion in the circuit. | CO4 | A | 9 |
|  | b. | Define Crossover distortion and explain how it is removed in class AB mode power amplifier. | CO4 | R | 3 |
|  |  |  |  |  |  |
| 22. | a. | Sketch the current shunt feedback connection and derive the gain, input impedance and output impedance for the circuit. | CO3 | U | 8 |
|  | b. | Explain the various modes of operation of differential amplifier circuit. | CO5 | U | 4 |
|  |  |  |  |  |  |
| 23. | a. | Summarize the operation of single stage amplifier with frequency response and discuss the need for multistage amplifier. | CO3 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Construct Colpitts oscillator and discuss the signal generation along with the frequency of oscillation. | CO6 | A | 8 |
|  | b. | The tuned collector oscillator circuit used in the local oscillator of radio receiver makes use of an LC tuned circuit with L=30 µH and C=100 pF. Calculate the frequency of oscillation. | CO6 | An | 4 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Summarize the application of diodes |
| CO2 | Classify the characteristics of BJT and JFET amplifiers |
| CO3 | Design and construct various amplifier circuits |
| CO4 | Describe the function of power amplifier |
| CO5 | Construct the differential amplifier for a given specification |
| CO6 | Identify sinusoidal and non-sinusoidal oscillators |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | 27 | - | - | - | - | 29 |
| CO2 | 1 | 23 | - | - | - | - | 24 |
| CO3 | 2 | 25 | 6 | - | - | - | 33 |
| CO4 | 3 | 4 | 9 | - | - | - | 16 |
| CO5 | 1 | 4 | - | - | - | - | 5 |
| CO6 | 3 | 2 | 8 | 4 | - | - | 17 |
|  | | | | | | | **124** |



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| **Course Code** | **18EC2010** | **Duration** | **3hrs** |
| **Course Name** | **Microcontrollers** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Write two registers that consist of 16-bit. | | CO1 | R | 1 |
| 2. | What is an External Memory Interface? | | CO1 | U | 1 |
| 3. | What are I/O ports? | | CO2 | R | 1 |
| 4. | What are timer registers? | | CO2 | U | 1 |
| 5. | Define Memory organization. | | CO3 | R | 1 |
| 6. | List out the interrupts used in the PIC microcontroller. | | CO3 | U | 1 |
| 7. | Define Timers. | | CO4 | R | 1 |
| 8. | Write about SPI. | | CO4 | R | 1 |
| 9. | Define Data types in Embedded C Programming. | | CO5 | R | 1 |
| 10. | Write real-time examples of embedded applications. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Write about the 8051 Instruction Set. | | CO1 | R | 3 |
| 12. | Write a program to perform the addition of 2 numbers using 8051. | | CO2 | C | 3 |
| 13. | List the PIC 18 Microcontroller Addressing modes. | | CO3 | R | 3 |
| 14. | Discuss the UART interface of the PIC 18 microcontroller. | | CO4 | U | 3 |
| 15. | What do you mean by Storage Classes? | | CO5 | R | 3 |
| 16. | Draw a DC motor interfacing block diagram. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the addressing modes of 8051Microcontroller | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Discuss briefly about the microcontroller 8051 Timer/Counter. | CO2 | R | 12 |
|  |  |  |  |  |  |
| 19. | a. | Draw and explain the interrupt structure of PIC microcontrollers. | CO3 | R | 12 |
|  |  |  |  |  |  |
| 20. | a. | Write a note on PWM in the PIC microcontroller. | CO4 | U | 6 |
|  | b. | Explain the I/O Expansion of the PIC18 Microcontroller. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | Explain the UART module of the PIC18 Microcontroller | CO4 | R | 12 |
|  |  |  |  |  |  |
| 22. | a. | Describe the Control Statements of Embedded C programming with syntax. | CO5 | C | 12 |
|  |  |  |  |  |  |
| 23. | a. | Discuss briefly the LCD and Keyboard Interface of the 8051 Microcontroller. | CO6 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain in detail about PIC 18 Microcontroller Architecture. | CO3 | An | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Describe the architecture of the 8051 microcontroller. |
| CO2 | Discuss 8051 assembly language programs for the given applications |
| CO3 | Illustrate the memory and I/O interfacing concepts for any microcontroller design. |
| CO4 | Illustrate the architectures of the PIC microcontroller. |
| CO5 | Develop Microcontrollers-based systems using C. |
| CO6 | Select the Microcontroller with proper specifications for various applications |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 4 | 13 | - | - | - | - | 17 |
| CO2 | 13 | 1 | - |  |  | 3 | 17 |
| CO3 | 16 | 1 |  | 12 |  |  | 29 |
| CO4 | 14 | 15 |  |  |  |  | 29 |
| CO5 | 4 | - |  |  |  | 12 | 16 |
| CO6 | 0 | 4 | 12 |  |  |  | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **18EC2012** | **Duration** | **3hrs** |
| **Course Name** | **LINEAR INTEGRATED CIRCUITS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Predict the input bias current of the op-amp , if IB + = 500nA and  IB - = 100 nẠ | | CO1 | U | 1 |
| 2. | Determine the gain of the given circuit if R1 = 10k ohm and  RF = 80k ohm. | | CO2 | A | 1 |
| 3. | Name the comparator whose output is given below: | | CO2 | R | 1 |
| 4. | Determine the output voltage if R1=R2=Rg=Rf, V1=10V and V2=20V. | | CO2 | A | 1 |
| 5. | Recall the expression of frequency of oscillation of RC phase shift oscillator. | | CO3 | R | 1 |
| 6. | Infer the damping factor Chebyshev filter. | | CO4 | U | 1 |
| 7. | Define capture range. | | CO5 | R | 1 |
| 8. | List any two applications of Astable multivibrator using 555. | | CO5 | R | 1 |
| 9. | Indicate the central frequency (f0)of wide-band pass filter having cut off frequencies fl=3 KHz and fh= 12 KHz. | | CO4 | U | 1 |
| 10. | Express the limitations of weighted resistor DAC. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Interpret the DC characteristics of op-amp. | | CO1 | U | 3 |
| 12. | Illustrate the working of zero crossing detector. | | CO2 | A | 3 |
| 13. | Infer briefly about series op-amp regulator. | | CO3 | U | 3 |
| 14. | Design a first order high-pass filter for cut-off frequency of 2 KHz and pass-band gain of 2 and C=0.1µF. | | CO4 | C | 3 |
| 15. | Sketch the schematic diagram of Schmitt trigger using 555 IC. | | CO5 | A | 3 |
| 16. | Illustrate the output of weighted resistor DAC if the input is 1100 and Vref=4V. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Discuss the functions and determine the gain of the following:  a. Inverting amplifier  b. Non-Inverting amplifier | CO2 | U | 8 |
|  | b. | Design an adder circuit using an op-amp to get the output expression as Vo= - (0.1V1+V2+100V3). | CO2 | C | 4 |
|  |  |  |  |  |  |
| 18. | a. | Explain the working principle of inverting and non-inverting comparator with positive reference. | CO2 | A | 6 |
|  | b. | Describe how op-amp is used as a differentiator. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Explain the working principle of Monostable Multivibrator using op-amp and derive the frequency of oscillation. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Predict the output of first order low pass filter with necessary diagrams and expressions. | CO4 | U | 6 |
|  | b. | Design a second order Butterworth low pass filter with the cut off frequency of 2 KHz and C=0.1µF. | CO4 | C | 6 |
|  |  |  |  |  |  |
| 21. | a. | Explain the working principle of Astable multivibrator using 555 IC with necessary equations and waveforms. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Illustrate the working principle of op-amp Schmitt trigger with relevant diagram and obtain the hysteresis voltage VH. | CO5 | U | 6 |
|  | b. | Discuss in detail about 723 low voltage regulator. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 23. | a. | Explain the working of successive approximation ADC with an example. | CO6 | A | 8 |
|  | b. | Indicate the circuit diagram of 3-bit weighted resistor DAC. | CO6 | U | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Discuss in the steps involved in basic planar process in detail. | CO6 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Understand the fundamentals of OP-AMP and its characteristics |
| CO2 | Use OP-AMP to design circuits such as Amplifiers, differentiator and Integrator |
| CO3 | Infer the significance of OP-AMP in Multivibrators and Oscillators |
| CO4 | Design filters using OP-AMP |
| CO5 | Explore the usefulness of IC555 timer and Phase Locked Loop |
| CO6 | Design ADC, DAC and understand the IC fabrication |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 4 | - | - | - | - | 4 |
| CO2 | 1 | 14 | 11 | - | - | 4 | 30 |
| CO3 | 1 | 9 | 12 | - | - | - | 22 |
| CO4 | 2 | 6 | - | - | - | 9 | 17 |
| CO5 | 2 | 6 | 15 | - | - | - | 23 |
| CO6 | - | 20 | 8 | - | - | - | 28 |
|  | | | | | | | **124** |



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| **Course Code** | **18EC2015 / 17EC2010** | **Duration** | **3hrs** |
| **Course Name** | **DIGITAL SIGNAL PROCESSING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define Decimation. | | CO1 | R | 1 |
| 2. | State an application of Sampling rate conversion. | | CO1 | R | 1 |
| 3. | Identify the number of stages of decimation required to compute 16-point DFT using FFT algorithm. | | CO2 | U | 1 |
| 4. | Identify the number of complex multiplications required to compute N-Point DFT using Direct calculation. | | CO2 | U | 1 |
| 5. | Identify the number of delays required in a Direct Form I structure that realizes a second order transfer function. | | CO3 | U | 1 |
| 6. | List any two methods of designing FIR filters. | | CO4 | R | 1 |
| 7. | Express the mathematical form of the Raised cosine window function. | | CO4 | U | 1 |
| 8. | Recall how overflow limit cycles can be eliminated. | | CO5 | R | 1 |
| 9. | Define Dead band. | | CO5 | R | 1 |
| 10. | What is Replication? | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Discuss the procedure to perform Linear convolution using circular convolution. | | CO1 | U | 3 |
| 12. | Identify the number of multiplications and additions required to compute N-point DFT using radix-2 FFT algorithm. | | CO2 | U | 3 |
| 13. | State the advantages and the disadvantages of Bilinear transformation. | | CO3 | R | 3 |
| 14. | Define Gibbs phenomenon. | | CO4 | R | 3 |
| 15. | Discuss why rounding is preferred to truncation in realizing a digital filter? | | CO5 | U | 3 |
| 16. | Sketch a hardware MAC configuration used in DSP. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Determine the response of a DTLTI system given the input and the impulse responseusing circular convolution. | CO1 | A | 7 |
|  | b. | Explain Sampling rate conversion with a neat diagram. | CO1 | U | 5 |
|  |  |  |  |  |  |
| 18. | a. | Compute the DFT of  using radix-2 DIF-FFT algorithm | CO2 | A | 9 |
|  | b. | Compare the Decimation – in-time algorithm with the Decimation -in-frequency algorithm. | CO2 | U | 3 |
|  |  |  |  |  |  |
| 19. | a. | Develop the Direct Form I and Direct Form II realization of the following system | CO3 | A | 8 |
|  | b. | Convert the analog filter with transfer function into a digital IIR filter using Impulse invariant method. | CO3 | U | 4 |
|  |  |  |  |  |  |
| 20. | a. | Determine the coefficients of the FIR filter with desired frequency response    Use a Hamming window and obtain the frequency response. Assume N = 11. Realize the filter using minimum number of multipliers. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Explain Coefficient quantization in detail. | CO5 | U | 6 |
|  | b. | Define Limit cycles. Discuss Limit cycles due to product round -off. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Explain the design of FIR filter using Frequency sampling technique. | CO4 | U | 6 |
|  | b. | Explain an application of DSP. | CO6 | U | 6 |
|  |  |  |  |  |  |
| 23. | a. | Discuss the procedure for the design of a digital filter using the Bilinear transformation method. | CO3 | U | 4 |
|  | b. | Develop the  (i)Cascade realization of the FIR filter given the transfer function.  (ii)Transversal Structure of | CO4 | A | 8 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the implementation of the LMS adaptive algorithm with a Flow chart | CO6 | U | 6 |
|  | b. | Explain the key architectural features of the DSP processors. | CO6 | U | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Define signals and system mathematically in discrete time domain. |
| CO2 | Formulate the Discrete-Fourier Transform (DFT) and the FFT algorithms. |
| CO3 | Explain the various transformations for digital IIR filter design procedures. |
| CO4 | Design FIR digital filters for various applications. |
| CO5 | Demonstrate the signal processing concepts and the practical issues with the help of finite word length effects. |
| CO6 | Compare and select the DSP processor and techniques, suitable for the analysis of real-life signals |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | 8 | 7 | - | - | - | 17 |
| CO2 | - | 8 | 9 | - | - | - | 17 |
| CO3 | 3 | 9 | 8 | - | - | - | 20 |
| CO4 | 4 | 7 | 20 | - | - | - | 31 |
| CO5 | 2 | 15 | - | - | - | - | 17 |
| CO6 | 1 | 18 | 3 | - | - | - | 22 |
|  | | | | | | | **124** |



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| **Course Code** | **18EC2017** | **Duration** | **3hrs** |
| **Course Name** | **COMPUTER NETWORK** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | List the various types of network topologies. | | CO4 | R | 1 |
| 2. | Define internetwork with respect to network engineering. | | CO4 | R | 1 |
| 3. | Infer the significant difference between space division switching and time division switching. | | CO2 | U | 1 |
| 4. | Extend your perception about symmetric network. | | CO2 | U | 1 |
| 5. | Interpret on the functions and size of MAC address. | | CO3 | A | 1 |
| 6. | Recall the taxonomy of multiple access protocols | | CO3 | R | 1 |
| 7. | Review the three types of switching fabrics used in a router | | CO4 | U | 1 |
| 8. | Interpret the mathematical evaluation of buffering size for a router with N input lines. | | CO4 | A | 1 |
| 9. | Recall the various types of closed loop congestion control techniques. | | CO5 | R | 1 |
| 10. | Extend your perception on congestion window. | | CO5 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | List any four network protocols. | | CO3 | R | 3 |
| 12. | Infer on the RIFS time duration. | | CO3 | U | 3 |
| 13. | Recall the schematic structure of a switching node with a neat sketch. | | CO2 | R | 3 |
| 14. | Illustrate the virtual circuit approach of packet switching with diagrams. | | CO2 | U | 3 |
| 15. | Interpret the format of the data/command, token and abort frames of IEEE 802.5 project. | | CO3 | A | 3 |
| 16. | Support your perception on the major disparity between IEEE 802.11 and IEEE 802.3 projects. | | CO3 | E | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Illustrate the OSI model layers and describe in detail about each layer with necessary and appropriate diagrams. | CO1 | A | 12 |
| 18. |  | Analyze in detail with necessary diagrams about the various methodologies of Circuit Switching techniques. | CO2 | An | 12 |
| 19. |  | Summarize the architecture, MAC sublayer, Physical layer and necessary frame formats of IEEE 802.11 project with neat diagrams. | CO3 | E | 12 |
| 20. |  | Analyze Distance Vector Routing (DVR) algorithm for the given network and explain in detail with necessary diagrams on the updated tables of all routers. How is the associated cost function evaluated in Distance Vector Routing algorithm? | CO4 | An | 12 |
| 21. | a. | Appraise on congestion control and explain the techniques to improve quality of service. | CO5 | E | 6 |
|  | b. | Explain the datagram frame formats of TCP & UDP with neat sketches. | CO5 | U | 6 |
| 22. | a. | Classify the various types of Ethernets. | CO3 | An | 4 |
|  | b. | Evaluate the protocol specifications characteristics of IEEE 802.3 project. | CO3 | An | 8 |
| 23. | a. | Discuss the mesh, star and ring topologies with a neat diagram and list its advantages and disadvantages. | CO1 | U | 6 |
|  | b. | Analyze the issues in resource allocation under the network model category. | CO5 | An | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Assess the various types of web documents and their relation with hypertext transfer protocol to access data in the world wide web. | CO6 | E | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Demonstrate the functions of the different layers of the OSI protocol. |
| CO2 | Identify the performance of different kinds of switching in the network. |
| CO3 | Design a network for a particular application using IEEE standards. |
| CO4 | Interpret the concepts of networking thoroughly. |
| CO5 | Develop TCP/IP protocol for suitable application. |
| CO6 | Configure application layer protocol. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  | 6 | 12 |  |  |  | 18 |
| CO2 | 3 | 5 |  | 12 |  |  | 20 |
| CO3 | 4 | 3 | 4 | 12 | 15 |  | 38 |
| CO4 | 2 | 1 | 1 | 12 |  |  | 16 |
| CO5 | 1 | 7 |  | 6 | 6 |  | 20 |
| CO6 |  |  |  |  | 12 |  | 12 |
|  | | | | | | | **124** |



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| **Course Code** | **18EC2019** | **Duration** | **3hrs** |
| **Course Name** | **DIGITAL IC DESIGN** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Identify a structure that is formed by superimposing several layers of conducting, insulating and transistor forming materials. | | CO1 | R | 1 |
| 2. | Indicate the area separating the n-regions that are capped with a sandwich of silicon dioxide and a conducting electrode called as poly crystalline silicon. | | CO1 | U | 1 |
| 3. | Write the electrostatic potential equation (ФFp) for PMOS transistor. | | CO2 | A | 1 |
| 4. | Write the gate oxide capacitance per unit area equation of MOS transistor. | | CO2 | A | 1 |
| 5. | Indicate about stacked via. | | CO3 | U | 1 |
| 6. | Identify two metals that can be used as interconnect for MOS Devices. | | CO3 | R | 1 |
| 7. | Predict the number of transistors in dynamic CMOS process. | | CO4 | A | 1 |
| 8. | Represent the on-resistance of the NMOS transistor in Saturation region to find the delay in transfer gate. | | CO4 | U | 1 |
| 9. | Identify the horizontal lines, which are driven from outside the storage array in a memory module. | | CO5 | R | 1 |
| 10. | List the type of ASIC in which all the logic cells and all mask layers are customized. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Sketch the architecture of NMOS transistor and examine all its terminals. | | CO1 | A | 3 |
| 12. | Determine the overlap capacitance in the MOS transistor. | | CO2 | A | 3 |
| 13. | Determine the syntax of specifying the MOS transistor with MOS layout and schematic in SPICE. | | CO3 | A | 3 |
| 14. | Design using CMOS Logic. | | CO4 | C | 3 |
| 15. | Describe about RAM and its types. | | CO5 | U | 3 |
| 16. | Discuss about structured gate array with proper diagram. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Illustrate in detail the construction and operation of enhancement mode NMOS transistor in three operating modes. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Discuss about the different types of power estimation in Digital IC circuits with suitable equations. | CO2 | U | 6 |
|  | b. | Discuss about the various delay parameters that affects the transient characteristics of MOS transistor with neat diagrams. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Illustrate about the SPICE MOS LEVEL1 Device model and BSIM3 model with the corresponding parameters in each model. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 20. | a. | Describe the various steps involved in IC fabrication Process with neat diagrams and explanation. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Distinguish in detail about NMOS and PMOS Pass Transistor Logic with its threshold effects and advantages. | CO4 | U | 6 |
|  | b. | Design using CMOS Logic. | CO4 | C | 6 |
|  |  |  |  |  |  |
| 22. | a. | Illustrate about dynamic CMOS Logic and design  Using dynamic CMOS Logic. | CO4 | A | 8 |
|  | b. | Illustrate about the SPICE MOS LEVEL1 device model with the corresponding parameters in each model. | CO3 | An | 4 |
|  |  |  |  |  |  |
| 23. | a. | Explain the 1-T and 3-T DRAM with two main fabrication techniques. | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Illustrate the ASIC design flow with neat diagram. | CO6 | A | 9 |
|  | b. | Sketch the basic architecture of FPGA with programmable interconnects. | CO6 | A | 3 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the basic concepts of MOS transistor |
| CO2 | Illustrate different second order effects of MOS transistor |
| CO3 | Analyse static and dynamic behavior of CMOS inverter |
| CO4 | Design combinational logic circuits in CMOS. |
| CO5 | Interpret different logic style for design of sequential logic circuits. |
| CO6 | Comprehend the significance of optimising the logic circuit design. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 13 | 3 | - | - | - | 17 |
| CO2 | - | 12 | 17 | - | - | - | 29 |
| CO3 | 1 | 1 | 3 | 16 | - | - | 21 |
| CO4 | - | 7 | 9 | - | - | 9 | 25 |
| CO5 | 1 | 3 | 12 | - | - | - | 16 |
| CO6 | 1 | 3 | 12 | - | - | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **18EC2020** | **Duration** | **3hrs** |
| **Course Name** | **ANTENNA THEORY AND WAVE PROPAGATION** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Estimate the length of an halfwave dipole antenna for f=1GHz. | | CO1 | U | 1 |
| 2. | Define gain of an antenna. | | CO1 | R | 1 |
| 3. | Infer on Radiation power density of an antenna. | | CO1 | U | 1 |
| 4. | List the shapes of loop antenna. | | CO2 | R | 1 |
| 5. | Enumerate the types of array antenna. | | CO2 | R | 1 |
| 6. | List the advantages of parabolic reflector antenna. | | CO3 | R | 1 |
| 7. | Enumerate the types of horn antenna based on its flare angle. | | CO4 | R | 1 |
| 8. | Describe the purpose of using cassegrain antenna. | | CO4 | U | 1 |
| 9. | State the applications of beamforming in wireless communication. | | CO5 | R | 1 |
| 10. | Classify types of patch antenna. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Calculate the gain of the antenna if its efficiency is 40%, wavelength is 0.01m, its aperture area is 4 Sq.m. | | CO1 | A | 3 |
| 12. | Explain the importance of capacitance hat loading in dipole antenna. | | CO2 | U | 3 |
| 13. | Give examples for aperture antennas. | | CO4 | U | 3 |
| 14. | State Huygene’s principle. | | CO4 | R | 3 |
| 15. | Classify the types of wave propagation. | | CO5 | U | 3 |
| 16. | List the feeding techniques in microstrip antenna. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Describe the radiated fields at point P away from a half wave dipole located in Z direction at distance r. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Evaluate the emf induced in transmitting antenna and prove that emf induced in receiving antenna is same as that of transmitting antenna when same current is induced in both. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 19. | a. | Explain End Fire Array and sketch its field pattern by determining the maxima and minima directions. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 20. | a. | Enumerate Schelkunoff polynomial method for synthesis of array antenna. | CO2 | R | 6 |
|  | b. | Explain the working principle of Loop Antenna with its radiation characteristics. | CO3 | An | 6 |
|  |  |  |  |  |  |
| 21. | a. | Explain the concept of rectangular aperture with example. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 22. | a. | Explain the geometry and operation of the Log Periodic (LPDA) antenna. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Explain the principle of operation of Rectangular microstrip patch antenna. | CO6 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Discuss different modes of Radio Wave propagation with neat diagrams. | CO5 | U | 8 |
|  | b | Enumerate the importance of smart antenna in wireless communication. | CO6 | R | 4 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Examine the antenna basic parameters |
| CO2 | Interpret the array factor for uniform and non-uniform arrays |
| CO3 | Relate the fundamental concepts to obtain field distributions of broad band antennas |
| CO4 | Infer the field characteristics of special type antennas |
| CO5 | Categorize the radio wave propagation regions |
| CO6 | Design and analyse various types of antennas using simulation tools |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 14 | 3 | 12 | - | - | 30 |
| CO2 | 8 | 15 | - | - | - | - | 23 |
| CO3 | 1 | 13 | - | 6 | - | - | 22 |
| CO4 | 4 | 13 | - | - | - | - | 17 |
| CO5 | 1 | 11 | - | - | - | - | 12 |
| CO6 | 7 | 1 | - | 12 | - | - | 20 |
|  | | | | | | | **124** |



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| **Course Code** | **18EC2021** | **Duration** | **3hrs** |
| **Course Name** | **MICROWAVE AND OPTICAL COMMUNICATION** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Indicate the reflection coefficient of matched termination. | | CO1 | U | 1 |
| 2. | Name the dominant mode in a circular waveguide. | | CO1 | R | 1 |
| 3. | Give an example of a reciprocal device. | | CO1 | U | 1 |
| 4. | Indicate a microwave passive device that is used to control the power level of the microwave. | | CO1 | U | 1 |
| 5. | Define Voltage Standing Wave Ratio (VSWR). | | CO2 | R | 1 |
| 6. | Name any one of the direct semiconductor materials. | | CO2 | R | 1 |
| 7. | Write an application of two cavity klystron. | | CO3 | A | 1 |
| 8. | Define density modulation. | | CO3 | R | 1 |
| 9. | Calculate the numerical aperture of an optical fiber in which the refractive index of the core is 1.6 and the refractive index of the cladding is 1.5. | | CO5 | A | 1 |
| 10. | Write the significance of population inversion in the operation of lasers. | | CO6 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Write the advantages of microwave communication. | | CO1 | A | 3 |
| 12. | Explain the negative resistance characteristics of the Gunn diode. | | CO2 | U | 3 |
| 13. | Compare two cavity klystron amplifier with traveling wave tube amplifier. | | CO3 | U | 3 |
| 14. | List the properties of the S matrix. | | CO4 | U | 3 |
| 15. | A light wave is traveling in a semiconductor medium (GaAs) of refractive index 3.6. It is incident on a different medium (AlGaAs) of refractive index 3.4 and the angle of incidence is 75°. Determine the condition for total internal reflection to take place. | | CO5 | A | 3 |
| 16. | Illustrate the stimulated emission process in laser. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Discuss the importance of waveguide corners, bends, and twists in the microwave system. | CO1 | U | 8 |
|  | b. | Summarize the functioning and significance of a tuning screw. | CO1 | U | 4 |
|  |  |  |  |  |  |
| 18. | a. | Explain the operation of the Directional Coupler and derive its scattering matrix. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 19. | a. | Describe the construction and operation of the magnetron with a schematic diagram. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. | a. | Explain the impact ionization process initiated within an IMPATT diode, and how does it shape the diode's functionality? | CO4 | A | 8 |
|  | b. | Write the applications of an IMPATT diode. | CO4 | A | 4 |
|  |  |  |  |  |  |
| 21. | a. | Analyze the factors responsible for attenuation when an optical signal passes through the fiber. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. | a. | Discuss the optical fiber communication system, detailing its components and operations with a neat block diagram. | CO5 | U | 8 |
|  | b. | Compare optical communication with electrical communication. | CO5 | U | 4 |
|  |  |  |  |  |  |
| 23. | a. | Explain the different types of microwave sensors employed for power measurement and discuss the functioning of a microwave power meter. | CO2 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Examine the fundamental function of a laser diode within the transmitter section of a communication system and explain how it converts the electrical signal into the optical signal. | CO6 | A | 8 |
|  | b. | List the requirements of photodetectors. | CO6 | R | 4 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Recognize the operation of passive waveguide components. |
| CO2 | Distinguish the limitations of existing vacuum tubes and solid-state devices at microwave frequencies. |
| CO3 | Predict the performance of specialized microwave tubes such as two cavity klystron, reflex klystron, magnetron and Travelling wave tube. |
| CO4 | Classify microwave circuits using scattering parameters. |
| CO5 | Relate the characteristics of Optical Fiber components |
| CO6 | Summarize optical source, Fiber and Detector operational parameters |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 15 | 3 | - | - | - | 19 |
| CO2 | 2 | 15 |  | - | - | - | 17 |
| CO3 | 1 | 15 | 1 | - | - | - | 17 |
| CO4 | 3 | 12 | 12 | - | - | - | 27 |
| CO5 | - | 12 | 4 | 12 | - | - | 28 |
| CO6 | 4 | 3 | 9 | - | - | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **18EC2022** | **Duration** | **3hrs** |
| **Course Name** | **OBJECT ORIENTED CONCEPTS USING C++** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Construct a simple program to display ‘Eligible to Vote’ if a variable ‘age’ is above 18, and display ‘Not Eligible to Vote’ otherwise. | | CO1 | A | 1 |
| 2. | How an array is initialized? | | CO2 | U | 1 |
| 3. | State the purpose of using Data type conversion. | | CO2 | R | 1 |
| 4. | Define pointer to pointer. | | CO3 | R | 1 |
| 5. | State the purpose of using ‘this pointer’. | | CO3 | R | 1 |
| 6. | Write C++ keywords for handling Exceptions. | | CO4 | A | 1 |
| 7. | Define iostream. | | CO4 | A | 1 |
| 8. | List the advantages of linked list over array. | | CO5 | R | 1 |
| 9. | List any 3 sorting Methods. | | CO6 | R | 1 |
| 10. | Differentiate Linear and Binary Search. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Write a C++ program to perform any two string operations. | | CO1 | A | 3 |
| 12. | Write about the memory management operators. | | CO2 | U | 3 |
| 13. | Write the concept of Polymorphism. | | CO3 | U | 3 |
| 14. | Express the hierarchical representation of stream classes. | | CO4 | U | 3 |
| 15. | How do you insert an element in a single Linked List? | | CO5 | U | 3 |
| 16. | Write the algorithm for Insertion sort routine. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Write a C++ example program which uses the concept of non-parameterized and parameterized constructors. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Write an object-oriented program using classes and objects with a class named bank with the following data members namely name, account number, amount to be deposited, withdrawn, balance, sex, age. Calculate the balance after performing every action. When the process of withdrawal is taking place check the balance amount with the amount to be withdrawn and then give the necessary details. | CO2 | A | 8 |
|  | b. | Discuss the ‘C++ objects as physical objects’. | CO2 | U | 4 |
|  |  |  |  |  |  |
| 19. | a. | Explain the concept of function and class templates with suitable examples. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | List the different ways for getting formatted output data. | CO4 | A | 4 |
|  | b. | Write a C++ program to read and display the content of a text file. | CO4 | A | 8 |
|  |  |  |  |  |  |
| 21. | a. | Define Doubly Linked List. Explain how do you insert and delete an element in the Doubly linked List? | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Discuss the types of arrays with an example. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Explain the various types of inheritance with examples. | CO4 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Write an algorithm for Bubble sort and explain the same with the following example: 40, 23, 38, 10, 64, 77 | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Exhibit basic knowledge in object-oriented programming for developing programming skills. |
| CO2 | Recognize features of object-oriented design such as encapsulation, inheritance, and composition of systems based on object identity for appropriate applications. |
| CO3 | Illustrate the concept of polymorphism and exceptions using object-oriented approach. |
| CO4 | Specify simple data types and design implementations, using functions to document them. |
| CO5 | Identify the suitable data structure for the storage of data involved in the application and develop applications using various linear data structures. |
| CO6 | Choose the appropriate techniques in algorithmic design strategies for real time application development. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 16 | - | - | - | - | - | 16 |
| CO2 | 1 | 8 | 8 | - | - | - | 17 |
| CO3 | 2 | 3 | 12 | - | - | - | 17 |
| CO4 | - | 15 | 26 | - | - | - | 41 |
| CO5 | 1 | 3 | 12 | - | - | - | 16 |
| CO6 | 1 | 1 | 15 | - | - | - | 17 |
|  | | | | | | | **124** |



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| **Course Code** | **18EC2023** | **Duration** | **3hrs** |
| **Course Name** | **ELECTROMAGNETIC WAVES AND WAVEGUIDES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Relate the conversion of spherical to cartesian coordinate system. | | CO1 | U | 1 |
| 2. | Interpret the cartesian coordinate x = 2, y = 1 and z= 3 in to spherical  coordinate system. | | CO1 | U | 1 |
| 3. | Solve the summation of the vector A and B. | | CO1 | A | 1 |
| 4. | Infer energy density of capacitor. | | CO2 | A | 1 |
| 5. | Write the value of μ0 for free space condition. | | CO3 | A | 1 |
| 6. | Define self-inductance. | | CO4 | R | 1 |
| 7. | Interpret the force equation between two parallel conductors where wires carry I1 and I2 in opposite direction. | | CO4 | U | 1 |
| 8. | Write about the linear polarization. | | CO5 | A | 1 |
| 9. | Express the efficiency of transmission line. | | CO5 | C | 1 |
| 10. | Infer the condition for no standing wave. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Interpret,, where V is a scalar. | | CO1 | U | 3 |
| 12. | Write the field effects due to opposite charges and point charges. | | CO2 | A | 3 |
| 13. | Express the compact form of energy stored in the system. | | CO3 | C | 3 |
| 14. | Define Ampere’s circuital law. | | CO4 | R | 3 |
| 15. | Illustrate impedance matching using quarter wave transmission lines. | | CO5 | A | 3 |
| 16. | Explain the properties of TE and TM modes. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | What are the conditions for two vectors A and B to parallel and perpendicular? | CO1 | R | 4 |
|  | b. | Analyze and prove the given condition below, | CO2 | An | 8 |
| 18. | a. | Infer the compact form of energy stored in the system. | CO3 | U | 4 |
|  | b. | Express the condition for energy density and energy stored in the integral form of a capacitor. | CO3 | C | 8 |
|  |  |  |  |  |  |
| 19. | a. | Express the condition for the magnetic field intensity due to infinite conductor, with a neat sketch. | CO3 | C | 10 |
|  | b. | Infer the condition of energy stored in inductor. | CO4 | C | 2 |
|  |  |  |  |  |  |
| 20. | a. | Express the condition for the magnetic field intensity due to infinitely long coaxial transmission line using Ampere’s circuital law with a neat sketch. | CO4 | C | 8 |
|  | b. | Interpret the vector magnetic potential of current loop with the suitable expression. | CO4 | U | 4 |
|  |  |  |  |  |  |
| 21. | a. | State and prove the Coulomb’s law with a neat sketch. | CO2 | R | 8 |
|  | b. | Explain any one of the applications in Coulomb’s law. | CO2 | U | 4 |
|  |  |  |  |  |  |
| 22. | a. | Define Maxwell’s equation. Derive any two equations with justification. | CO5 | R | 12 |
|  |  |  |  |  |  |
| 23. | a. | State and prove Poynting vector with power flow equation. | CO5 | R | 10 |
|  | b. | Explain the concept of uniform plane waves. | CO5 | U | 2 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Write short notes on VSWR. | CO6 | A | 4 |
|  | b. | Explain about half and quarter wave transmission lines. | CO6 | U | 4 |
|  | c. | Discuss about the Smith chart and its applications. | CO6 | U | 4 |

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|  | **COURSE OUTCOMES** |
| CO1 | Demonstrate an ability to apply the co-ordinate systems and are familiar with the different vector operators. |
| CO2 | Formulate the electric flux density and define potential and potential gradient. |
| CO3 | Describe the current and current density from ohm’s law and design the capacitance using Poisson’s equations and Laplace’s equations. |
| CO4 | Design the magnetic flux density from the Biot Savart’s law and the Ampere’s circuital law. |
| CO5 | Differentiate the TE, TM and TEM – guided wave solutions. |
| CO6 | Evaluate TE and TM mode patterns of field distributions in a waveguides. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 4 | 5 | 1 | - | - | - | 10 |
| CO2 | 8 | 4 | 4 | 8 | - | - | 24 |
| CO3 | - | 4 | 1 | - | - | 21 | 26 |
| CO4 | 4 | 5 | - | - | - | 10 | 19 |
| CO5 | 22 | 2 | 4 | - | - | 1 | 29 |
| CO6 | - | 12 | 4 | - | - | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **18EC2028** | **Duration** | **3hrs** |
| **Course Name** | **MICROPROCESSOR AND MICROCONTROLLER** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Give examples of 16 bit register in 8085 microprocessors. | | CO1 | U | 1 |
| 2. | Indicate the use of data bus in 8085 microprocessors. | | CO1 | U | 1 |
| 3. | Identify the size of an internal RAM memory of 8051 microcontrollers. | | CO2 | R | 1 |
| 4. | Name any two examples of 8051 special function registers. | | CO2 | R | 1 |
| 5. | List the components of an assembly language program. | | CO3 | R | 1 |
| 6. | Define compiler. | | CO3 | R | 1 |
| 7. | Indicate the use of ALE control signal in 8051 microcontrollers. | | CO4 | U | 1 |
| 8. | Estimate the maximum count value for a 16-bit timer. | | CO5 | U | 1 |
| 9. | Define baud rate. | | CO4 | R | 1 |
| 10. | Identify the non-invasive method to measure an oxygen saturation of a patient. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Differentiate between microprocessor and microcontroller. | | CO1 | U | 3 |
| 12. | Identify the purpose of reset circuits in 8051 microcontrollers. | | CO2 | R | 3 |
| 13. | State the necessity of an addressing modes in 8051 microcontrollers with one example. | | CO3 | R | 3 |
| 14. | Sketch the schematic diagram of R-2R ladder network type DAC. | | CO4 | A | 3 |
| 15. | Enumerate the purpose of various communication links for data transmission. | | CO5 | R | 3 |
| 16. | Write the significance of microcontroller for designing an embedded system. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Describe the features of 8085 architecture with neat diagram. | CO1 | R | 10 |
|  | b. | Classify the different types of an embedded systems. | CO1 | U | 2 |
|  |  |  |  |  |  |
| 18. | a. | Explain the functional architecture of 8051 microcontroller with necessary diagrams. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. | a. | Describe the functions of various 8051 Instruction sets with an example. | CO3 | R | 10 |
|  | b. | List the various software tools used for designing an embedded system. | CO3 | R | 2 |
|  |  |  |  |  |  |
| 20. | a. | Discuss the interfacing methods of an output device with 8051 microcontrollers with neat diagram. | CO3 | U | 8 |
|  | b. | Differentiate between timer and counter. | CO3 | U | 4 |
|  |  |  |  |  |  |
| 21. | a. | Enumerate the steps involved in serial data transmission using I2C protocol. | CO5 | R | 12 |
|  |  |  |  |  |  |
| 22. | a. | Write an assembly level code for performing arithmetic operations using 8051 microcontrollers. | CO3 | A | 4 |
|  | b. | Illustrate the interfacing methods of ADC0809 with 8051 microcontrollers. | CO3 | U | 8 |
|  |  |  |  |  |  |
| 23. | a. | Explain the message format of RS232 communication protocol. | CO4 | R | 6 |
|  | b. | Compare the features of Bluetooth and ZigBee wireless communication devices. | CO5 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Design a real time embedded system to acquire an ECG signal and measure heart rate of a patient. Support your hardware design with a block diagram and software development with a flow diagram. | CO6 | C | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Discuss the microprocessor organization and its evolution. |
| CO2 | Describe the architecture of 8051 controllers. |
| CO3 | Express their knowledge in designing a system using 8051 |
| CO4 | Differentiate controller / processor architecture and features. |
| CO5 | Write processor / controller specific programs in Embedded C. |
| CO6 | Simulate the real time system using integrated development environment. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 10 | 7 | - | - | - | - | 17 |
| CO2 | 5 | 12 | - | - | - | - | 17 |
| CO3 | 17 | 20 | 4 | - | - | - | 41 |
| CO4 | 7 | 1 | 3 | - | - | - | 11 |
| CO5 | 15 | 7 | - | - | - | - | 22 |
| CO6 | 1 | - | 3 | - | - | 12 | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **18EC2030** | **Duration** | **3hrs** |
| **Course Name** | **DIGITAL ELECTRONICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Convert (FA.B4) 16 to binary. | | CO1 | U | 1 |
| 2. | Interpret “Logic Gates” in your own terms. | | CO1 | U | 1 |
| 3. | Represent (8)10 in BCD 8-4-2-1 code. | | CO2 | U | 1 |
| 4. | List the universal gates. | | CO2 | R | 1 |
| 5. | State the functioning of multiplexer. | | CO3 | U | 1 |
| 6. | List the two types of parity checkers. | | CO3 | R | 1 |
| 7. | Rewrite the truth table of SR latch. | | CO4 | U | 1 |
| 8. | Sketch a 1 bit memory element. | | CO4 | R | 1 |
| 9. | Describe ‘Shift register’ in your own words. | | CO5 | R | 1 |
| 10. | Sketch a MOS inverter. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Solve (1110)2 - (1001)2 through 2’s compliment addition method. | | CO1 | A | 3 |
| 12. | Represent (-5 )10 Using Signed 1’s compliment representation. | | CO2 | U | 3 |
| 13. | List the design procedure for implementing a function through Multiplexer. | | CO3 | U | 3 |
| 14. | Convert an SR Latch into a D Latch. | | CO4 | U | 3 |
| 15. | Distinguish between synchronous and asynchronous counter. | | CO5 | U | 3 |
| 16. | Differentiate PLA and PAL. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Construct a Logic Circuit whose functionality is expressed by the Boolean function F=(A’+B’+C’).(A+B’+C’).(A+B’+C).(A+B+C’).(A+B+C). | CO1 | A | 4 |
|  | b. | Construct a Standard SOP form from the given expression and implement it using Logic gates  AB’C+A’B’+ABC’D. | CO1 | A | 8 |
|  |  |  |  |  |  |
| 18. | a. | Solve the following expression using Quine Mc Cluskey method of minimization Y(A,B,C,D)=∑m(0,1,3,7,8,9,11,15). | CO2 | A | 10 |
|  | b. | Solve the expression F(A,B,C,D)=∑m(0,1,3,7,8,9,11,15) using Karnaugh map Minimization and prove the Results are same. | CO2 | A | 2 |
|  |  |  |  |  |  |
| 19. | a. | Deduce a logic circuit for the given function using 8:1 multiplexer F(A,B,C,D) = A’BD’+ACD+B’CD+A’C’D. | CO3 | An | 7 |
|  | b. | Devise a 4 Bit Parallel Adder/Subtractor. | CO3 | An | 5 |
|  |  |  |  |  |  |
| 20. | a. | Analyze JKMS flip flop and find out how the JKMS FF overcomes race around condition. | CO4 | An | 9 |
|  | b. | Devise Toggle and Data flip flop from the JK Flip flop. | CO4 | An | 3 |
|  |  |  |  |  |  |
| 21. | a. | Construct an asynchronous MOD counter which can count from 0000 to 1001 using JK Flip flop. | CO5 | A | 8 |
|  | b. | Illustrate the timing diagram of 4 bit Up counter . | CO5 | An | 4 |
|  |  |  |  |  |  |
| 22. | a. | Deduce a sequential circuit for given sequence using T flip-flop.  Lightbox | CO4 | An | 10 |
|  | b. | Reproduce the Excitation table of T flip flop. | CO4 | R | 2 |
|  |  |  |  |  |  |
| 23. | a. | Devise a SISO and SIPO shift register using D Flip flop. | CO5 | An | 7 |
|  | b. | Construct a 4 bit Johnson counter. | CO5 | A | 5 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Deduce a logic circuit using Programmable Logic Circuit for the given function A(X,Y,Z) )=∑m(1,2,4,6), B(X,Y,Z) )=∑m(0,1,6,7). | CO6 | An | 8 |
|  | b. | Construct a BCD-to-Excess-3 converter using ROM. | CO6 | A | 4 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Compute the Number System Conversion |
| CO2 | Simplify the Boolean Expression Using Various Simplification Techniques |
| CO3 | Design Various Combinational Circuits |
| CO4 | Design Various Sequential Circuits |
| CO5 | Implement Combinational Circuits Using PLD. |
| CO6 | State and Compare Different Digital Logic Families |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| **CO1** | - | 2 | 15 | - | - | - | **17** |
| **CO2** | 1 | 4 | 12 | - | - | - | **17** |
| **CO3** | 1 | 4 | - | 12 | - | - | **17** |
| **CO4** | 3 | 4 | - | 22 | - | - | **29** |
| **CO5** | 1 | 3 | 13 | 11 | - | - | **28** |
| **CO6** | 1 | 3 | 4 | 8 | - | - | **16** |
|  | | | | | | | **124** |



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| **Course Code** | **18EC2032** | **Duration** | **3hrs** |
| **Course Name** | **ELECTRON DEVICES AND CIRCUITS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Specify the dopants of semiconductor materials. | | CO1 | R | 1 |
| 2. | Define Avalanche breakdown. | | CO2 | R | 1 |
| 3. | Calculate the value of collector current IC, if a transistor has a β of 200 and a base current IB, of 20 μA. | | CO3 | R | 1 |
| 4. | Define Rectifier. | | CO4 | U | 1 |
| 5. | Draw the Block Diagram of Regulated power Supply. | | CO5 | U | 1 |
| 6. | List the applications of Gunn Diode. | | CO1 | R | 1 |
| 7. | Quote the main difference between center tapped and Bridge fullwave rectifier. | | CO4 | R | 1 |
| 8. | State the IC number of Negative fixed voltage regulator. | | CO2 | U | 1 |
| 9. | List the advantages of multistage amplifier. | | CO6 | U | 1 |
| 10. | Specify the frequency determining elements in phase shift oscillator. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Compare silicon and Germanium materials. | | CO1 | U | 3 |
| 12. | Define current amplification factor in CB transistor. | | CO2 | U | 3 |
| 13. | Write the major difference between a BJT and a FET device. | | CO3 | U | 3 |
| 14. | Distinguish between donor and acceptor impurities. | | CO4 | R | 3 |
| 15. | Draw the phototransistor circuit. | | CO5 | R | 3 |
| 16. | Classify amplifiers based on the coupling method. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the Generation and recombination process with suitable diagram. | CO1 | R | 6 |
|  | b. | Explain forward bias and reverse bias in a PN Junction and plot the VI characteristics. | CO1 | R | 6 |
|  |  |  |  |  |  |
| 18. | a. | Describe the input and output characteristics of CE and CC configurations of a transistor. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. | a. | A transistor is connected in common emitter (CE) configuration in which collector supply is 8 V and the voltage drop across resistance RCconnected in the collector circuit is 0.5 V. The value of RC = 800 Ω. If α = 0.96, determine: (i) collector-emitter voltage (ii) base current. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Explain the VI characteristics of Zener diode and Schottky Barrier Diode. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Explain the various configurations of Full wave rectifier with Capacitor and Inductor filters. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. | a. | Discuss the RC coupled amplifier with neat sketch. | CO5 | R | 12 |
|  |  |  |  |  |  |
| 23. | a. | Describe Feedback and Differential Amplifiers. | CO3 | R | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the RC Phase shift oscillator using op-amp and obtain the frequency of oscillation. | CO6 | An | 6 |
|  | b. | Illustrate on Hartley oscillator with the circuit diagram. | CO6 | U | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Describe the basic properties of solid state devices like diode, transistor and FET. |
| CO2 | Identify and differentiate rectifiers, amplifiers and oscillators. |
| CO3 | Analyze the amplitude and frequency response of general amplifier circuits. |
| CO4 | Describe the types of power amplifiers and their transfer characteristics. |
| CO5 | Classify the power amplifiers to meet certain specifications. |
| CO6 | Distinguish between amplifiers and oscillators. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 14 | 3 | - | - | - | - | 19 |
| CO2 | 1 | 16 | - | - | - | - | 17 |
| CO3 | 13 | 3 | 12 | - | - | - | 28 |
| CO4 | 4 | 13 | - | - | - | - | 17 |
| CO5 | 15 | 13 | - | - | - | - | 28 |
| CO6 | - | 11 | - | 6 | - | - | 17 |
|  | | | | | | | **124** |



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| **Course Code** | **18EC3005** | **Duration** | **3hrs** |
| **Course Name** | **ANTENNAS AND RADIATION SYSTEMS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | With illustrations, explain the different types of radiation patterns. | CO1 | U | 12 |
|  | b. | Illustrate any two reflector antenna configurations. | CO1 | U | 4 |
|  |  |  |  |  |  |
| 2. | a. | Sketch the transmission-line Thevenin equivalent of the antenna in transmitting mode and explain the radiation mechanism. | CO1 | A | 12 |
|  | b. | Recall the following antenna parameters with expressions.  i) Radiation power density ii) Radiation intensity | CO1 | R | 4 |
|  |  |  |  |  |  |
| 3. | a. | Predict the working principle of Dipole (λ/2) with expressions for its parameters. | CO2 | An | 12 |
|  | b. | Discuss the equivalent circuit of a loop antenna in transmitting mode. | CO2 | U | 4 |
|  |  |  |  |  |  |
| 4. | a. | Determine the directivity of the N-Element linear broadside array. | CO3 | A | 10 |
|  | b. | Interpret the expressions for the parameters regarding the end-fire array with uniform spacing and amplitude. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 5. | a. | Determine the expressions and explain the beam widths of rectangular aperture on an infinite ground plane. | CO4 | A | 12 |
|  | b. | Estimate the directivity in decibels for a rectangular aperture with Lx=10λ and Ly= 20λ for a completely uniform aperture illumination. | CO4 | E | 4 |
|  |  |  |  |  |  |
| 6. | a. | Summarize the design procedure and characteristics of rectangular microstrip antenna. | CO5 | U | 12 |
|  | b. | List out the factors affecting the quality factor of a microstrip antenna. | CO5 | R | 4 |
|  |  |  |  |  |  |
| 7. | a. | Discuss in detail the different feeding techniques of a microstrip patch antenna and their equivalent circuits with the illustration. | CO5 | U | 12 |
|  | b. | Interpret expressions for Bandwidth and Efficiency of a microstrip patch antenna. | CO5 | A | 4 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. | a. | Discuss the design considerations and challenges of MIMO antennas. | CO6 | U | 10 |
|  | b. | Illustrate and explain the geometrical configuration of reflector antennas. | CO6 | A | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Compute the far field distance, radiation pattern and gain of an antenna for given current distribution. |
| CO2 | Estimate the input impedance, efficiency and ease of match for linear wire antennas. |
| CO3 | Explain the array factor for an array of antennas. |
| CO4 | Use aperture concept for efficient antenna design. |
| CO5 | Design Micro strip antennas for various desired radiation pattern characteristics. |
| CO6 | Determine the desired parameters of reflector antennas for specific application. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 4 | 16 | 12 | - | - | - | 32 |
| CO2 | - | 4 | - | - | 12 | - | 16 |
| CO3 | - | - | 16 | - | - | - | 16 |
| CO4 | - | - | 12 | - | 4 | - | 16 |
| CO5 | 4 | 24 | 4 | - | - | - | 32 |
| CO6 | - | 10 | 10 | - | - | - | 20 |
|  | | | | | | | **132** |



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| **Course Code** | **18EC3011** | **Duration** | **3hrs** |
| **Course Name** | **COMPUTATIONAL INTELLIGENCE AND OPTIMIZATION TECHNIQUES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Describe the role of computational intelligence and optimization techniques in bridging the divide between human problem-solving and computer algorithms. | CO1 | R | 10 |
|  | b. | Discuss how does the classification of Artificial Neural Networks (ANNs) differentiate various network architectures and what are the distinctive features of the McCulloh-Pitts model within this classification? | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Analyze the function of artificial neuron, what are the different types of activation functions used in artificial neurons? What is the role of classification procedures in the context of artificial neural networks (ANNs)? | CO1 | An | 20 |
|  |  |  |  |  |  |
| 3. | a. | Evaluate the characteristics of Hopfield neural networks and Kohonen neural networks in terms of architecture and functionality. | CO2 | E | 10 |
|  | b. | Interpret how perceptron algorithm and the Back Propagation neural network address the challenges of learning and adapting in the context of training deep neural networks with a necessary mathematical condition. | CO2 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Explain the fundamental concepts and key objectives in the field of deep learning neural networks. How do these objectives distinguish deep learning from traditional machine learning approaches. | CO2 | A | 10 |
|  | b. | Summarize the core principles and mechanisms of Adaptive Resonance Theory (ART) neural networks. | CO2 | E | 10 |
|  |  |  |  |  |  |
| 5. | a. | Explain the principles of fuzzy logic theory based on  a) fuzzy sets b) operations  c)membership functions d) defuzzification methods | CO3 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Write short note on Fuzzy Associative Memories (FAMs), and describe how do they differ from conventional associative memories. | CO3 | A | 10 |
|  | b. | Evaluate the architecture and training algorithm of an Adaptive Neuro-Fuzzy Inference System (ANFIS). | CO4 | An | 10 |
|  |  |  |  |  |  |
| 7. | a. | Differentiate K-means, mountain clustering, and subtractive clustering algorithms in terms of their underlying principles. | CO4 | An | 10 |
|  | b. | Distinguish how the Fuzzy C-means algorithm differ from traditional K-means clustering. | CO4 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Evaluate the key principles and mechanisms underlying Genetic Algorithms and Particle Swarm Optimization algorithms. | CO5 | E | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Summarize the role of optimization techniques, genetic algorithms and particle swarm optimization, in the process of feature selection for signal denoising and pattern recognition using ANFIS with any-one case. | CO6 | U | 10 |
|  | b. | Discuss the key components of a fuzzy system used in pattern recognition. How do fuzzy sets, fuzzy rules, and fuzzy inference play a role in improving the recognition of complex patterns? | CO6 | E | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Explain the principles of neural networks |
| CO2 | Develop hybrid artificial neural networks |
| CO3 | Frame fuzzy logic based expert systems |
| CO4 | Determine the performances of hybrid neuro fuzzy algorithms |
| CO5 | Distinguish the various evolutionary computation algorithms |
| CO6 | Solve practical problems using intelligence techniques |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 10 | 10 |  | 20 |  |  | 40 |
| CO2 |  |  | 20 |  | 20 |  | 40 |
| CO3 |  | 20 | 10 |  |  |  | 30 |
| CO4 |  |  |  | 30 |  |  | 30 |
| CO5 |  |  |  |  | 20 |  | 20 |
| CO6 |  | 10 |  |  | 10 |  | 20 |
|  | | | | | | | **180** |



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| **Course Code** | **18EC3012** | **Duration** | **3hrs** |
| **Course Name** | **DATA COMPRESSION TECHNIQUES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Analyze the need for compression considering the storage requirements of multimedia applications. | CO1 | An | 10 |
|  | b. | List and defend the importance of source models in lossless compression. | CO1 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Illustrate the specific characteristic features of different multimedia data. | CO1 | A | 10 |
|  | b. | Distinguish lossy and lossless compression techniques. | CO1 | E | 10 |
|  |  |  |  |  |  |
| 3. | a. | Demonstrate the encoding and decoding process of LZW algorithm with suitable examples. | CO2 | A | 10 |
|  | b. | Write and explain the properties of Shannon Fano encoding algorithm. | CO2 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Determine the sequence A=[a, b, c, d, e, f, g] with the probability values [0.25, 0.15, 0.05, 0.1, 0.2,0.2, 0.05] respectively using Shannon-Fano coding technique. | CO2 | A | 10 |
|  | b. | Determine the sequence A=[f, g, h, k, m, n] with the probability values [0.3, 0.1, 0.1, 0.2, 0.15, 0.15] using Huffman coding approach. | CO2 | A | 10 |
|  |  |  |  |  |  |
| 5. | a. | Identify the encoding of adaptive dictionary-based technique and explain. | CO2 | R | 10 |
|  | b. | Describe a channel vocoder and explain its model for speech synthesis. | CO3 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Devise the Image compression technique of the Portable network graphics. | CO4 | An | 10 |
|  | b. | Interpret modes of the Context Adaptive Lossless Image Compression (CALIC) scheme. | CO4 | U | 10 |
|  |  |  |  |  |  |
| 7. | a. | Summarize the applications of Progressive Image Transmission. | CO4 | U | 10 |
|  | b. | Review the Generic Decoding Procedures of JBIG2 standard. | CO4 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | The tag value of an encoded dataset B= {5,6,7,8} is given by 0.81742. Using this tag value, decode the sequence which consists of 5 numerals. Assume the interval as [0, 0.6] for ‘5’, [0.6, 0.65] for ‘6’ and [0.65, 0.85] for ‘7’ and [0.85, 1] for ‘8’. | CO2 | An | 10 |
|  | b. | Interpret the video compression schemes used in DVI compression. | CO5 | U | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Generalize the compression Issues in ATM Networks. | CO6 | C | 10 |
|  | b. | Sketch the working phases of EZW algorithm with suitable examples. | CO4 | A | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Distinguish the pros and cons of lossy and lossless compression techniques. |
| CO2 | Discriminate the compression algorithms of text data. |
| CO3 | Develop hybrid compression algorithms for audio data. |
| CO4 | Formulate methodologies for image compression approaches. |
| CO5 | Determine the performances of video compression algorithms. |
| CO6 | Solve practical problems using the coding techniques. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 10 | - | 10 | 10 | 10 | - | 40 |
| CO2 | 10 | 10 | 30 | 10 | - | - | 60 |
| CO3 | 10 | - | - | - | - | - | 10 |
| CO4 | - | 20 | - | 10 | 10 | - | 40 |
| CO5 | - | 10 | - | - | - | - | 10 |
| CO6 | - | - | 10 | - | - | 10 | 20 |
|  | | | | | | | **180** |

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| **Course Code** | **18EC3013** | **Duration** | **3hrs** |
| **Course Name** | **ADVANCED DIGITAL IMAGE PROCESSING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Explain the components of an image processing system with neat block diagram. Include the various application areas of digital image processing. | CO1 | U | 14 |
|  | b. | Describe the structure of human eye with diagram. | CO1 | U | 6 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Illustrate the basic relationship between pixels with necessary mathematical equations. | CO1 | U | 14 |
|  | b. | Distinguish between spatial and intensity resolution. | CO1 | E | 6 |
|  |  |  |  |  |  |
| 3. | a. | Summarize the different histogram operations with necessary mathematical equations. Include graphical illustrations wherever necessary. | CO2 | E | 14 |
|  | b. | Distinguish between 2D DFT and IDFT for image processing applications. | CO2 | E | 6 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Explain the technical concepts of smoothing spatial filters with necessary mathematical equations. | CO2 | U | 14 |
|  | b. | Describe the technical concepts of filtering in the frequency domain. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 5. | a. | Distinguish between erosion and dilation operations with necessary mathematical equations. Include diagrams wherever necessary. | CO3 | E | 10 |
|  | b. | Distinguish between opening and closing operations with necessary mathematical equations. | CO3 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Illustrate the edge detection methods and active contour method with neat diagrams and mathematical equations. | CO3 | U | 14 |
|  | b. | Distinguish between morphological operations on binary images and grayscale images. | CO3 | E | 6 |
|  |  |  |  |  |  |
| 7. | a. | “Extraction of relevant features improve the classification accuracy of the system”. Justify this statement with mathematical equations. | CO4 | E | 14 |
|  | b. | Distinguish between image registration and image fusion methods. | CO4 | E | 6 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Describe the characteristic features of different 3D image processing systems with neat diagrams and mathematical equations. | CO5 | U | 10 |
|  | b. | Explain the stereo view and ray tracing methods in 3D image processing with neat diagrams. | CO5 | U | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Illustrate the application of digital image processing in scene understanding with neat block diagrams. | CO6 | U | 10 |
|  | b. | Explain the techniques used for object detection in satellite images. | CO6 | U | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Explain the basic concepts of image formation and representation. |
| CO2 | Design techniques for enhancing the quality of the images. |
| CO3 | Frame morphology-based methodologies for image segmentation. |
| CO4 | Assess the performances of various image registration approaches. |
| CO5 | Differentiate the concepts of 2D and 3D image processing approaches. |
| CO6 | Solve practical problems using image processing techniques. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 34 | - | - | 6 | - | 40 |
| CO2 | - | 20 | - | - | 20 | - | 40 |
| CO3 | - | 14 | - | - | 26 | - | 40 |
| CO4 | - | - | - | - | 20 | - | 20 |
| CO5 | - | 20 | - | - | - | - | 20 |
| CO6 | - | 20 | - | - | - | - | 20 |
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| **Course Code** | **18EC3014** | **Duration** | **3hrs** |
| **Course Name** | **PATTERN RECOGNITION AND MACHINE LEARNING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Explain the concept of Maximum Likelihood Estimation (MLE) and how it is used to estimate parameters in statistical models. | CO1 | A | 15 |
|  | b. | Compare parametric and non-parametric learning. | CO1 | An | 5 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Explain the logistics regression and briefly explain its design steps for classification tasks. | CO2 | A | 10 |
|  | b. | Write the real-world examples where linear regression is commonly used for classification tasks and describe the advantages and limitations in these scenarios. | CO2 | A | 10 |
|  |  |  |  |  |  |
| 3. | a. | Examine the role of the weighted error and the importance of adjusting weights in AdaBoost. | CO3 | A | 10 |
|  | b. | Compare the activation functions like ReLU, sigmoid, and tanh, and explain their impact on deep neural network training and convergence. | CO3 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Describe the concept of Linear Discriminant Analysis (LDA) and how it differs from logistic regression. | CO4 | U | 10 |
|  | b. | Discuss the role of kernel functions in SVMs. Provide examples of kernel functions and their applications. | CO4 | U | 10 |
|  |  |  |  |  |  |
| 5. | a. | Examine the bias-variance trade-off in machine learning. | CO5 | A | 10 |
|  | b. | Explain the importance of cross-validation in machine learning. How does it help assess model performance and avoid overfitting? Provide examples of different cross-validation techniques. | CO5 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Compare linear and nonlinear discriminant functions. What are the advantages and disadvantages of each type in various classification tasks? Provide real-world examples. | CO1 | An | 10 |
|  | b. | Discuss the trade-off between false positives and false negatives in Bayesian error analysis. | CO1 | U | 10 |
|  |  |  |  |  |  |
| 7. | a. | Write the significance of the following layers in a deep neural network architecture: (i) convolution (ii) pooling (iii) dropout (iv) Fully connected | CO3 | A | 10 |
|  | b. | Explain the architecture and working principles of a multi-layer perceptron (MLP). | CO3 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Analyze Fisher’s linear discriminant function for two classes of observations. | CO4 | An | 10 |
|  | b. | Employ the naive-bayes algorithm for solving the learning and classifying text data problems. | CO2 | A | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Explain the challenges of evaluating clustering algorithms and the various metrics used for assessing clustering quality | CO6 | A | 10 |
|  | b. | Explain K-Means, hierarchical Clustering with the working principles and the strengths and weaknesses of each. | CO6 | A | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Explain the basics of pattern recognition and machine learning. |
| CO2 | Illustrate the linear models for classification. |
| CO3 | Select the neural network for classification. |
| CO4 | Summarize the concept of linear discriminant function. |
| CO5 | Design algorithm independent machine learning. |
| CO6 | Develop unsupervised learning techniques and clustering. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 10 | 15 | 15 | - | - | 40 |
| CO2 | - | - | 30 | - | - | - | 30 |
| CO3 | - | - | 20 | - | - | - | 20 |
| CO4 | - | 20 | 10 | 20 | - | - | 50 |
| CO5 | - | 20 | - | - | - | - | 20 |
| CO6 | - | - | 20 | - | - | - | 20 |
|  | | | | | | | **180** |



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| **Course Code** | **18EC3015** | **Duration** | **3hrs** |
| **Course Name** | **MIMO SYSTEMS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Discuss in detail about MIMO and multi antenna systems. | CO1 | U | 10 |
|  | b. | Explain the different types of multi-antenna systems. | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Describe the operation spatial multiplexing techniques in MIMO systems. | CO2 | U | 10 |
|  | b. | Explain the working of RAKE receiver with neat diagrams. | CO2 | U | 10 |
|  |  |  |  |  |  |
| 3. | a. | Explain Alamouti Space Time Code for two transmit and one receive antenna with necessary mathematical expressions with the important features of Alamouti scheme. | CO2 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Explain the significance of channel state information in MIMO systems. | CO5 | U | 10 |
|  | b. | Discuss transmit diversity and receive diversity with necessary diagrams. | CO2 | U | 10 |
|  |  |  |  |  |  |
| 5. | a. | Explain narrow band and wide band beam former. List the difference between them. | CO4 | U | 10 |
|  | b. | Explain training based and blind channel estimation in detail. | CO6 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Examine the different MIMO technologies adopted by LTE. Using any one technology, describe the codeword-to-layer mapping for spatial multiplexing. | CO4 | A | 20 |
|  |  |  |  |  |  |
| 7. | a. | Discuss the channel estimation techniques for CDMA. | CO6 | U | 10 |
|  | b. | State singular value decomposition. How this technique is useful in analysis of MIMO systems. | CO4 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Explain the concept of adaptive beamforming in detail with the help of any one adaptive beam forming algorithm. | CO4 | U | 10 |
|  | b. | Discuss precoding on spatial multiplexing in detail. | CO2 | U | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Illustrate the detailed classification of channel estimation algorithms and explain MMSE channel estimation in detail. | CO6 | U | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Demonstrate mathematical modeling and analysis of MIMO systems. |
| CO2 | Explain channel modeling and propagation, MIMO Capacity, space-time coding techniques. |
| CO3 | Design and Distinguish code book-based MIMO beamforming. |
| CO4 | Distinguish the principle behind MIMO receivers Vs MIMO for multi-carrier systems (e.g. MIMO-OFDM). |
| CO5 | Illustrate the significance of multi-user MIMO communications. |
| CO6 | Compare and contrast various types of Channel estimation techniques in MIMO communications |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 20 | - | - | - | - | 20 |
| CO2 | - | 50 | - | - | - | - | 50 |
| CO3 | - | 20 | - | - | - | - | 20 |
| CO4 | 10 | 10 | 20 | - | - | - | 40 |
| CO5 | - | 10 | - | - | - | - | 10 |
| CO6 | - | 40 | - | - | - | - | 40 |
|  | | | | | | | **180** |



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| **Course Code** | **18EC3025** | **Duration** | **3hrs** |
| **Course Name** | **RF AND MICROWAVE CIRCUIT DESIGN** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | “Quarter-wave transformer is a practical circuit for impedance matching”- - Justify | CO1 | E | 10 |
|  | b. | Discuss how the Smith chart is a useful graphical aid for solving transmission line problems. | CO3 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Express the advantages of double-stub tuning for impedance match in comparison with single-stub tuning. | CO1 | U | 10 |
|  | b. | Discuss the properties of the scattering matrix. | CO2 | U | 10 |
|  |  |  |  |  |  |
| 3. | a. | Show the importance of transmission matrix in microwave networks. Relate transmission matrix to impedance matrix. | CO2 | U | 10 |
|  | b. | Write the four basic decomposition rules to get a single branch between two nodes from the signal flow graph. | CO2 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Represent the properties of dividers and couplers with necessary mathematical equations. | CO4 | U | 20 |
|  |  |  |  |  |  |
| 5. | a. | Design microwave filter using the image parameter method using the specification of passband and stopband characteristics. | CO4 | C | 20 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Discuss dynamic range and sources of noise in microwave circuits. | CO4 | U | 10 |
|  | b. | An X-band amplifier has a gain of 20 dB and a 1 GHz bandwidth. Its equivalent noise temperature is to be measured via the Y-factor method. The following data are obtained:  For T1 = 290 K, N1 =−62.0dBm.  For T2 = 77 K, N2 =−64.7dBm.  If the amplifier is used with a source having an equivalent noise temperature of Ts = 450 K, determine the output noise power from the amplifier, in dBm. | CO4 | A | 10 |
|  |  |  |  |  |  |
| 7. | a. | Express harmonic, intermodulation distortion and third-order intercept point of a cascaded RF and microwave circuit. | CO4 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Compare and contrast IMPATT and TRAPATT devices. | CO5 | An | 10 |
|  | b. | Sketch high electron mobility transistor (HEMT) and explain its working. | CO5 | A | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Discuss two-port power gain expressions in a general transistor amplifier circuit. | CO6 | U | 10 |
|  | b. | Explain the design considerations of a low-noise amplifier circuit. | CO6 | U | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the behaviour of RF passive components and model active components. |
| CO2 | Perform transmission line analysis. |
| CO3 | Demonstrate use of Smith Chart for high frequency circuit design. |
| CO4 | Justify the choice/selection of components from the design aspects. |
| CO5 | Design and simulate microwave circuits |
| CO6 | Select suitable measurement methodologies to characterize and verify the performance of RF  and microwave circuits |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 10 | - | - | 10 | - | 20 |
| CO2 | - | 20 | 10 | - | - | - | 30 |
| CO3 | - | 10 | - | - | - | - | 10 |
| CO4 | - | 50 | 10 | - | - | 20 | 80 |
| CO5 | - | - | 10 | 10 | - | - | 20 |
| CO6 | - | 20 | - | - | - | - | 20 |
|  | | | | | | | **180** |



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| **Course Code** | **18EC3026** | **Duration** | **3hrs** |
| **Course Name** | **INTERNET OF THINGS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Describe enabler technologies that are used in designing (i) IoT devices, and (ii) communication methods between the devices and remote server, cloud and applications. | CO1 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Discuss the factors that are covered in the IoT general conceptual framework. | CO1 | U | 10 |
|  | b. | Explain the functions of M2M architectural domains and the relationships of an M2M system with an IoT system. | CO1 | U | 10 |
|  |  |  |  |  |  |
| 3. | a. | Differentiate between IPv4 and IPv6. Justify its part in IoT revolution. | CO1 | E | 10 |
|  | b. | Illustrate software defined network (SDN) based IoT architecture. | CO2 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Discuss on the technologies that support IoT from cloud to fog computing. | CO2 | U | 10 |
|  | b. | Describe the cloud computing paradigm in IoT. | CO2 | U | 10 |
|  |  |  |  |  |  |
| 5. | a. | Differentiate between pooling and caching with respect to Edge Computing. | CO3 | An | 10 |
|  | b. | Discriminate the LAN, PAN and WAN IOT networks with relevant examples. | CO3 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Extend the understanding of web communication protocols used by connected IoT devices. | CO4 | U | 20 |
|  |  |  |  |  |  |
| 7. | a. | Explain the use and capabilities of smart sensors in IoT. | CO4 | U | 10 |
|  | b. | Categorize the embedded device platforms for prototyping and designing of IoT based systems. | CO4 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Compare and contrast popular IoT operating systems. | CO5 | U | 10 |
|  | b. | Criticize the concept of big data for IoT applications. | CO5 | E | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Devise an IoT-based instant patient monitoring system. Also, express the benefits of IoT in healthcare. | CO6 | C | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Summarize the evolution of IoT. |
| CO2 | Classify IoT technologies that are used now. |
| CO3 | Explain the requirement of IoT in certain scenarios. |
| CO4 | Choose appropriate technologies to tackle scenarios using experimental platform for  implementing prototypes. |
| CO5 | Use the types of technologies that are available to implement IoT solutions. |
| CO6 | Examine IoT applications. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 40 | - | - | 10 | - | 50 |
| CO2 | - | 30 | - | - | - | - | 30 |
| CO3 | - | - | - | 20 | - | - | 20 |
| CO4 | - | 30 | - | 10 | - | - | 40 |
| CO5 | - | 10 | - | - | 10 | - | 20 |
| CO6 | - | - | - | - | - | 20 | 20 |
|  | | | | | | | **180** |



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| **Course Code** | **18EC3027** | **Duration** | **3hrs** |
| **Course Name** | **CMOS VLSI DESIGN** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Analyze Gradual Channel Approximation (GCA) method find the derivation of ID in Cutoff, Non-Saturation and Saturation region and draw the Drain voltage Vs Drain current characteristics. | CO1 | An | 16 |
|  |  |  |  |  |  |
| 2. | a. | With neat diagram explain in detail about clocked CMOS logic (C2MOS) and design 3-input NAND gate using clocked CMOS (C2MOS) logic. | CO4 | A | 16 |
|  |  |  |  |  |  |
| 3. | a. | Design the basic Boolean functional unit using CMOS transistor logic with the stick diagram for Y = ((A.B.C)+D) and Y= (A (B.C + D)) | CO2 | C | 8 |
|  | b. | Estimate the propagation delay of an first order analysis and evaluate propagation delay of a 0.25 µm CMOS Inverter for a supply voltage of 2.5 V, the normalized on-resistances of NMOS and PMOS transistors equal 13 kΩ and 31 kΩ, respectively and determine the (W/L) ratios of the transistors to be 1.5 for the NMOS and 4.5 for the PMOS. | CO3 | E | 8 |
|  |  |  |  |  |  |
| 4. | a. | Design and apply generals rules to describe the color codes used in stick diagram also brief the step by step procedure to draw the Euler’s Path algorithm for example Y= A(B+CD)+XW and Y= (A+BC).XW | CO3 | C | 16 |
|  |  |  |  |  |  |
| 5. | a. | Analyze the CMOS inverter design with derivation in all five regions of operation with noise margin. | CO2 | An | 16 |
|  |  |  |  |  |  |
| 6. | a. | Design the structure of a mirror adder and explain its working principle. | CO5 | C | 16 |
|  |  |  |  |  |  |
| 7. | a. | Analyze the relationship between depletion capacitance, sidewall capacitance and zero-biased capacitance with derivation in detail. | CO2 | An | 16 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. | a. | Design the structure logic of 5\*6 Array Multiplier and illustrate its function. | CO6 | An | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Compute the MOS transistor theory |
| CO2 | Sketch the Stick Diagram and Layout of CMOS Logic Gates, analyze the DC Characteristics of NMOS and CMOS Inverters and predict timing issues. |
| CO3 | Compute various CMOS Logic styles to construct Logic Circuits |
| CO4 | Illustrate the performance of Sequential logic design |
| CO5 | Determine and develop the various Arithmetic logic blocks based on CMOS design |
| CO6 | Design various high speed building blocks based on CMOS design |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | - | - | 16 | - | - | 16 |
| CO2 | - | - | - | 32 | - | 8 | 40 |
| CO3 | - | - | - | - | 8 | 16 | 24 |
| CO4 | - | - | 16 | - | - | - | 16 |
| CO5 | - | - | - | - | - | 16 | 16 |
| CO6 | - | - | - | 20 | - | - | 20 |
|  | | | | | | | **132** |



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| **Course Code** | **18EC3028** | **Duration** | **3hrs** |
| **Course Name** | **SOLID STATE DEVICE MODELING AND SIMULATION** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Explain carrier generation, recombination using continuity equation. | U | CO1 | 16 |
|  |  |  |  |  |  |
| 2. | a. | Explain the I-V characteristics of BJT with necessary base and collector current equations. | A | CO2 | 16 |
|  |  |  |  |  |  |
| 3. | a. | Write the equations to describe the collector current falloff at high currents. | A | CO3 | 8 |
|  | b. | Express the equations for small signal equivalent circuit of BJT. | U | CO3 | 8 |
|  |  |  |  |  |  |
| 4. | a. | Distinguish the differences between the long channel device and short channel device. Also express the basic IV characteristics of long channel MOSFET that operates at linear and saturation region. | An | CO5 | 8 |
|  | b. | Discuss about polysilicon gate work function and its depletion effects. | U | CO4 | 8 |
| 5. | a. | Write a detailed note on body effect and subthreshold characteristics of MOSFET. | A | CO5 | 16 |
|  |  |  |  |  |  |
| 6. | a. | Rewrite the expression that represents effective mobility and effective normal field. | U | CO5 | 16 |
|  |  |  |  |  |  |
| 7. | a. | Paraphrase the features of short channel MOSFET with necessary diagrams and plots | U | CO6 | 16 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. | a. | Write a detailed note on MOSFET scaling and constant field scaling. | A | CO6 | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Compute the Mathematical Techniques for Device Simulations |
| CO2 | Predict the various Quantum Mechanical Concepts |
| CO3 | Categorize the Bipolar Device Models |
| CO4 | Compute the effects in MOS Capacitors |
| CO5 | Illustrate the performance and characterize MOS Devices |
| CO6 | Determine and develop CMOS design |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  | 16 |  |  |  |  | 16 |
| CO2 |  |  | 16 |  |  |  | 16 |
| CO3 |  | 8 | 8 |  |  |  | 16 |
| CO4 |  | 8 |  |  |  |  | 8 |
| CO5 |  | 16 | 16 | 8 |  |  | 40 |
| CO6 |  | 16 | 20 |  |  |  | 36 |
|  | | | | | | | **132** |



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| --- | --- | --- | --- |
| **Course Code** | **18EC3029** | **Duration** | **3hrs** |
| **Course Name** | **ANALYSIS AND DESIGN OF ANALOG INTEGRATED CIRCUITS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Interpret the cascode amplifier with resistive load, active load also derive the large signal analysis with its merits and demerits. | CO1 | A | 12 |
|  | b. | Infer the non-linear operation of the common source amplifier and obtain the small signal gain of the amplifier. | CO1 | An | 4 |
|  |  |  |  |  |  |
| 2. | a. | Describe in detail the common source amplifier with resistive load and analyze using Large Signal Model. | CO2 | An | 12 |
|  | b. | Estimate common-source amplifier with a load resistance of 5K Ohms. Consider the amplifier in it is identical with the circuit except that we have added a load resistor RL. Evaluate the gain with transconductance of 20 Siemens. | CO1 | E | 4 |
|  |  |  |  |  |  |
| 3. | a. | Explain the PMOS and NMOS current mirror circuit operation and obtain the gain. | CO2 | A | 8 |
|  | b. | Determine the various types of Noises in the amplifiers and obtain the Noise Figure in the Common Source amplifier. | CO3 | A | 8 |
|  |  |  |  |  |  |
| 4. | a. | Interpret the differential amplifier in the various modes of operation and derive the parameters using small signal model. List out its merits and demerits. | CO2 | A | 16 |
|  |  |  |  |  |  |
| 5. | a. | Draw the small signal model of single stage operational amplifier and derive the gain of the Op-amp. | CO5 | E | 16 |
|  |  |  |  |  |  |
| 6. | a. | Interpret the gain of various feedback amplifier topologies, model the system for loading in voltage-voltage feedback and state its merits and demerits. | CO4 | A | 16 |
|  |  |  |  |  |  |
| 7. | a. | Categorize the frequency response of amplifier and give an analysis of its different operating modes. | CO5 | A | 16 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. | a. | Interpret the Phase Locked Loop in various modes of operation also derive the parameter and draw the transfer characteristics of PLL. | CO6 | An | 14 |
|  | b | Mention the various types of feedback amplifier and justify the need of negative in feedback in amplifier. | CO4 | A | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Compute the single stage amplifier |
| CO2 | Identify various Differential amplifiers and current mirror circuits |
| CO3 | Demonstrate the noise characteristics in amplifiers |
| CO4 | Illustrate different types of feedback concepts in amplifiers |
| CO5 | Determine the characteristics of operational amplifiers |
| CO6 | Design various analog circuits for different applications |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | - | 12 | 4 | 4 | - | 20 |
| CO2 | - | - | 16 | 12 | 8 | - | 36 |
| CO3 | - | - | 8 | - | - | - | 8 |
| CO4 | - | - | - | 22 | - | - | 22 |
| CO5 | - | - | 16 | - | 16 | - | 32 |
| CO6 | - | - | - | 14 | - | - | 14 |
|  | | | | | | | **132** |



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| **Course Code** | **18EC3048** | **Duration** | **3hrs** |
| **Course Name** | **DESIGN OF SEMICONDUCTOR MEMORIES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. |  | Explain the method of read, write and erase operations performed in a SRAM. | CO1 | A | 16 |
|  |  |  |  |  |  |
| 2. |  | Design the 3T and 1T DRAM cell. | CO2 | An | 16 |
|  |  |  |  |  |  |
| 3. |  | Explain the reliability issues of RAM failure modes and its mechanism. | CO3 | An | 16 |
|  |  |  |  |  |  |
| 4. |  | Estimate the various functional testing algorithms. | CO3 | A | 16 |
|  |  |  |  |  |  |
| 5. |  | Examine the function of radiation hardening techniques of the memory. | CO4 | An | 16 |
|  |  |  |  |  |  |
| 6. |  | Write the functions of Silicon-On-Insulator with neat diagram. | CO2 | A | 16 |
|  |  |  |  |  |  |
| 7. |  | Explain the three types of observable degradation effects upon exposing memories to ionizing radiation. | CO5 | An | 16 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. |  | Explain the Ferroelectric Random Access Memories (FRAMs with necessary diagram. | CO6 | An | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Design the architecture of Random Access Memory. |
| CO2 | Choose the type of memory for a specific application. |
| CO3 | Illustrate different types of faults that occur in memories. |
| CO4 | Illustrate various reliability and radiation effects that occur in memories. |
| CO5 | Prove the radiation effects that occur in memories |
| CO6 | Comprehend the significance of technology development in memories. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | - | 16 | - | - | - | 16 |
| CO2 | - | - | 16 | 16 | - | - | 32 |
| CO3 | - | - | 16 | 16 | - | - | 32 |
| CO4 | - | - | - | 16 | - | - | 16 |
| CO5 | - | - | - | 16 | - | - | 16 |
| CO6 | - | - | - | 20 | - | - | 20 |
|  | | | | | | | **132** |



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| **Course Code** | **18EC3050** | **Duration** | **3hrs** |
| **Course Name** | **SOLID STATE DEVICE MODELING AND SIMULATION-MOS MODEL** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Discuss the energy band diagram of solids and carrier transport mechanism in semiconductors with suitable diagrams. | CO1 | R | 10 |
|  | b. | Describe the operation modes and characteristics of MOS capacitor in detail. | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Analyze the linear MOS transistor behaviour in the AC small signal model and examine how advanced MOSFET modeling benefits transistors design. | CO2 | An | 20 |
|  |  |  |  |  |  |
| 3. | a. | List out different noise sources in MOSFET and elaborate the flicker noise modeling. | CO3 | R | 10 |
|  | b. | Enumerate the modeling used for accurate distortion analysis to guide a circuit synthesis. | CO3 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Comprehend how the scaling of gate oxide thickness affects another physical parameter using gate dielectric model. | CO4 | A | 10 |
|  | b. | Classify three models of effective mobility and explain BSIM4 mobility model. | CO4 | An | 10 |
|  |  |  |  |  |  |
| 5. | a. | Infer the modeling of second order effects and MOS transistor's long channel drain current model in a MOSFET. | CO5 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Summarize PSP model, its simulations and the effect of process variation. | CO6 | E | 10 |
|  | b. | Demonstrate the correlation of temperature and geometry using MOS 9 model. | CO6 | A | 10 |
|  |  |  |  |  |  |
| 7. | a. | Discuss about the significance of sub-threshold characteristics of MOS device. | CO1 | R | 10 |
|  | b. | Indicate the features of BSIM4 capacitance model and explain the fringing/overlap capacitance. | CO4 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Demonstrate MOSAI model and explain its process variation parameters in detail. | CO5 | C | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Interpret BSIM4 high speed model and enhanced model for effective DC and AC channel length and width. | CO6 | C | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Compute new mathematical models for various devices. |
| CO2 | Demonstrate the physics behind the semiconductor devices. |
| CO3 | Illustrate various noise modeling and non-linearities in CMOS Devices. |
| CO4 | Summarize various BSIM4 MOSFET Models. |
| CO5 | Choose EKV MOSFET Models. |
| CO6 | Develop various SPICE models for MOS devices. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 20 | 10 | - | - | - | - | 30 |
| CO2 | - | - | - | 20 | - | - | 20 |
| CO3 | 10 | 10 | - | - | - | - | 20 |
| CO4 | - | 10 | 10 | 10 | - | - | 30 |
| CO5 | - | 20 | - | - | - | 20 | 40 |
| CO6 | - | - | 10 | - | 10 | 20 | 40 |
|  | | | | | | | **180** |



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| **Course Code** | **18EC3052** | **Duration** | **3hrs** |
| **Course Name** | **NANOSCALE FET** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Explain the band theory of solids and carrier transport mechanism in solid structures. | CO1 | U | 8 |
|  | b. | Discuss about semiconducting nanoparticles and its advantages. | CO1 | R | 8 |
|  |  |  |  |  |  |
| 2. | a. | Analyze the correlation of mobility and temperature in terms of scattering mechanism in a solid structure. | CO2 | An | 8 |
|  | b. | Explain briefly about the DC characteristics of MOSFET. | CO2 | R | 8 |
|  |  |  |  |  |  |
| 3. | a. | Discuss MOS scaling theory and furnish its challenges. | CO3 | R | 8 |
|  | b. | Infer the significance of using high k dielectrics and its integration challenges. | CO3 | U | 8 |
|  |  |  |  |  |  |
| 4. | a. | Estimate the traits of partially and fully depleted SOI and make a comparison of each. | CO4 | E | 16 |
|  |  |  |  |  |  |
| 5. | a. | Explain compound semiconductor meterials and operation of MESFET in detail. | CO5 | U | 16 |
|  |  |  |  |  |  |
| 6. | a. | Sketch the structure of carbon nanotube transistor and explain its working in detail. | CO6 | R | 8 |
|  | b. | Compare and contrast between FET and SET circuit designs. | CO6 | E | 8 |
|  |  |  |  |  |  |
| 7. | a. | Explain MOS capacitor in transistors and the effects of gate oxide interfaces in the field effect transistors. | CO3 | A | 16 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. | a. | Design a vertical finFET and differentiate it from surrounded gate FET with neat diagram. | CO4 | C | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Use the important of nano structures and scaling in FETs. |
| CO2 | Demonstrate the concept and structure of Nano scale MOSFET and its various parameters. |
| CO3 | Explain the issues in scaling, interface issues in gate oxide and leakages. |
| CO4 | Investigate compound materials and heterostructure devices. |
| CO5 | Develop the Novel structures such as Finfet, MODFET, MESFET etc.. |
| CO6 | Explore various nano-structures such as SET, CNT, RTD etc.. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 8 | 8 | - | - | - | - | 16 |
| CO2 | 8 | - | - | 8 | - | - | 16 |
| CO3 | 8 | 8 | 16 | - | - | - | 32 |
| CO4 | - | - | - | - | 16 | 20 | 36 |
| CO5 | - | 16 | - | - | - | - | 16 |
| CO6 | 8 | - | 8 | - | - | - | 16 |
|  | | | | | | | **132** |



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| **Course Code** | **19EC1001** | **Duration** | **3hrs** |
| **Course Name** | **FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | List any two examples of non - conventional energy. | | CO1 | R | 1 |
| 2. | State Ohms law. | | CO1 | R | 1 |
| 3. | Identify the motor that is used in home ceiling fans. | | CO2 | R | 1 |
| 4. | Name the electromechanical device that converts electrical energy into mechanical energy. | | CO2 | R | 1 |
| 5. | Identify the color code for 220Ω resistor with tolerance value +/- 5%. | | CO3 | R | 1 |
| 6. | Name the most widely used semiconductor. | | CO3 | R | 1 |
| 7. | Identify the logic gate which gives a high output when both the inputs are high. | | CO4 | R | 1 |
| 8. | List any 2 examples for an embedded system. | | CO5 | R | 1 |
| 9. | State the purpose of using base station in mobile communication. | | CO6 | R | 1 |
| 10. | Define modulation. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Determine the current flow in the following circuit. | | CO1 | A | 3 |
| 12. | Discuss about the types of motors. | | CO2 | U | 3 |
| 13. | Differentiate intrinsic and extrinsic semiconductor. | | CO3 | U | 3 |
| 14. | Y =  Show the logic diagram for the above given expression. | | CO4 | U | 3 |
| 15. | Discuss about any 2 sensors that is used for agricultural applications. | | CO5 | U | 3 |
| 16. | Differentiate 3G and 4G. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. |  | Illustrate with a neat block diagram, the different ways by which electricity is generated through hydro power plant. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. |  | Explain the construction and operation of DC motor. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. |  | Explain the operation of PN junction diode under forward bias and reverse bias condition along with its characteristics. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. |  | Illustrate the output characteristics of a NPN transistor in CE configuration. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 21. |  | Discuss about the various logic gates with a neat schematic sketch, truth table and characteristics. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 22. |  | Explain the principle of operation of an automatic irrigation system. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Identify the resistor color bands for the following (assume 5% tolerance for all).   1. 220 Ω ii) 100 kΩ iii) 220 kΩ | CO3 | R | 6 |
|  | b. | Identify: Using the resistor color coding, decode the value of the following resistors and indicate the tolerance   1. Brown, Orange, Red, Gold 2. Violet, Brown, Yellow, Gold 3. Orange, Black, Red, Gold | CO3 | R | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Illustrate a satellite communication system and explain its functioning. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Recognize importance and judicious use of energy systems in everyday life |
| CO2 | Identify the types of electrical machines used for various applications. |
| CO3 | Understand and apply the concept of electronics to design simple circuits. |
| CO4 | Understand and relate various digital circuits. |
| CO5 | Understand the various sensing and instrumentation applications |
| CO6 | Identify the various generations of wireless communications |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | 12 | 3 | - | - | - | 17 |
| CO2 | 2 | 15 | - | - | - | - | 17 |
| CO3 | 14 | 27 | - | - | - | - | 41 |
| CO4 | 1 | 15 | - | - | - | - | 16 |
| CO5 | 1 | 15 | - | - | - | - | 16 |
| CO6 | 2 | 3 | 12 | - | - | - | 17 |
|  | | | | | | | **124** |



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| **Course Code** | **19EC2001** | **Duration** | **3hrs** |
| **Course Name** | **ELECTRONICS FOR INTELLIGENT MACHINES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define automation. | | CO1 | R | 1 |
| 2. | List the key terms that characterizes each industrial revolution. | | CO1 | R | 1 |
| 3. | List the characteristics of intelligent machines. | | CO2 | R | 1 |
| 4. | State the difference between edge and cloud computing. | | CO2 | R | 1 |
| 5. | List the IoT communication models. | | CO3 | R | 1 |
| 6. | State few applications of IoT. | | CO3 | R | 1 |
| 7. | Define sensor. | | CO4 | R | 1 |
| 8. | Interpret the applications of GPS. | | CO4 | U | 1 |
| 9. | Infer the features of big data. | | CO5 | U | 1 |
| 10. | List the drawbacks of public cloud. | | CO5 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Compare Industry 3.0 and Industry 4.0. | | CO1 | U | 3 |
| 12. | List the advantages of intelligent machines. | | CO2 | R | 3 |
| 13. | Interpret machine to machine communication. | | CO3 | U | 3 |
| 14. | Describe GSM. | | CO4 | R | 3 |
| 15. | List the types of cloud deployment models. | | CO5 | R | 3 |
| 16. | Discuss the advantages of CDN. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Paraphrase the effects of industrial revolutions in smart business transformations. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Interpret the design flow process of intelligent machines with suitable examples. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Interpret the functional blocks of IoT and explain its 4-stage architecture with relevant diagram. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Explain the types of sensors with necessary diagrams. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Illustrate the applications of big data and cloud computing in media streaming services. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Paraphrase the request-response, publish-subscribe and exclusive pair communication models with necessary diagrams. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Explain the functions of field and cloud protocols. | CO5 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Illustrate the design of intelligent machines with a case study example. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | To compare the different industry standards |
| CO2 | To articulate the structure of an Intelligent machine |
| CO3 | To illustrate the m2m interface needed in intelligent machining |
| CO4 | To be able to categorize the sensors for various intelligent machines |
| CO5 | To assess the data requirements for cloud storage |
| CO6 | To be able to grade various types of Intelligent machines |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | 15 | - | - | - | - | 17 |
| CO2 | 5 | - | 12 | - | - | - | 17 |
| CO3 | 2 | 15 | 12 | - | - | - | 29 |
| CO4 | 4 | 13 | - | - | - | - | 17 |
| CO5 | 4 | 13 | 12 | - | - | - | 29 |
| CO6 | - | 3 | 12 | - | - | - | 15 |
|  | | | | | | | **124** |



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| **Course Code** | **19EC2005** | **Duration** | **3hrs** |
| **Course Name** | **FIBER OPTIC COMMUNICATION** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | Define Snell’s law. | | CO1 | R | | 1 |
| 2. | List the types of bending losses. | | CO1 | R | | 1 |
| 3. | Quote the formula for calculating refractive index difference. | | CO2 | R | | 1 |
| 4 | Name any one material used in making photo detector. | | CO3 | R | | 1 |
| 5 | State any one application of laser. | | CO3 | R | | 1 |
| 6 | Define the feature of Y optical coupler. | | CO4 | R | | 1 |
| 7 | State the data rate of OC3. | | CO5 | R | | 1 |
| 8. | Describe the formula for calculating energy of the photon. | | CO5 | R | | 1 |
| 9 | State stark splitting in EDFA. | | CO5 | R | | 1 |
| 10 | State any one application of optical network. | | CO6 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | List the difference between splicer & connector. | | CO1 | | R | 3 |
| 12. | Identify the number of modes in multimode graded index fiber with parabolic profile for normalized frequency 75.69. | | CO2 | | U | 3 |
| 13. | List the difference between laser and LED. | | CO3 | | R | 3 |
| 14. | Illustrate the structure of PIN photodetector. | | CO3 | | U | 3 |
| 15. | Elaborate the working of Raman amplifier. | | CO5 | | R | 3 |
| 16. | List the data link layer in SONNET. | | CO6 | | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | | |
| 17. | a. | Describe the degradation of optical fiber through intrinsic & extrinsic absorptions. | CO2 | | U | 12 |
|  |  |  |  | |  |  |
| 18. | a. | Express numerical aperture (NA) = sin (acceptance angle). | CO1 | | U | 12 |
|  |  |  |  | |  |  |
| 19. | a. | Discuss the working principle of semiconductor laser diode and semiconductor laser amplifier. | CO3 | | U | 12 |
|  |  |  |  | |  |  |
| 20. | a. | Justify that the stimulated emission helps in achieving high gain in EDFA. | CO4 | | E | 12 |
|  |  |  |  | |  |  |
| 21. | a. | Describe the passive components in wavelength division multiplexer. | CO5 | | U | 12 |
|  |  |  |  | |  |  |
| 22. | a. | Describe the working principle of optical isolator. | CO5 | | R | 5 |
|  | b. | Analyze the frame format of synchronous optical network. | CO6 | | An | 7 |
|  |  |  |  | |  |  |
| 23. | a. | Justify the importance of PIN photo detector. | CO3 | | E | 6 |
|  | b. | Compare optical communication with electrical communication. | CO1 | | U | 6 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. | a. | Enumerate radio over fiber system with neat diagram stating its applications. | CO6 | | R | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Explain the basics of optical communication and to recognize the structures and types of optical fibre |
| CO2 | Discuss the channel impairments, and parameters of different types of optical fibres |
| CO3 | Classify the optical sources and detectors and to discuss their principles |
| CO4 | Explain the working of optical couplers, modulators, amplifiers and analyse the performance of optical amplifiers |
| CO5 | Design optical links, know the concept of WDM, and to discuss different optical components of WDM |
| CO6 | Discuss various types of optical networks and to gain knowledge about standards regarding fibre optic systems |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 5 | 18 | - | - | - | - | 23 |
| CO2 | 1 | 15 | - | - | - | - | 16 |
| CO3 | 5 | 15 | - | - | 6 | - | 26 |
| CO4 | 4 | - | - | - | 12 | - | 16 |
| CO5 | 12 | 12 | - | - | - | - | 24 |
| CO6 | 12 | - | - | 7 | - | - | 19 |
|  | | | | | | | **124** |



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| **Course Code** | **19EC2007** | **Duration** | **3hrs** |
| **Course Name** | **EMBEDDED SYSTEM DESIGN** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | List few challenges of real time embedded system. | | CO1 | R | 1 |
| 2. | Classify embedded systems. | | CO1 | U | 1 |
| 3. | Describe the significance of memory in embedded systems. | | CO2 | U | 1 |
| 4. | Solve the parity detection for one bit error. | | CO2 | A | 1 |
| 5. | State the importance of watchdog timer. | | CO3 | R | 1 |
| 6. | Label the frame format of CAN bus. | | CO3 | R | 1 |
| 7. | List the different approaches of embedded firmware design. | | CO4 | R | 1 |
| 8. | Infer integrated development environment. | | CO4 | U | 1 |
| 9. | Define real time kernel. | | CO5 | R | 1 |
| 10. | Describe deadlock condition in task scheduling. | | CO5 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Discuss real time embedded system with an example. | | CO1 | U | 3 |
| 12. | Interpret the function of address bus, data bus and chip select signal in a memory system. | | CO2 | A | 3 |
| 13. | Sketch the interrupt mechanism between CPU and a device. | | CO3 | A | 3 |
| 14. | Interface DS12887 with 8051 microcontroller and appraise its significance. | | CO4 | E | 3 |
| 15. | Compare application and system software. | | CO5 | U | 3 |
| 16. | Summarize the microkernel model with its flow diagram. | | CO6 | E | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Interpret the hierarchy of an embedded system design life cycle with an example. | CO1 | A | 8 |
|  | b. | Infer the significance of co-processors in embedded design | CO1 | A | 4 |
|  |  |  |  |  |  |
| 18. | a. | Describe memory technology in embedded system design and explain the operation of DRAM and its refreshing practices. | CO2 | U | 8 |
|  | b. | Infer cache memory and its organization. | CO2 | A | 4 |
|  |  |  |  |  |  |
| 19. | a. | Interpret the application of CAN bus in embedded systems and describe the data frame format of CAN. | CO3 | A | 8 |
|  | b. | Describe the types of reset circuit in embedded hardware. | CO3 | U | 4 |
|  |  |  |  |  |  |
| 20. | a. | Interpret the different pre-processor directives in embedded C and explain with examples. | CO4 | A | 8 |
|  | b. | Summarize the importance of Integrated Development Environment and explain the linker/locator tool in a software development process. | CO4 | E | 4 |
|  |  |  |  |  |  |
| 21. | a. | Explain tasks, process and threads in the context of an operating systems with necessary diagrams and examples. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. | a. | Examine the Pipelined execution for improving the processor performance. | CO1 | A | 8 |
|  | b. | Infer cache coherency and its challenges with necessary justifications and diagrams | CO2 | A | 4 |
|  |  |  |  |  |  |
| 23. | a. | Appraise the program level energy, power analysis and optimization techniques in a CPU. | CO4 | E | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Develop an automatic cruise control system in a car, which maintains the speed of the car set by the driver. Illustrate the design with necessary diagrams and algorithm. | CO6 | C | 8 |
|  | b. | Infer the significance of closed loop control system in embedded real time applications. | CO6 | A | 4 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Acquire knowledge about the embedded system architecture. |
| CO2 | Gain knowledge on the types of memories. |
| CO3 | Design the hardware required for embedded systems. |
| CO4 | Develop good programming skills to develop embedded software. |
| CO5 | Demonstrate the OS design for embedded firmware. |
| CO6 | Apply the acquired knowledge to develop closed loop embedded system. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 4 | 20 | - | - | - | 25 |
| CO2 | - | 9 | 12 | - | - | - | 21 |
| CO3 | 2 | 4 | 11 | - | - | - | 17 |
| CO4 | 1 | 1 | 8 | - | 19 | - | 29 |
| CO5 | 1 | 4 | - | 12 | - | - | 17 |
| CO6 | - | - | 4 | - | 3 | 8 | 15 |
|  | | | | | | | **124** |



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| **Course Code** | **19EC2008** | **Duration** | **3hrs** |
| **Course Name** | **ARM PROCESSORS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Indicate the ALU size of ARM7TDMI Processor. | | CO3 | U | 1 |
| 2. | Define Pipelining. | | CO3 | R | 1 |
| 3. | Indicate the bit of CPSR that determine the Thumb and ARM state of ARM7TDMI. | | CO3 | U | 1 |
| 4. | Write the instruction size in Thumb State. | | CO1 | A | 1 |
| 5. | Justify the need for Memory Hierarchy. | | CO4 | E | 1 |
| 6. | State Hit Ratio in Cache Memory. | | CO4 | R | 1 |
| 7. | Define Page frame. | | CO4 | R | 1 |
| 8. | Name the method that is used to translate Virtual address to Physical address. | | CO4 | R | 1 |
| 9. | Write the purpose of Advanced Microcontroller Bus Architecture. | | CO5 | A | 1 |
| 10. | Differentiate Timer and Counter. | | CO6 | An | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Sketch the format of ARM7 Current Program Status Register. | | CO1 | A | 3 |
| 12. | Differentiate between ARM State and Thumb State of ARM Processor. | | CO3 | An | 3 |
| 13. | Consider a direct mapped cache of size 16KB with block size 256 bytes. The size of main memory is 128KB. Estimate the number of bits in tag. | | CO4 | E | 3 |
| 14. | Compare Physical Memory with Virtual Memory. | | CO4 | U | 3 |
| 15. | Define tools chain and list any two software tools chain. | | CO6 | R | 3 |
| 16. | List the three buses defined within the Advanced Microcontroller Bus Architecture Specification. | | CO5 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. |  | With neat diagram, explain the Data flow model of ARM7TDMI Processor. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 18. |  | Write down the operating modes of ARM7 and explain each mode in detail with necessary diagram. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Discuss the steps involved in Interrupt Service Routine with neat sketch and indicate the different exceptions in ARM7TDMI. | CO3 | U | 8 |
|  | b. | Identify the addressing modes of ARM7 for the following instructions.   1. STR R0, Label 2. MOV R0,R1 3. LDR R0,[R2] 4. ADD R0,R1,#45H | CO1 | U | 4 |
|  |  |  |  |  |  |
| 20. | a. | Explain the Thumb Programmers Model with neat diagram and compare Thumb State with ARM state. | CO3 | U | 6 |
|  | b. | Develop an Assembly Language Program to transfer a block of data from one memory location to another memory location. | CO2 | C | 6 |
|  |  |  |  |  |  |
| 21. |  | Explain the Set Associative and Fully Associative Mapping of Cache Memory with necessary diagrams. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 22. |  | Justify the need for Memory Management Unit and summarize the two principle approaches to Memory Management. | CO4 | E | 12 |
|  |  |  |  |  |  |
| 23. |  | Sketch the structure of the ARM cross-development tool kit and explain the various ARM development tools. | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Sketch the diagram to interface a unipolar stepper motor with LPC2148 ARM Controller and discuss in detail using Embedded C Program. | CO6 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Summarize ARM7TDMI assembly instructions and their formats and usage. |
| CO2 | Write ARM7 based assembly level programs. |
| CO3 | Describe the architecture of ARM Processors. |
| CO4 | Express their knowledge in cache design, virtual memory and memory protection concepts. |
| CO5 | Discuss AMBA bus architecture, various HW peripherals. |
| CO6 | Apply their understanding and to handle issues in using any processor SW tools chain for embedded software solution development. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  | 4 | 4 |  |  |  | 8 |
| CO2 |  |  |  |  |  | 6 | 6 |
| CO3 | 1 | 28 | 12 | 3 |  |  | 44 |
| CO4 | 3 | 3 | 12 |  | 16 |  | 34 |
| CO5 | 3 |  | 13 |  |  |  | 16 |
| CO6 | 3 | 12 |  | 1 |  |  | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **19EC2012** | **Duration** | **3hrs** |
| **Course Name** | **WIRELESS SENSOR NETWORKS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define wireless sensor networks. | | CO1 | R | 1 |
| 2. | List the two basic types of sensor network architecture used in WSN. | | CO1 | R | 1 |
| 3. | Identify the responsibility of datalink layer. | | CO2 | U | 1 |
| 4. | Differentiate reference synchronization protocol and traditional synchronization protocol. | | CO2 | An | 1 |
| 5. | Recall the IEEE standard for Zigbee protocol. | | CO2 | R | 1 |
| 6. | Name the algorithm which is used for similarity searching in pattern matching. | | CO3 | R | 1 |
| 7. | Infer the metrics used to characterize the performance of sensor network database. | | CO4 | U | 1 |
| 8. | List the types of High-Level database organization. | | CO5 | R | 1 |
| 9. | Identify the maximum number of master and slaves are permitted in blue tooth technology. | | CO3 | U | 1 |
| 10. | Assess the limitations of firewall. | | CO6 | E | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | List the applications of wireless sensor networks. | | CO1 | R | 3 |
| 12. | Illustrate the hidden terminal problem with an example. | | CO2 | A | 3 |
| 13. | Justify the following statement “GPS is not suitable for WSN applications” | | CO3 | E | 3 |
| 14. | Estimate the position of the new location (X,Y) using NNSS-AVG algorithm if X1=4, Y1= 6, X2= 10, Y2 = 14. | | CO4 | An | 3 |
| 15. | Discuss the challenges of sensor network database. | | CO5 | U | 3 |
| 16. | Explain the mobile code intrusion techniques | | CO6 | An | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Discuss the functional architecture of wireless sensor networks with a neat diagram. | CO1 | U | 8 |
|  | b. | Explain the various design challenges of wireless sensor networks. | CO1 | U | 4 |
|  |  |  |  |  |  |
| 18. | a. | Discuss the following Routing protocols in detail.   1. Flat-routing Protocol 2. Hierarchical-routing Protocol 3. Location-based routing Protocol | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. | a. | Interpret the three main phases of localization in wireless sensor networks. | CO3 | A | 04 |
|  | b. | Estimate the position of an unknown object with the following methods (i) Trilateration (ii) Multilateration. | CO3 | E | 08 |
|  |  |  |  |  |  |
| 20. | a. | List the different types of sensor network queries and infer the importance. | CO4 | R | 04 |
|  | b. | Describe the different types of data aggregation in detail. | CO4 | R | 08 |
|  |  |  |  |  |  |
| 21. | a. | Explain the dynamic power management in WSN with relevant diagrams. | CO5 | A | 6 |
|  | b. | Illustrate the functional elements of bluetooth architecture with appropriate diagrams. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | Explain the characteristics of IEEE 802.15.4 WPAN in terms of   1. Protocol architecture 2. Network Topology 3. Data Transmission models 4. Traffic types | CO2 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | Infer the major components of SMAC protocol and explain in detail. | CO2 | C | 8 |
|  | b. | Explain the schedule-based MAC protocol. | CO2 | An | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Illustrate any two application of wireless sensor networks in agriculture. | CO6 | A | 6 |
|  | b. | Explain briefly the power management in Ad-hoc network. | CO6 | An | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Understand the concepts of sensor network architecture. |
| CO2 | Categorize the different types of protocols. |
| CO3 | Acquire knowledge in IEEE 802.15.4 standards for Wireless Sensor Networks. |
| CO4 | Understand different tracking techniques. |
| CO5 | Express the functions of sensor database. |
| CO6 | Analyze the energy management in WSN. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 5 | 12 | - | - | - | - | 17 |
| CO2 | 2 | 12 | 15 | 1 | - | 8 | 38 |
| CO3 | 1 | 1 | 4 | 4 | 11 | - | 21 |
| CO4 | 12 | 1 | - | 3 | - | - | 16 |
| CO5 | 1 | 3 | 12 | - | - | - | 16 |
| CO6 | - | - | 6 | 9 | 1 | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **19EC2013** | **Duration** | **3hrs** |
| **Course Name** | **OPTOELECTRONICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Select a material which is suitable for electroluminescence. | | CO1 | U | 1 |
| 2. | Define contrast ratio. | | CO1 | R | 1 |
| 3. | State blackbody radiation. | | CO2 | R | 1 |
| 4. | Define Snell’s Law. | | CO2 | R | 1 |
| 5. | Identify the photo detector which has a single point of contact. | | CO3 | U | 1 |
| 6. | List any two applications of PIN diode. | | CO3 | R | 1 |
| 7. | Define insertion loss. | | CO4 | R | 1 |
| 8. | Write the angle of rotation for plane polarization in magneto optic modulator. | | CO4 | A | 1 |
| 9. | Select a switch which is used for multiwavelength network. | | CO5 | U | 1 |
| 10. | List the types of integrated LASER. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Discuss the types of polarization. | | CO1 | U | 3 |
| 12. | Sketch the structure of transmissive and reflective LCD. | | CO2 | U | 3 |
| 13. | Illustrate the principle of population inversion. | | CO3 | A | 3 |
| 14. | Compare Pockels effect and Kerr effect. | | CO4 | U | 3 |
| 15. | Sketch the schematic diagram of 2X2 tunable directional couplers. | | CO5 | A | 3 |
| 16. | Differentiate Electronic IC from Opto-IC. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Review the concepts of semiconductor physics. | CO1 | U | 6 |
|  | b. | Discuss the following properties of light with relevant diagram.  (i) Interference (ii) Diffraction. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | List the types of Luminescence and explain any two in detail. | CO2 | R | 8 |
|  | b. | Explain the basic construction of LED display. | CO2 | U | 4 |
|  |  |  |  |  |  |
| 19. | a. | Describe the structure of Avalanche Photo detector and sketch the energy band diagram. | CO3 | R | 6 |
|  | b. | Discuss the principle of optical feedback and optical cavity. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Review the concepts of Digital modulation. | CO4 | U | 8 |
|  | b. | Explain the working principle of Acousto-optic Devices. | CO4 | A | 4 |
|  |  |  |  |  |  |
| 21. | a. | Illustrate the types of Opto-Multiplexers and sketch the Optical Wavelength Division Multiplexing (OWDM) in detail. | CO5 | A | 9 |
|  | b. | Discuss the principle of wavelength convertors. | CO5 | U | 3 |
|  |  |  |  |  |  |
| 22. | a. | Sketch the schematic diagram of optical switch and explain the internal block. | CO5 | U | 6 |
|  | b. | Explain the working principle of optical tunable filter with an example. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 23. | a. | Describe the construction and working principle of Schottky diode. | CO3 | R | 8 |
|  | b. | Define coupling coefficient and directivity. | CO5 | R | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Discuss the essential elements of an optoelectronic integrated circuits. | CO6 | U | 6 |
|  | b. | Illustrate the techniques for fabricating waveguides. | CO6 | U | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Understand the nature of light and to analyse various semiconductor physics and  semiconductor junction characteristics. |
| CO2 | Explore electronic displays with its working principle & characteristics |
| CO3 | Discuss optical detection devices and its types. |
| CO4 | Explain optical modulation and optical modulation devices |
| CO5 | Investigate various optical networking components and their applications. |
| CO6 | Develop various applications of optoelectronics integrated circuits |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 16 | - | - | - | - | 17 |
| CO2 | 10 | 7 | - | - | - | - | 25 |
| CO3 | 15 | 7 | 3 | - | - | - | 17 |
| CO4 | . | 12 | 5 | - | - | - | 28 |
| CO5 | 4 | 15 | 12 | - | - | - | 21 |
| CO6 | 1 | 15 | - | - | - | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **19EC2014** | **Duration** | **3hrs** |
| **Course Name** | **BASICS OF SATELLITE COMMUNICATION** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | List the two major elements of satellite communication. | | CO1 | R | 1 |
| 2. | Illustrate the ‘ascending node’ in the earth orbiting satellites. | | CO1 | U | 1 |
| 3. | Name the satellite subsystem that maintains the temperature within the specified range. | | CO2 | R | 1 |
| 4. | Define the term “despun” concerning satellite. | | CO2 | R | 1 |
| 5. | Name the application of receive-only Earth station terminals. | | CO3 | R | 1 |
| 6. | Classify the Earth station based on the type of service provided. | | CO3 | U | 1 |
| 7. | Identify the multiple access technique that allows multiple Earth stations to access the same carrier frequency and bandwidth at the same time at all times. | | CO4 | U | 1 |
| 8. | List the advantages of TDMA over FDMA. | | CO4 | U | 1 |
| 9. | Show the mathematical equation related to system noise temperature with reference to the output of the antenna. | | CO5 | U | 1 |
| 10. | Name the satellite used for European communication purposes. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Define Kepler’s third law. | | CO1 | R | 3 |
| 12. | Show different ways of generating controlling torques in the attitude control subsystem. | | CO2 | U | 3 |
| 13. | Express the purpose of testing an Earth Station. | | CO3 | U | 3 |
| 14. | Illustrate a typical TDMA frame structure. | | CO4 | U | 3 |
| 15. | List the important parameters that influence the design of a satellite communication link. | | CO5 | R | 3 |
| 16. | Indicate the different satellite services provided by the Indian Space Research Organization (ISRO). | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the orbital mechanics of LEO, MEO, and GEO with necessary diagrams. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | List the fundamental criteria to design a perfect power system for satellites. With the necessary diagrams, explain the satellite power subsystem. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. | a. | Discover the major system parameters relevant to Earth station design and with a neat diagram explain the basic architecture of Earth station. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. | a. | Explain the frequency division multiple access (FDMA) techniques used for communications via satellite with necessary diagrams. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | A 12 GHz receiver consists of an RF stage with gain G1 = 30 dB and noise temperature T1 = 20 K, a down converter with gain G2 = 10 dB and noise temperature T2 = 360K and an IF amplifier stage with gain G3 = 15 dB and noise temperature T3 = 1000K. Compute the noise figure specifications of the three stages and then compute the overall noise figure from the individual noise figure specifications. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Explain the various steps involved in launching satellites into orbits. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Explain the attitude control of satellites. With neat diagrams, explain the spinning satellite stabilization and momentum wheel stabilization. | CO2 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Discuss a typical VSAT network with a neat block diagram and illustrate different VSAT network topologies. | CO6 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the satellite orbits, elements of satellite and operation of satellite communication. |
| CO2 | Interpret the concepts of space segment, propulsion, payload, and TTC. |
| CO3 | Analyze the design requirements and the performance of earth station. |
| CO4 | Develop the multiplexing techniques, modulation techniques, and multiple access techniques for satellite communication. |
| CO5 | Illustrate the concepts of link design, rain fading and link availability and perform interference calculations. |
| CO6 | Design various satellite applications |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 4 | 25 | - | - | - | - | 29 |
| CO2 | 2 | 15 | - | 12 | - | - | 29 |
| CO3 | 1 | 16 | - | - | - | - | 17 |
| CO4 | - | 17 | - | - | - | - | 17 |
| CO5 | 3 | 1 | 12 | - | - | - | 16 |
| CO6 | 1 | 15 | - | - | - | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **19EC2015** | **Duration** | **3hrs** |
| **Course Name** | **PRINCIPLES OF DIGITAL IMAGE PROCESSING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Write the normal video rate. | | CO1 | A | 1 |
| 2. | List the secondary colors | | CO1 | R | 1 |
| 3. | Criticize the impact of notch filter. | | CO2 | E | 1 |
| 4. | State the use of histogram. | | CO2 | R | 1 |
| 5. | Justify image restoration is an objective technique. | | CO3 | E | 1 |
| 6. | Infer periodic noise. | | CO3 | U | 1 |
| 7. | Indicate the use of opening. | | CO4 | U | 1 |
| 8. | Identify the drawback of image thresholding. | | CO5 | R | 1 |
| 9. | Give example for an edge operator. | | CO5 | U | 1 |
| 10. | State shape number. | | CO5 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Compare and contrast cones and rods. | | CO1 | An | 3 |
| 12. | Identify the difference between point and neighborhood processing. | | CO2 | R | 3 |
| 13. | Discuss the drawback of inverse filter. | | CO3 | U | 3 |
| 14. | Distinguish between dilation and erosion operators. | | CO4 | U | 3 |
| 15. | List the types of gray level discontinuities. | | CO5 | R | 3 |
| 16. | Describe principal components and its use. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Illustrate 4, 8 and mixed adjacencies. | CO1 | An | 9 |
|  | b. | Describe spatial and gray level resolution. | CO1 | U | 3 |
|  |  |  |  |  |  |
| 18. | a. | Justify brightness is not a function of intensity alone using the following phenomena: Mach-band effect and Simultaneous contrast. | CO1 | E | 8 |
|  | b. | Calculate the Euclidean distance between the pixels at (2,4) and (4,2). | CO1 | A | 4 |
|  |  |  |  |  |  |
| 19. | a. | Explain the implementation and impact of average and medium filters. | CO2 | An | 8 |
|  | b. | Infer the properties of 2-D Discrete Fourier Transform. | CO2 | U | 4 |
|  |  |  |  |  |  |
| 20. | a. | Infer why Wiener filter can restore the degraded image in the presence of noise. | CO3 | U | 6 |
|  | b. | Explain how image observation and experimentation methods are used to estimate the degradation function. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | Explain the use of Hit-or-Miss transform. | CO4 | U | 5 |
|  | b. | Illustrate the morphological algorithm to extract the connected components in an image. | CO4 | A | 7 |
|  |  |  |  |  |  |
| 22. | a. | Criticize over-segmentation in watershed algorithm and the solution to overcome it. | CO5 | An | 6 |
|  | b. | Compute various Accumulative Difference Images and compare. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Illustrate the following descriptors: chain code and shape numbers. | CO6 | A | 8 |
|  | b. | Indicate the applications of image coding and image classification. | CO6 | U | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Illustrate image enhancement using histogram equalization | CO2 | A | 7 |
|  | b. | Explain the concept of edge detection. | CO4 | U | 5 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Grasp the basics of digital image acquisition and processing system |
| CO2 | Select methods for enhancing an image |
| CO3 | Estimate and restore the degraded images |
| CO4 | Detect object shapes using morphological operators |
| CO5 | Segment the object of interest and provide suitable representation and description |
| CO6 | Analyze the image processing methods |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 3 | 5 | 12 | 8 |  | 29 |
| CO2 | 4 | 4 | 7 | 8 | 1 |  | 24 |
| CO3 |  | 16 |  |  | 1 |  | 17 |
| CO4 |  | 14 | 7 |  |  |  | 21 |
| CO5 | 5 | 1 | 6 | 6 |  |  | 18 |
| CO6 | 3 | 4 | 8 |  |  |  | 15 |
|  | | | | | | | **124** |



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| **Course Code** | **19EC2016** | **Duration** | **3hrs** |
| **Course Name** | **MULTIMEDIA COMPRESSION TECHNIQUES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | List any two image compression methods. | | CO1 | R | 1 |
| 2. | Summarize the concept of compression rate. | | CO1 | U | 1 |
| 3. | Name the adaptive dictionary technique used for data compression. | | CO2 | R | 1 |
| 4. | Summarize the concept of ‘search buffer’ in data compression method. | | CO2 | U | 1 |
| 5. | Distinguish between up sampling and down sampling in audio compression. | | CO3 | An | 1 |
| 6. | Illustrate the concept of analysis filters with a diagram. | | CO3 | U | 1 |
| 7. | List the disadvantages of quantization in still image compression. | | CO4 | R | 1 |
| 8. | List the various parameters used in EZW algorithm. | | CO4 | R | 1 |
| 9. | Explain the differential encoding technique in data compression. | | CO5 | U | 1 |
| 10. | Name the different types of video compression standards. | | CO5 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Distinguish between LZW and LZ78 algorithms used for text compression. | | CO2 | An | 3 |
| 12. | Distinguish between text and audio compression methods. | | CO1 | An | 3 |
| 13. | Illustrate the G.722 compression method with neat diagram. | | CO3 | U | 3 |
| 14. | Explain the advantages of wavelet coding techniques. | | CO4 | U | 3 |
| 15. | Distinguish between SPIHT and EZW algorithms used for still images. | | CO4 | An | 3 |
| 16. | Summarize the concept of motion compensation with neat diagram. | | CO5 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Summarize the technical concepts of text, image, audio and video data. Illustrate the various parameters used to judge the performance of any compression method. | CO1 | U | 8 |
|  | b. | Distinguish between lossy and lossless compression techniques. | CO1 | An | 4 |
|  |  |  |  |  |  |
| 18. | a. | Estimate the codes for the sequence A= [a, b, c, d, e, f, g] with the probability values [0.2, 0.1, 0.05, 0.15, 0.1, 0.1, 0.3] respectively using minimum variance Huffman coding technique. | CO2 | E | 12 |
|  |  |  |  |  |  |
| 19. | a. | Determine the codes for the sequence ‘gthhtgthhthttphttpghttpghttpghtghtght’ using the LZ78 algorithm. | CO2 | E | 12 |
|  |  |  |  |  |  |
| 20. | a. | Explain the sub band coding method for speech compression applications with neat block diagram. | CO3 | U | 6 |
|  | b. | Determine the codes for the sequence ‘…abracadabraabraca….’ using the LZ77 approach. Consider a window size of 11 with ‘5’ as the size of the search buffer. | CO3 | E | 6 |
|  |  |  |  |  |  |
| 21. | a. | Illustrate the JPEG methodology of compression of still images with neat diagram. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 22. | a. | Summarize the SPIHT coding methodology used for image compression with a numerical example. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Explain the compression methodology of motion pictures using MPEG algorithm. | CO5 | U | 6 |
|  | b. | Illustrate the H.261 algorithm-based video data compression with neat diagram. | CO5 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the role of compression methods in object tracking and detection in digital videos. | CO6 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Recall the basic concepts of multimedia data |
| CO2 | Demonstrate knowledge about the principles of various coding techniques |
| CO3 | Assess lossy and lossless compression systems |
| CO4 | Choose suitable compression algorithm for signal processing |
| CO5 | Analyze the performance of various compression algorithms |
| CO6 | Apply the appropriate coding technique for real time applications |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 9 | - | 7 | - | - | 17 |
| CO2 | 1 | 1 | - | 3 | 24 | - | 29 |
| CO3 | - | 10 | - | 1 | 6 | - | 17 |
| CO4 | 2 | 27 | - | 3 | - | - | 32 |
| CO5 | 1 | 16 | - | - | - | - | 17 |
| CO6 | - | 12 | - | - | - | - | 12 |
|  | | | | | | | **124** |



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| **Course Code** | **19EC2018** | **Duration** | **3hrs** |
| **Course Name** | **SYSTEM VERILOG AND FUNCTIONAL VERIFICATION** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define the different level of model for Verilog code | | CO1 | R | 1 |
| 2. | Examine the need for test bench in Verilog code. | | CO1 | A | 1 |
| 3. | Describe the simple system Verilog code for procedural statement | | CO2 | R | 1 |
| 4. | Represent the numerical data type in System Verilog Programming with the states. | | CO2 | U | 1 |
| 5. | State the different statistics properties of class for System Verilog code | | CO3 | R | 1 |
| 6. | Predict the need for Constructor in System Verilog code. | | CO3 | A | 1 |
| 7. | State the simple System Verilog code for randomize variable. | | CO4 | R | 1 |
| 8. | Relate numerical data type in System Verilog Programming with the states. | | CO4 | U | 1 |
| 9. | Illustrate the significance of the System Verilog Mod port. | | CO5 | An | 1 |
| 10. | Justify the need of System Verilog Events. | | CO6 | E | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Describe the two input NAND gate with behavioral modelling of Verilog | | CO1 | U | 3 |
| 12. | Distinguish between Design module and Test Module. | | CO1 | An | 3 |
| 13. | Choose the Enum datatype to create RED and GREEN signal and display the same sequentially using System Verilog | | CO2 | A | 3 |
| 14. | Estimate the benefits of Structure and Union. | | CO3 | E | 3 |
| 15. | Choose the implication constraint need for the System Verilog. | | CO4 | A | 3 |
| 16. | Estimate the benefits of pre\_randomise and post \_randomise methods . | | CO5 | E | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Compare in detail about various levels of abstraction in Verilog code with the illustration of Decoder code in details. | CO1 | An | 6 |
|  | b. | Justify testbench in sequential circuit D flip flop and give all the test cases of D flip flop model. | CO2 | E | 6 |
|  |  |  |  |  |  |
| 18. | a. | Evaluate in detail about various types of structures of the System Verilog with the illustration of design of LED display sequentially after 20ns. | CO3 | E | 12 |
|  |  |  |  |  |  |
| 19. | a. | Compare in detail about various properties of class in Verilog code with the illustration of any two properties with system Verilog Code in detail. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 20. | a. | Evaluate in detail about various types system Verilog code of for loop constraint with addr and data are the two dynamic arrays, the first size of the arrays is constrained and then the values for each array element are constrained using a foreach loop.  Constraining array sizes,  constraint asize { addr.size < 4; }  constraint dsize { data.size == addr.size; }  Constraining array elements,  constraint avalues { foreach ( addr[i] ) addr[i] inside {4,8,12,16}; }  constraint dvalues { foreach ( data[j] ) data[j] > 4 \* j; } | CO5 | E | 12 |
|  |  |  |  |  |  |
| 21. | a. | Analyze the system Verilog testbench code to Memory Model TestBench Without Monitor, Agent, and Scoreboard  a. the topmost file, which connects the DUT and TestBench.  b. TestBench top consists of DUT, Test and Interface instances.  c. The interface connects the DUT and TestBench. | CO6 | An | 12 |
|  |  |  |  |  |  |
| 22 | a. | Justify the system need of Verilog Virtual Interface in System Verilog Testcase receives the interface handle from the testcase and passes it to environment . | CO6 | E | 12 |
|  |  |  |  |  |  |
| 23. | a. | Survey the need for Coverage are untested portions of the design. Write the System Verilog code for Coverage is defined as the percentage of verification objectives that have been met with the types of Coverage metrics. | CO5 | An | 6 |
|  | b. | Reframe the event triggering and waiting for the event trigger for the System Verilog Events? | CO5 | E | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Summarize the Verification process and Testbench with the various types.  Explain the various testbench architecture in the System Verilog components in detail with neat block diagram. | CO6 | An | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Understand concept of Verilog programming in Functional Verification |
| CO2 | Illustrate the concept of System Verilog |
| CO3 | Analyze different classes in System Verilog |
| CO4 | Code in System Verilog using constraint and randomization |
| CO5 | Interpret coverage methods and interprocess synchronization |
| CO6 | Comprehend test bench concept in System Verilog |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 3 | 1 | 9 |  |  | 14 |
| CO2 | 1 | 1 | 3 |  | 6 |  | 11 |
| CO3 | 1 |  | 1 |  | 15 |  | 17 |
| CO4 | 1 | 1 | 3 | 12 |  |  | 17 |
| CO5 |  |  |  | 7 | 21 |  | 28 |
| CO6 |  |  |  | 24 | 13 |  | 37 |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **19EC2020** | **Duration** | **3hrs** |
| **Course Name** | **ANALYSIS AND DESIGN OF DIGITAL IC** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | List the 4 terminals of MOSFET. | | CO1 | R | 1 |
| 2. | Name the minimum voltage required to turn ON the transistor. | | CO1 | R | 1 |
| 3. | Identify the potential of the gate voltage to be applied to NMOS to turn it ON. | | CO2 | U | 1 |
| 4. | Examine the operating region of the NMOS transistor, Vt = 0.2 V, Vg= 0.5 V, Vd = 1.8 V. | | CO2 | A | 1 |
| 5. | List the types of power dissipation in CMOS. | | CO3 | R | 1 |
| 6. | Indicate the type of MOS transistors present in the PUN of static CMOS design. | | CO3 | U | 1 |
| 7. | List two properties of Complementary Static CMOS gates. | | CO4 | R | 1 |
| 8. | Identify the logic that combines domino logic and np CMOS logic while cascading dynamic gates. | | CO4 | U | 1 |
| 9. | Identify the names of edge-sensitive storage device and level sensitive storage device. | | CO5 | R | 1 |
| 10. | Define clock skew. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Classify three levels of MOSFET models based on their physics. | | CO1 | U | 3 |
| 12. | Justify the statement, “NMOS transistors pass strong zero but not strong one”. | | CO2 | E | 3 |
| 13. | Explain dynamic power dissipation with a mathematical equation. | | CO3 | U | 3 |
| 14. | Distinguish combinational circuits from sequential logic circuits. | | CO4 | An | 3 |
| 15. | Sketch the schematic of CMOS Schmitt trigger. | | CO5 | A | 3 |
| 16. | Differentiate mesochronous signals from plesiochronous signals. | | CO6 | An | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain different regions of operation of the NMOS transistor with a neat diagram and equation. Obtain the characteristic curve for the same. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Analyze the impact of velocity saturation and DIBL second-order effects in the short channel and long channel device of the MOS transistor. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. | a. | Analyze the voltage transfer curve of the CMOS inverter and indicate the status of PMOS and NMOS transistors in different regions | CO3 | An | 6 |
|  | b. | Analyze the different types of power dissipation that occur in CMOS inverter design with mathematical equations. | CO3 | An | 6 |
|  |  |  |  |  |  |
| 20. | a. | Analyze three different issues that occur in dynamic CMOS logic design and provide suitable solutions for the same with a neat diagram. | CO4 | An | 6 |
|  | b. | Analyze the issue that happen in cascading dynamic gates and provide one suitable solution for the same. | CO4 | An | 6 |
|  |  |  |  |  |  |
| 21. | a. | Design a pipelined data path for the computation of log (la+bl) and explain its operation by comparing it with the conventional design. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Construct a MUX-based negative edge-triggered register with a neat diagram and timing waveform. | CO4 | A | 6 |
|  | b. | Explain the np-CMOS logic style of cascading dynamic gates with a neat diagram. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 23. | a. | Explain the operation of the CMOS Schmitt trigger with a neat diagram. | CO5 | U | 6 |
|  | b. | Construct a NORA CMOS logic style for pipelined structure and tabulate its operation modes. | CO5 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the operation of PLL and its application with a neat block diagram. | CO6 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Understand the basic concepts of MOS transistor. |
| CO2 | Illustrate different second order effects in MOS transistor. |
| CO3 | Analyze static and dynamic behavior of CMOS inverter. |
| CO4 | Design combinational logic circuits in CMOS. |
| CO5 | Interpret different logic style to design sequential logic circuits and its optimization. |
| CO6 | Comprehend the significance of timing issues in logic circuit design. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | 15 |  |  |  |  | 17 |
| CO2 |  | 1 | 1 | 12 | 3 |  | 17 |
| CO3 | 1 | 4 |  | 12 |  |  | 17 |
| CO4 | 1 | 7 | 6 | 15 |  |  | 29 |
| CO5 | 1 | 6 | 21 |  |  |  | 28 |
| CO6 | 1 | 12 |  | 3 |  |  | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **19EC2021** | **Duration** | **3hrs** |
| **Course Name** | **LOW POWER TECHNIQUES IN VLSI DESIGN** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | State Moore’s law. | | CO2 | R | 1 |
| 2. | Define sub-threshold leakage current. | | CO1 | R | 1 |
| 3. | Define propagation delay. | | CO2 | R | 1 |
| 4. | Identify the basic building block of a CMOS digital circuit. | | CO2 | U | 1 |
| 5. | Sketch the clock gating logic used in power reduction of clock signals. | | CO3 | A | 1 |
| 6. | Summarize the power reduction technique used in microprocessors. | | CO3 | U | 1 |
| 7. | Sketch the functionality theme of SR latch. | | CO4 | A | 1 |
| 8. | List the applications of pipelining in a combinational circuit. | | CO4 | R | 1 |
| 9. | Sketch the superimposed pair of inverter loop for RAM operation. | | CO5 | A | 1 |
| 10. | Name the logic that has two transmission gates and a dual-rail encoded output. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Analyze the impact of static current in a pseudo NMOS NOR gate. | | CO1 | An | 3 |
| 12. | Describe the logic encoding techniques used to achieve low power consumption. | | CO2 | U | 3 |
| 13. | Summarize the applications of frequency division multiplication. | | CO3 | U | 3 |
| 14. | Describe the need for low power latches and flip-flops. | | CO4 | R | 3 |
| 15. | Infer the impact of reduced voltage swing on a SRAM. | | CO5 | R | 3 |
| 16. | List the four steps involved for adiabatic realization of any function. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Illustrate the equivalent circuit of charging and discharging a capacitor and calculate the power dissipation. | CO1 | An | 8 |
|  | b. | Analyze the short circuit current of an inverter with its transfer characteristics. | CO1 | An | 4 |
|  |  |  |  |  |  |
| 18. | a. | Illustrate the transition analysis of state encoding technique to identify the functionalities of two identical state machine. | CO2 | U | 8 |
|  | b. | Summarize the gate reorganization technique with necessary diagrams. | CO2 | A | 4 |
|  |  |  |  |  |  |
| 19. | a. | Illustrate the principle of low swing bus technique in a low power communication bus with necessary diagrams and expressions. | CO3 | U | 8 |
|  | b. | Summarize how the sleep mode of microprocessor is used for power reduction. | CO3 | A | 4 |
|  |  |  |  |  |  |
| 20. | a. | Examine a fully static and RAM based SR latch with respect to optimization theme. | CO4 | A | 8 |
|  | b. | Illustrate the NORA Pipeline Register with Ф and Фb block for all the possible conditions. | CO4 | U | 4 |
|  |  |  |  |  |  |
| 21. | a. | Illustrate the 6T Static RAM organization with a neat sketch and explain. | CO5 | U | 6 |
|  | b. | Explain banked organization of SRAM. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Summarize the network reconstructing and reorganization technique with a suitable example. | CO2 | U | 8 |
|  | b. | A 32 bit off-chip bus operating at 3.3V and 66MHz clock rate is driving a capacitance of 20pF/bit. Each bit is estimated to have a toggling probability of 0.26 at each clock cycle. Calculate the power dissipation in operating the bus. | CO1 | An | 4 |
|  |  |  |  |  |  |
| 23. | a. | Explain the power and performance management technique used in microprocessors with necessary diagrams. | CO3 | A | 8 |
|  | b. | Compare the power dissipation techniques in uniprocessing and parallel processing systems. | CO4 | An | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Determine the energy dissipated and output voltage using stepwise charging circuits in adiabatic logic with necessary diagrams and expressions. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Describe the simulation based power analysis. |
| CO2 | Apply the various low power reduction techniques at circuit level and logic level. |
| CO3 | Demonstrate the various special techniques at architecture and system techniques. |
| CO4 | Design of low power latches & flip-flops. |
| CO5 | Design low power SRAM chips. |
| CO6 | Apply the of energy recovery concepts to design low power circuits. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  | - | - | 19 | - | - | 20 |
| CO2 | 2 | 23 | 5 | - | - | - | 30 |
| CO3 | - | 9 | 12 | - | - | - | 21 |
| CO4 | 4 | 4 | 9 | 4 | - | - | 21 |
| CO5 | 3 | 12 | 1 | - | - | - | 16 |
| CO6 | 4 | - | 12 | - | - | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **19EC2022** | **Duration** | **3hrs** |
| **Course Name** | **NANOELECTRONICS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Identify few semiconducting materials used in nano electronics. | | CO1 | U | 1 |
| 2. | List the issues of transistor scaling. | | CO1 | R | 1 |
| 3. | Define Quantum mechanics. | | CO2 | R | 1 |
| 4. | Describe the term degenerancy in nanotechnology. | | CO2 | R | 1 |
| 5. | State the importance of C60 molecule in electronic systems. | | CO3 | U | 1 |
| 6. | Describe the mobility in ballistic transport mechanism. | | CO3 | U | 1 |
| 7. | List the different nanoscale materials and structures based on the dimensions. | | CO4 | A | 1 |
| 8. | List few important properties of atomistic device simulation. | | CO4 | R | 1 |
| 9. | Write any two examples of 2D semiconductor materials. | | CO5 | A | 1 |
| 10. | Define ball milling. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Write the schrodinger wave equation and state the application of it. | | CO1 | U | 3 |
| 12. | Examine the density of states with a neat diagram. | | CO2 | R | 3 |
| 13. | Interpret velocity saturation and I-V characteristics of MOSFET. | | CO3 | A | 3 |
| 14. | Explain 1D nanoscale materials with an example. | | CO4 | A | 3 |
| 15. | Describe Single Electron Transistor and list few applications. | | CO5 | R | 3 |
| 16. | Elaborate the types of oxidation techniques involved in nanofabrication. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Discuss in detail the steps involved in NMOS fabrication process and criticize its challenges. | CO1 | U | 10 |
|  | b. | State the importance of MOS scaling. | CO1 | A | 2 |
|  |  |  |  |  |  |
| 18. | a. | Summarize the implications of Schrödinger's wave equation on the behavior of particles with necessary equations. | CO2 | R | 6 |
|  | b. | Determine the expression of Kronig-Penny model in electronic band structures. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Explain the working of vertical MOSFET with its region of operation with necessary diagrams and state few applications. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. | a. | Illustrate the Chemical Vapour Deposition method with neat diagram. | CO4 | R | 10 |
|  | b. | Classify the various nanomaterial types. | CO4 | U | 2 |
|  |  |  |  |  |  |
| 21. | a. | Develop a Carbon based FET and discuss its operation with a neat diagram. | CO5 | A | 10 |
|  | b. | Interpret the types of oxidation methods involved in nanofabrication. | CO6 | A | 2 |
|  |  |  |  |  |  |
| 22. | a. | Examine the process of Dip pen lithography method with a neat sketch. | CO6 | A | 7 |
|  | b. | Illustrate the sol-gel method of fabrication. | CO4 | A | 5 |
|  |  |  |  |  |  |
| 23. | a. | Develop plasma ark nanomaterial synthesis with necessary diagrams. | CO4 | A | 10 |
|  | b. | List the types of nano composite materials. | CO5 | A | 2 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain in detail about the Czochralski crystal growth technique with the neat diagram. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Demonstrate the basic concepts of nanotechnology and the processes involved in making nano components and material. |
| CO2 | Use the fundamental concepts of nano-electronics. |
| CO3 | Explore various structure and operation of various MOS nanodevices |
| CO4 | Compare Tunneling devices and SET transistors in nano regim. |
| CO5 | Investigate the emerging nanodevices and its applications. |
| CO6 | Choose various fabrication methods of nano-devices. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 14 | 2 | - | - | - | 17 |
| CO2 | 11 | - | 6 | - | - | - | 17 |
| CO3 | - | 14 | 3 | - | - | - | 17 |
| CO4 | 11 | 2 | 19 | - | - | - | 32 |
| CO5 | 3 | - | 13 | - | - | - | 16 |
| CO6 | 4 | - | 21 | - | - | - | 25 |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **19EC2027** | **Duration** | **3hrs** |
| **Course Name** | **MATLAB PROGRAMMING FOR ENGINEERS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | List the advantages of MATLAB over other programming languages. | | CO1 | R | 1 |
| 2. | State the command that is used to clear the figure window. | | CO1 | R | 1 |
| 3. | Differentiate the functions ceil (x) and floor (x). | | CO2 | U | 1 |
| 4. | Identify the function which is used to read an audio file. | | CO2 | R | 1 |
| 5. | Give examples of a row vector and a column vector. | | CO3 | U | 1 |
| 6. | Name the function that calculates the value of a polynomial. | | CO3 | R | 1 |
| 7. | Indicate the function of scope block in MATLAB Simulink. | | CO4 | U | 1 |
| 8. | Name any three tool boxes available in MATLAB Simulink. | | CO4 | R | 1 |
| 9. | Identify the MATLAB functions that are used to make plots using logarithmic axes. | | CO5 | R | 1 |
| 10. | Identify the control used to display a series of text strings. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Illustrate the working of stem function in plotting graphs. | | CO1 | U | 3 |
| 12. | Write a MATLAB code to perform the matrix multiplication operation between two vectors x and y, where x = [1, -1, -2] and y = [3, 1, 2]. | | CO2 | A | 3 |
| 13. | Construct a MATLAB code for dividing 2x3 + 9x2 + 7x-6 by x + 3. | | CO3 | A | 3 |
| 14. | Differentiate scope and spectrum analyzer in a simulink model. | | CO4 | U | 3 |
| 15. | Summarize plot(x) and plot(x,y)commands with an example. | | CO5 | U | 3 |
| 16. | Enumerate the various button options available in MATLAB GUI. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the different windows available in MATLAB and illustrate how it is used as a scratch pad with examples. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Explain the functions of following in-built functions in MATLAB with the help of a MATLAB code.  (i) stem(x), (ii) max(x), (iii) imread(x), (iv) plot(x), (v) input(x),  (vi) size(x). | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. | a. | Develop a MATLAB program to plot the polynomial for -1.5 ≤x ≤ 6.7 for the function f(x) = x5 -12.1x4 +4 0.59x3-17.015x2 -71.95x + 35.88 | CO3 | A | 6 |
|  | b. | Explain polynomial curve fitting with MATLAB examples. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Create a model in MATLAB Simulink to generate a complex signal and to perform Fourier transform on it. | CO4 | C | 12 |
|  |  |  |  |  |  |
| 21. | a. | Illustrate the following with MATLAB examples.   1. Putting multiple plots on the same page 2. Multiple figure windows 3. Polar plots | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. | a. | Explain the different types of conditional statements and loop control statements with MATLAB examples. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Explain the following MATLAB functions with an illustration.  (i) conv (ii) deconv (iii) polyder(p) (iv) polyder(a,b) (v) polyfit  (vi) ode45 | CO3 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Create a MATLAB GUI that can perform arithmetic operations and explain each component. | CO6 | C | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the process of converting computational problems into a series of simple steps |
| CO2 | Develop programs in the MATLAB language for engineering applications |
| CO3 | Analyze numerical data and perform input and output operations on it |
| CO4 | Illustrate the concept of toolboxes for practical applications |
| CO5 | Summarize the concepts of various data visualization techniques |
| CO6 | Design Graphical User Interfaces for practical applications |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | 15 | - | - | - | - | 17 |
| CO2 | 1 | 25 | 3 | - | - | - | 29 |
| CO3 | 1 | 19 | 9 | - | - | - | 29 |
| CO4 | 1 | 4 | - | - | - | 12 | 17 |
| CO5 | 1 | 15 | - | - | - | - | 16 |
| CO6 | 4 | - | - | - | - | 12 | 16 |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **19EC2029** | **Duration** | **3hrs** |
| **Course Name** | **DATA SCIENCE AND DATA ANALYTICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | | |
| 1. | Compare data analytics and data analysis. | | | CO1 | U | | 1 |
| 2. | List any two data science tool kit. | | | CO1 | R | | 1 |
| 3. | Name any two web-based APIs. | | | CO2 | R | | 1 |
| 4. | Define Data Fatigue. | | | CO2 | R | | 1 |
| 5. | Name a machine learning algorithm which is used to solve regression task. | | | CO3 | R | | 1 |
| 6. | Distinguish between classification and regression tasks. | | | CO3 | A | | 1 |
| 7. | State data sharding. | | | CO4 | R | | 1 |
| 8. | Write an example for nominal data type. | | | CO4 | A | | 1 |
| 9. | Define Data Encoding. | | | CO5 | R | | 1 |
| 10. | Identify the membership operators in python. | | | CO6 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | |
| 11. | Explain exploratory data analysis. | | | CO1 | | U | 3 |
| 12. | Describe secondary data collection with an example. | | | CO2 | | R | 3 |
| 13. | Calculate the accuracy and specificity of the machine learning model whose confusion matrix parameters are as follows: TN=525, FP=150, FN=86, TP=420. | | | CO3 | | A | 3 |
| 14. | Compare quantitative data and qualitative data. | | | CO4 | | U | 3 |
| 15. | List the different components of Microsoft power BI. | | | CO5 | | R | 3 |
| 16. | Write a python code for creating a list ‘lst’ with four elements as follows: 7, 15.2, 25, Data and replace the element 25 by 32. | | | CO6 | | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | | | |
| 17. | | a. | Examine the data preparation phase of data science lifecycle with suitable examples. | CO1 | | A | 12 |
|  | |  |  |  | |  |  |
| 18. | | a. | Explain the ACID properties of Relational Database Management System (RDBMS) with suitable examples. | CO2 | | A | 12 |
|  | |  |  |  | |  |  |
| 19. | | a. | Explain support vector machine in detail with necessary illustrations. | CO3 | | U | 12 |
|  | |  |  |  | |  |  |
| 20. | | a. | Summarize the descriptive statistics with necessary examples. | CO4 | | U | 12 |
|  | |  |  |  | |  |  |
| 21. | | a. | Explain visual encodings with the appropriate examples, by using Bertin’s visual variables. | CO5 | | A | 12 |
|  | |  |  |  | |  |  |
| 22. | | a. | Identify the real time big data visualization tools and explain the tools in detail. | CO4 | | U | 12 |
|  | |  |  |  | |  |  |
| 23. | | a. | Explain linear regression algorithm in detail with necessary illustrations. | CO3 | | U | 12 |
| **COMPULSORY QUESTION** | | | | | | | |
| 24. | | a. | Explain R datatypes with suitable examples. | CO6 | | U | 6 |
|  | | b. | List the advantages of R programming. | CO6 | | R | 6 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the key concepts in data science, its applications and the toolkit used by data scientists |
| CO2 | Realize how data is collected, managed and stored for data science |
| CO3 | Apply various machine learning techniques in real-world applications |
| CO4 | Implement data collection and management |
| CO5 | Apply visualization tools for data visualization |
| CO6 | Possess the required knowledge and expertise to become a proficient data scientist |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 4 | 12 | - | - | - | 17 |
| CO2 | 5 | - | 12 | - | - | - | 17 |
| CO3 | 1 | 24 | 4 | - | - | - | 29 |
| CO4 | 1 | 27 | 1 | - | - | - | 29 |
| CO5 | 4 | - | 12 | - | - | - | 16 |
| CO6 | 7 | 6 | 3 | - | - | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **19EC2030** | **Duration** | **3hrs** |
| **Course Name** | **CLOUD COMPUTING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | List two real time popular VM software’s. | | CO1 | R | 1 |
| 2. | Recall the operations used in cloud computing. | | CO1 | R | 1 |
| 3. | Define cloud computing. | | CO2 | R | 1 |
| 4. | List out two differences between private and public cloud. | | CO2 | R | 1 |
| 5. | Tell two reasons faced by cloud security issues in cloud computing. | | CO3 | R | 1 |
| 6. | Discuss on term eavesdropping which has been used for network level security. | | CO3 | U | 1 |
| 7. | Define availability management in cloud. | | CO4 | R | 1 |
| 8. | Recall the compliance standard for securing Amazon Web Services (AWS) resources. | | CO4 | R | 1 |
| 9. | Identify the other name for cloud middleware. | | CO5 | R | 1 |
| 10. | Discuss on concept mashup used in assembling and prototype. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Recall the unique features of virtual machine architecture. | | CO1 | R | 3 |
| 12. | Discuss the mechanism of elastic load balancing with real time examples. | | CO2 | U | 3 |
| 13. | Discuss the key difference between ISO 27001 & ISO 27002. | | CO3 | U | 3 |
| 14. | List out the trust principles that are used to demonstrate SOC 2 Audit Report. | | CO4 | R | 3 |
| 15. | Explain the issues faced in Cloud of Things (CoT). | | CO5 | U | 3 |
| 16. | Explain the limitations of IoT Cloud Integration. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Discuss on Microsoft Hyper V & Citrix Zen Server architecture with a neat diagram. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Differentiate between IaaS, PaaS & SaaS with required specifications. | CO2 | U | 8 |
|  | b. | Describe about the unique characteristics of cloud computing. | CO2 | R | 4 |
|  |  |  |  |  |  |
| 19. | a. | Discuss on various application based cloud security with real time examples. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. | a. | Discuss on various security management with independent tactics in cloud. | CO4 | U | 10 |
|  | b. | Explain the benefits of cloud security standards. | CO4 | U | 2 |
|  |  |  |  |  |  |
| 21. | a. | Discuss on various cloud computing technologies with needed diagrams. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. | a. | Discuss on virtualization techniques with its classification diagram. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Discuss on cloud deployment models with necessary neat diagrams. | CO2 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Discuss the issues for deployment in Microsoft Azure reference architecture with a neat diagram. | CO6 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Infer the concept of virtualization in the cloud computing. |
| CO2 | Use the concepts of cloud storage, cloud networks and its management. |
| CO3 | Identify security aspects of each cloud model. |
| CO4 | Develop a risk-management strategy for moving to the Cloud. |
| CO5 | Infer the advantages of Cloud Services. |
| CO6 | Learn about optimization of cloud storage. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 5 | 24 | - | - | - | - | 29 |
| CO2 | 6 | 23 | - | - | - | - | 29 |
| CO3 | 1 | 16 | - | - | - | - | 17 |
| CO4 | 5 | 12 | - | - | - | - | 17 |
| CO5 | 1 | 15 | - | - | - | - | 16 |
| CO6 | - | 16 | - | - | - | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **19EC2033** | **Duration** | **3hrs** |
| **Course Name** | **CRYPTOGRAPHY AND NETWORK SECURITY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define Steganography. | | CO1 | R | 1 |
| 2. | What is integrity? | | CO1 | R | 1 |
| 3. | List the prime numbers smaller than 7. | | CO2 | R | 1 |
| 4. | State the condition for two numbers x, y is additive inverse of each other. | | CO2 | R | 1 |
| 5. | List the disadvantages of double DES. | | CO3 | R | 1 |
| 6. | State the key size of DES algorithm. | | CO3 | R | 1 |
| 7. | Express the full form of CMAC. | | CO4 | U | 1 |
| 8. | Mention any one approach of digital signature approach. | | CO4 | R | 1 |
| 9. | What is HMAC? | | CO5 | R | 1 |
| 10. | Define Message Digest (MD). | | CO5 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Differentiate passive attack from active attack with example. | | CO1 | U | 3 |
| 12. | State the Euler’s Theorem. | | CO2 | R | 3 |
| 13. | List the different modes of operation in DES? | | CO3 | R | 3 |
| 14. | Predict the requirement of Digital Signature. | | CO4 | U | 3 |
| 15. | Show few block cipher techniques. | | CO5 | U | 3 |
| 16. | List the web security considerations. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain OSI Security architecture model with neat diagram. | CO1 | U | 6 |
|  | b. | Describe the various security mechanisms. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | State Chinese remainder theorem and find X for the given set of congruent equations using CRT  X = 1(mod 5)  X = 2(mod 7)  X = 3(mod 9)  X = 4(mod 11) | CO2 | R | 12 |
|  |  |  |  |  |  |
| 19. | a. | Construct encryption and decryption using RSA algorithm for the following. P=17; q=11; e=7; M=88. | CO3 | C | 12 |
|  |  |  |  |  |  |
| 20. | a. | Interpret the Secret key to be shared using Diffie Hellman Key exchange technique.  Suppose that two parties A and B wish to set up a common secret key (D-H key). They agree on q= 7 as the modulus and g=3 as the primitive root. Party A chooses a=2 and party B chooses b=5 as their respective secrets. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Discuss the types of Hash algorithms and describe the working of Secure Hash Algorithm (SHA-512). | CO4 | U | 12 |
|  |  |  |  |  |  |
| 22. | a. | Illustrate the steps involved in Exchanging public key certificates. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Express the importance of Message Authentication Code and its properties. | CO5 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain pretty good privacy with its block schematic. | CO6 | U | 6 |
|  | b. | Illustrate the IPsec with its architecture. | CO6 | U | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | List and describe the various security risks and mechanisms for handling them |
| CO2 | Understand the mathematical concepts involved in cryptography |
| CO3 | Classify symmetric and asymmetric ciphers |
| CO4 | Handle data integrity using hash functions and fulfil message authentication requirements |
| CO5 | Describe key management and user authentication techniques |
| CO6 | Apply algorithms to handle network security issues |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | 15 | - | - | - | - | 17 |
| CO2 | 17 | - | - | - | - | - | 17 |
| CO3 | 5 | - | - | - | - | 12 | 17 |
| CO4 | 1 | 16 | 12 | - | - | - | 29 |
| CO5 | 2 | 27 | - | - | - | - | 29 |
| CO6 | 3 | 12 | - | - | - | - | 15 |
|  | | | | | | | **124** |



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| **Course Code** | **19EC2038** | **Duration** | **3hrs** |
| **Course Name** | **IOT BASED DATA ACQUISITION SYSTEMS AND PROTOCOLS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Identify the layer which is responsible for data management between gate ways and transit network | | CO1 | R | 1 |
| 2. | Give two examples of everything as services (Xaas) | | CO1 | U | 1 |
| 3. | Give an example of position sensor | | CO2 | R | 1 |
| 4. | Differentiate active and passive sensors | | CO2 | U | 1 |
| 5. | Tell the number of PAN coordinator in a network | | CO3 | R | 1 |
| 6. | State the topology used in Lora WAN | | CO3 | R | 1 |
| 7. | List any two challenges for IP in IoT. | | CO4 | R | 1 |
| 8. | Tell a transportation method in IoT application layer | | CO4 | R | 1 |
| 9. | Choose the type of ground points which are suitable for connecting IoT devices in data acquisition | | CO5 | A | 1 |
| 10. | Infer the importance of smart grid | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Summarize the benefits of XaaS. | | CO1 | U | 3 |
| 12. | List the classification of actuators | | CO2 | R | 3 |
| 13. | Compare Full-Function Device(FFD) and Reduced Function Device(RFD) | | CO3 | U | 3 |
| 14. | Compare the Adoption model with the Adaptation Model | | CO4 | U | 3 |
| 15. | Express the importance of IoT data broker | | CO5 | U | 3 |
| 16. | List the features of Amazon Web Services for IoT | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Discuss the types of IoT Analytics. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Describe the communication criteria in terms of the following   1. Range 2. Frequency band 3. Topology | CO2 | R | 9 |
|  | b. | Illustrate different types of sensors and their applications. | CO2 | A | 3 |
|  |  |  |  |  |  |
| 19. | a. | Discuss the modes of operation and topology of NB-IoT | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. | a. | Discuss the schedule management mechanisms and the forwarding models defined by 6TiSCH. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Explain in detail about Supervisory Control Data Acquisition system (SCADA) | CO4 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Illustrate the functions of Message Queuing Telemetry Transport(MQTT) protocol. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | Illustrate the types of Interfaces. Explain in detail about General Purpose Interface Bus (GPIB). | CO5 | An | 6 |
|  | b | Discuss the different types of signal sources used in data acquisition system. | CO5 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a | Recommend the factors to be considered, while designing a IoT based smart grid | CO6 | E | 8 |
|  |  | Express the challenges in Industry IoT (IIoT). | CO6 | U | 4 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Acquire knowledge about the various network architectures of IoT |
| CO2 | Understand the basic concepts of sensors and actuators |
| CO3 | Gain knowledge in various network protocols |
| CO4 | Gain knowledge in data acquisition methods and instruments |
| CO5 | Articulate the various applications of IoT networked systems |
| CO6 | Apply the acquired knowledge to develop an IoT networked application |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 16 | - | - | - | - | 17 |
| CO2 | 13 | 1 | 3 | - | - | - | 17 |
| CO3 | 2 | 15 | 12 | - | - | - | 29 |
| CO4 | 2 | 15 | 12 | - | - | - | 29 |
| CO5 | - | 9 | 1 | 6 | - | - | 16 |
| CO6 | 3 | 5 |  |  | 8 |  | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **19EC2040** | **Duration** | **3hrs** |
| **Course Name** | **INTERNET OF INTELLIGENT THINGS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define IAAS. | | CO3 | R | 1 |
| 2. | Name the relationship which gets established among objects that are always  used in the same shared space. | | CO1 | R | 1 |
| 3. | Define Parental object relationship in case of SIoT. | | CO1 | R | 1 |
| 4. | Identify the HMMs for the word “need”. | | CO1 | R | 1 |
| 5. | Recall Max-Pooling in CNN. | | CO2 | R | 1 |
| 6. | Explain Intelligent Large-Scale Sensing | | CO1 | U | 1 |
| 7. | List the architecure of Fog Computing. | | CO3 | R | 1 |
| 8. | List any two disadvantages of fog computing. | | CO3 | R | 1 |
| 9. | Illustrate the HMMs for the letter "on". | | CO3 | A | 1 |
| 10. | Recall the two main types of Boards for an Iot hardware set-up. | | CO4 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Recall the Properties of an SBC | | CO4 | R | 3 |
| 12. | Enumerate the types of Machine Learning. | | CO1 | R | 3 |
| 13. | Briefly explain the given image : | | CO1 | U | 3 |
| 14. | Define BAN with an example. | | CO4 | R | 3 |
| 15. | Differentiate between Fog computing and Edge computing. | | CO3 | An | 3 |
| 16. | Illustrate the device management layer in the smart gateway. | | CO4 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Differentiate between Supervised Learning, Semi-supervised Learning  and Unsupervised Learning with suitable illustrations. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | b. | Explain ASR with the help of a block diagram and elaborate on the  specified units in ASR. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 19. | a. | Illustrate the feature Map for the number 8 using CNN. | CO2 | U | 8 |
|  | b | List the Trust Models of Trustworthiness | CO1 | R | 4 |
|  |  |  |  |  |  |
| 20. | a. | Create a solution of your own using Raspberry pi that solves a day-to-day problem. Explain the following in terms of your solution:  • Problem statement (20 words)  • Solution (50 words)  • Equipment Required  • Block diagram,  • The type of cloud used and  • The Overall usage of the solution | CO4 | C | 12 |
|  |  |  |  |  |  |
| 21. | a. | Explain the concept of Smart Health care with a help of a Block Diagram. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. | a. | Explain the types of Raspberry Pi Boards and elaborate on its properties. | CO4 | U | 6 |
|  | b. | Explain ISR with its methodology and a neat diagram of a real time implementation of the model. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Explain the Architecture of Fog. | CO3 | A | 6 |
|  | b. | Differentiate between Invasive and Non-Invasive types of approaches in a BCI model. | CO6 | An | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain Smart Stick for Blind People with a block diagram. | CO6 | A | 6 |
|  | b. | Explain Smart Home Assistive System with a Block diagram. | CO6 | A | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the concepts of intelligent things. |
| CO2 | Articulate the structure of Neural Networks in IoT. |
| CO3 | Understand the need of FOG computing services. |
| CO4 | Design and build IoT systems using Raspberry Pi. |
| CO5 | Apply the concepts and demonstrate various prototypes. |
| CO6 | Examine various real time applications and case studies. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 10 | 28 | - | - | - | - | 38 |
| CO2 | 1 | 8 | - | - | - | - | 9 |
| CO3 | 3 | - | 7 | 3 | - | - | 13 |
| CO4 | 7 | 9 | 6 | - | - | 12 | 34 |
| CO5 | - | - | - | 12 | - | - | 12 |
| CO6 | - | - | 12 | 6 | - | - | 18 |
|  | | | | | | | **124** |



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| **Course Code** | **19EC2054** | **Duration** | **3hrs** |
| **Course Name** | **FUNDAMENTALS OF MEMS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Classify the mobility of GaAs with silicon. | | CO1 | U | 1 |
| 2. | Name a DLP-based microoptoelectromechanical system. | | CO1 | R | 1 |
| 3. | Describe the volumetric strain of a body. | | CO2 | U | 1 |
| 4. | Define poisons ratio. | | CO2 | R | 1 |
| 5. | Identify a technique for doping silicon substrates. | | CO3 | R | 1 |
| 6. | Identify the carrier gas used in a sputtering technique of manufacturing. | | CO3 | U | 1 |
| 7. | Name a substrate that could be etched in bulk manufacturing. | | CO4 | R | 1 |
| 8. | State an advantage of anisotropic etching. | | CO4 | R | 1 |
| 9. | Describe an application of NEMS devices. | | CO5 | R | 1 |
| 10. | Identify a piezoelectric material. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | List out and explain any three microactuators. | | CO1 | R | 3 |
| 12. | Identify a few geometries used in MEMS components with examples. | | CO2 | U | 3 |
| 13. | Recall two applications of SiO2 layers. | | CO3 | R | 3 |
| 14. | Explain three types of dry etching techniques. | | CO4 | U | 3 |
| 15. | State a few advantages of RF MEMS switches. | | CO5 | R | 3 |
| 16. | Enumerate a few applications of shape memory alloys. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Discuss the working of the micro gyroscope in detail with illustration. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Summarize the ion implantation process in manufacturing. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. | a. | Explain the photolithography process in detail with illustration. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. | a. | Discuss in detail the plasma etching process with a diagram. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | List out and explain two types of MEMS switches in detail with illustration. | CO5 | R | 12 |
|  |  |  |  |  |  |
| 22. | a. | Illustrate and explain the microsystem in detail with relevant examples. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Justify the statement, “Silicon an ideal substrate material for MEMS”. Explain the process of ion implantation. | CO2 | E | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Describe in detail the features, benefits, and drawbacks of SMA. | CO6 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Acquire knowledge on the basic concepts of MEMS Design. |
| CO2 | Understand the mechanics behind MEMS devices. |
| CO3 | Demonstrate on the rudiments of Micro fabrication techniques. |
| CO4 | Develop MEMS structures based on various Micromachining techniques. |
| CO5 | Design and model Smart devices. |
| CO6 | Apply smart materials to intelligent systems. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 4 | 25 | - | - | - | - | 29 |
| CO2 | 1 | 16 | - | - | 12 | - | 29 |
| CO3 | 4 | 13 | - | - | - | - | 17 |
| CO4 | 2 | 14 | - | - | - | - | 17 |
| CO5 | 16 | - | - | - | - | - | 16 |
| CO6 | 3 | 13 | - | - | - | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **19EC2057** | **Duration** | **3hrs** |
| **Course Name** | **ARTIFICIAL NEURAL NETWORKS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | **CO / BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | |
| 1. | List the advantage of artificial neuron over biological neuron. | CO 1/ R | 1 |
| 2. | List the limitations of artificial neural networks. | CO 1/ R | 1 |
| 3. | Infer the significance of sigmoidal activation function in training. | CO 2/ U | 1 |
| 4. | Outline the principle of reinforced learning. | CO 2/ U | 1 |
| 5. | Relate the development of perceptron for classification. | CO 3/ U | 1 |
| 6. | Recall the development of ANN model for multicategory classification. | CO 3/ R | 1 |
| 7. | Relate the formulation of delta rule. | CO 4/ R | 1 |
| 8. | Interpret the formation of backpropagation training. | CO 4/ U | 1 |
| 9. | Explain the types of associative memory. | CO 5/ U | 1 |
| 10. | Spell the significance of Bidirectional associative memory. | CO 6/ R | 1 |

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| **PART – B (6 X 3 = 18 MARKS)** | | | |
| 11. | Outline the pros and cons of Computers. | CO 1/ U | 3 |
| 12. | Identify the principle of various training methodologies of ANN. | CO 2/ A | 3 |
| 13. | Infer the development of discrete and continuous perceptron network. | CO 3/ U | 3 |
| 14. | Formulate the change of weight in the testing phase of Backpropagation neural network. | CO 4/ U | 3 |
| 15. | Interpret the convergence of weight value in multilayer network. | CO 5/ E | 3 |
| 16. | Explain the application of discrete Hopfield network. | CO 6/ U | 3 |

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| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.no 17 to 23. Q.No 24 is Compulsory)** | | | | |
| 17. | a. | Assess the pros and cons of artificial neuron with respect to biological neuron. | CO 1/ E | 12 |
|  |  |  |  |  |
| 18. | a. | Examine the principles of supervised, unsupervised and reinforcement learning strategies. | CO 2/An | 12 |
|  |  |  |  |  |
| 19. | a. | Explain the architecture and training perceptron network and give you recommendation for novelty for pattern classification. | CO 3/ E | 12 |
|  |  |  |  |  |
| 20. | a. | Illustrate with necessary diagram the formulation of change of weight values for outer and hidden layers of Backpropagation network. | CO 4/ U | 12 |
|  |  |  |  |  |
| 21. | a. | Analyze the architecture and training of Bidirectional associative memory. | CO 5/ A | 12 |
|  |  |  |  |  |
| 22. | a. | Compare the models of associative memory and examine the use of BAM energy function. | CO 5/An | 12 |
|  |  |  |  |  |
| 23. | a. | Illustrate the pros and cons of various activation functions with necessary diagram. | CO1 / U | 12 |
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|  |  | **Compulsory:** | | |
| 24. | a. | Construct the artificial neural network model for process identification and fault diagnosis. | CO 6/ A | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Summarize the pros and cons of different artificial neural networks |
| CO2 | Discuss the principles of training methodologies of neural networks |
| CO3 | Develop novel artificial neural networks |
| CO4 | Formulate neural networks based expert systems |
| CO5 | Analyze the single layer and multi-layer neural networks |
| CO6 | Apply artificial neural networks for solving engineering problems |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 2 | 15 | - | - | - | - | 17 |
| CO2 | - | 2 | 3 | 12 | - | - | 17 |
| CO3 | 1 | 4 | - | - | 12 | - | 17 |
| CO4 | 1 | 16 | - | - | - | - | 17 |
| CO5 | - | 1 | - | 12 | 3 | - | 16 |
| CO6 | 1 | 3 | 12 | - | - | - | 16 |
|  | | | | | | | **100** |



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| **Course Code** | **19EC2059** | **Duration** | **3hrs** |
| **Course Name** | **FUNDAMENTALS OF SATELLITE COMMUNICATION** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Name the first non-government active communication satellite launched. | | CO1 | R | 1 |
| 2. | Which law describes that the orbital velocity varies around the orbit? | | CO1 | R | 1 |
| 3. | Why is aluminum used in satellites? | | CO2 | R | 1 |
| 4. | What are the three axes that defines the attitude of satellite? | | CO2 | R | 1 |
| 5. | Name the type of antennas that produce directional beams. | | CO3 | R | 1 |
| 6. | Identify the section that performs modulation/demodulation function in the Earth station. | | CO3 | U | 1 |
| 7. | Define modulation. | | CO4 | R | 1 |
| 8. | Identify the largely used analog modulation type in satellite communications. | | CO4 | U | 1 |
| 9. | Identify the antenna beam used in satellite switched TDMA instead of a single antenna beam. | | CO5 | U | 1 |
| 10. | State an application of satellite. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Examine the reason- satellite appears fixed from earth. | | CO1 | A | 3 |
| 12. | Illustrate single conversion transponder. | | CO2 | A | 3 |
| 13. | Define antenna aperture. | | CO3 | R | 3 |
| 14. | Classify the various types of digital modulation. | | CO4 | U | 3 |
| 15. | Illustrate the general model of spread spectrum digital communication system. | | CO5 | U | 3 |
| 16. | Determine EIRP in dBW for the following: A satellite downlink at 12 GHZ operates with a transmit power of 6W and an antenna gain of 48.2 dB. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain expendable launch vehicle profile. Give examples. | CO1 | U | 6 |
|  | b. | List the frequency bands for satellite communications and their applications. | CO1 | R | 6 |
|  |  |  |  |  |  |
| 18. | a. | Distinguish geosynchronous satellite and geostationary satellite. | CO1 | E | 6 |
|  | b. | Illustrate frequency spectrum. Classify RF and microwave frequencies. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Discuss on earth station performance parameters. | CO2 | U | 6 |
|  | b. | Illustrate multiple amplifier HPA configuration and low noise amplifier (LNA). | CO2 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Differentiate the different types of multiplexing. | CO2 | An | 6 |
|  | b. | Describe frequency division multiple access (FDMA) with suitable figures. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | Sketch the slow frequency-hop spread spectrum of 16 carrier frequencies for the following data and list the gains of spread spectrum:  PN Sequence : 00 11 01 10 00  Input Binary Data: 0111 0011 1101 1000 0011 | CO3 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Illustrate with suitable figures.  i) Inter symbol interference  ii) Adjacent channel interference | CO4 | U | 6 |
|  | b. | Locate the various layers of Ionosphere through a neat diagram. | CO4 | R | 6 |
|  |  |  |  |  |  |
| 23. | a. | Compare the layers and their characteristics of ionosphere. | CO5 | E | 6 |
|  | b. | Discuss on satellite frequency reuse. | CO5 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Describe the technologies and configurations of VSAT. | CO6 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the satellite orbits, elements of satellite and operation of satellite communication. |
| CO2 | Interpret the concepts of space segment, propulsion, payload, and TTC. |
| CO3 | Analyze the design requirements and the performance of earth station. |
| CO4 | Develop the multiplexing techniques, modulation techniques, and multiple access techniques for satellite communication. |
| CO5 | Illustrate the concepts of link design, rain fading and link availability and perform interference calculations. |
| CO6 | Design various satellite applications. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 8 | 12 | 3 | - | 6 | - | 29 |
| CO2 | 2 | 12 | 9 | 6 | - | - | 29 |
| CO3 | 4 | 1 | 12 | - | - | - | 17 |
| CO4 | 7 | 10 | - | - | - | - | 17 |
| CO5 | - | 10 | - | - | 6 | - | 16 |
| CO6 | 1 | 12 | 3 | - | - | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **20EC1001** | **Duration** | **3hrs** |
| **Course Name** | **PYTHON PROGRAMMING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Write for loop statement to print the following series: 10,20,30 ... ... 300 | | CO1 | U | 1 |
| 2. | What will be the output of below Python code?  str1="Information"  print(str1[2:8]) | | CO1 | R | 1 |
| 3. | Write a code to print a string in lowercase. | | CO2 | U | 1 |
| 4. | Identify the output of the print statement in the code below.  s = "python is awesome"  print(s[2] + s[-5]) | | CO2 | A | 1 |
| 5. | Examine the following Python code return?  str1="Stack of books"  print(len(str1)) | | CO3 | A | 1 |
| 6. | Classify the various types of inheritance | | CO3 | R | 1 |
| 7. | Name the Python Library module which need to be imported to invoke the  pow() function. | | CO4 | E | 1 |
| 8. | Estimate the output of the following:  x = [1, "hi", "Python", 2]  print(x\*2) | | CO4 | E | 1 |
| 9. | Fill the last statement to print x.  class MyClass:  x = 5  p1 = MyClass()  print ( ) | | CO5 | R | 1 |
| 10. | Show an object syntax used in Python Programming | | CO6 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Create a Python user defined function to odd numbers in the given range. | | CO1 | R | 3 |
| 12. | What will be the output of the following code snippet?  a = [1, 2, 3, 4, 5]  sum = 0  for ele in a:  sum += ele  print(sum) | | CO2 | A | 3 |
| 13. | Relate the given list and write a loop statement in Python to print each item  in a new line.  fruits = [‘Car, ‘Van’, ‘Bus’, ‘Bike’] | | CO3 | A | 3 |
| 14. | Build the Python Code for the data visualization given below | | CO4 | A | 3 |
| 15. | Infer the significance of OOP in Python. | | CO5 | U | 3 |
| 16. | Recommend the correct syntax to create a class named Student that will inherit properties and methods from a class named Person. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the arithmetic operators and logical operators with suitable example. | CO1 | An | 9 |
|  | b. | Write a Python program for an online shopping store which is willing to offer discounts on bill amounts as below:  Rs.1000 and above -5%  Rs.500 to Rs.999 -3%  Below Rs.499 -2%  Which accepts the bill amount from the user and displays the  discounted bill amount as per above tariff. | CO1 | A | 3 |
|  |  |  |  |  |  |
| 18. | a. | Develop a python program to print ‘n’ natural numbers using while loop statement. | CO2 | A | 6 |
|  | b. | Construct a Python code to check whether the given string is a palindrome or not. | CO2 | R | 6 |
|  |  |  |  |  |  |
| 19. | a. | Explain the data types of Python programming with a suitable code for each data type. | CO3 | A | 8 |
|  | b. | Predict the output of the following Python expressions:  i. 5+3\*2  ii. (5+3)\*2  iii. 2\*3\*\*2 | CO3 | R | 4 |
|  |  |  |  |  |  |
| 20. | a. | Write code snippets in Python to perform the following operations.  i) Access an element of a Dictionary  ii) Modifying the elements of a Dictionary  iii) Delete elements from a Dictionary | CO4 | U | 6 |
|  | b. | Write a program to create a new string S by taking alternate words from each string S1 and S2 as given below:  S1 = “Good Morning KU”  S2 = “Have a nice day” | CO4 | E | 6 |
|  |  |  |  |  |  |
| 21. | a. | Examine various types of the data visualization Python plot with the illustration of visualization. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | What does arguments organize in Python, and how do they operate? Describe the different types of Python arguments and provide an example for each one. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 23. | a. | Explain the python code to perform the matrix addition of two matrices. | CO5 | E | 6 |
|  | b. | Explain the following using suitable Python code; Returning and Higher order functions. | CO5 | E | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Examine any two properties of OOPS in Python with the illustration of employee database. | CO6 | A | 6 |
|  | b. | Explain Multiple and Multilevel inheritance method in the OOP concept of Python. | CO6 | A | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the basics of programming using python |
| CO2 | Write and execute python programs |
| CO3 | Understand the concepts of using math library |
| CO4 | Adopt different techniques using functions in the program |
| CO5 | Formulate algorithms and write programs using modules, packages and strings |
| CO6 | Apply python for real time application using object-oriented approach |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 4 | 1 | 3 | 9 |  | 17 | 4 |
| CO2 | 6 | 1 | 10 |  |  | 17 | 6 |
| CO3 | 5 |  | 12 |  |  | 17 | 5 |
| CO4 |  | 6 | 15 |  | 8 | 29 |  |
| CO5 | 1 | 3 |  | 12 | 12 | 28 | 1 |
| CO6 | 3 |  | 13 |  |  | 16 | 3 |
|  | | | | | | | **124** |



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| **Course Code** | **20EC2002** | **Duration** | **3hrs** |
| **Course Name** | **ELECTRONIC DEVICES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Calculate the probability that that a particular energy level E is occupied by a hole. The probability that the same energy level E is occupied by an electron is 0.2. | | CO1 | An | 1 |
| 2. | Indicate the position of fermi level in an Extrinsic N-type semiconductor. | | CO1 | U | 1 |
| 3. | Define transition capacitance. | | CO2 | R | 1 |
| 4. | List the applications of PN Diode. | | CO2 | R | 1 |
| 5. | Define Base transport factor for a Bipolar Junction Transistor. | | CO3 | R | 1 |
| 6. | Indicate the majority carrier in NPN transistor. | | CO3 | U | 1 |
| 7. | Identify the transistor that exhibits negative resistance characteristics. | | CO5 | R | 1 |
| 8. | Sketch the circuit symbol of Zener diode and photodiode. | | CO5 | A | 1 |
| 9. | Indicate the number of transsitors used in the transistor equivalent circuit of DIAC. | | CO6 | U | 1 |
| 10. | Explain the concept of solar cell. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Sketch the variation of fermi level with respect to temperature and doping concentration in n-type and p-type semiconductor. | | CO1 | U | 3 |
| 12. | Illustrate the diode current components with a neat diagram. | | CO2 | A | 3 |
| 13. | Differentiate NPN from PNP transistor. | | CO3 | An | 3 |
| 14. | Explain the V-I characteristics of Uni Junction Transistor and discuss the applications. | | CO5 | U | 3 |
| 15. | Illustrate the operation of Schottky barrier diode with necessary diagrams. | | CO5 | An | 3 |
| 16. | Summarize the function of solid-state memories with its applications. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the carrier generation and recombination methods in a semiconductor. | CO1 | U | 8 |
|  | b. | Compare drift and diffusion current in a semiconductor. | CO1 | E | 4 |
|  |  |  |  |  |  |
| 18. | a. | Describe the structure of PN diode and explain the operation of the diode in forward and reverse bias. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. | a. | Analyze the Common Base configuration of BJT and plot the input and output V-I characteristics. | CO3 | An | 8 |
|  | b. | Calculate the thermal equilibrium electron concentration in an extrinsic semiconductor. [Assume ni2= 5 x 1010 cm-3 and p0 = 1010 cm-3] | CO1 | An | 4 |
|  |  |  |  |  |  |
| 20. | a. | Summarize the construction and working principle of Enhancement and Depletion MOSFET. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Examine the working of Zener diode in forward and reverse bias and plot the V-I characteristics. | CO5 | A | 8 |
|  | b. | List the applications of LASER diode. | CO5 | R | 4 |
|  |  |  |  |  |  |
| 22. | a. | Illustrate the modes of operation in MOS capacitor with necessary diagrams. | CO4 | A | 8 |
|  | b. | Sketch the energy band diagram of compensated semiconductor. | CO1 | A | 4 |
|  |  |  |  |  |  |
| 23. | a. | Examine the significance of continuity equation and derive a mathematical expression for the holes in p-type material. | CO1 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Analyze the conversion of light energy into electrical energy in a photodiode. | CO6 | An | 4 |
|  | b. | Appraise the characteristics of Silicon Controlled Rectifier with necessary diagrams | CO6 | E | 8 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Demonstrate the flow of charge carriers in semiconductor and interpret the VI relations |
| CO2 | Understand the physical and functional properties of diode. |
| CO3 | Compare the properties of different configurations of bipolar junction transistors. |
| CO4 | Apply the semiconductor concepts to construct MOS devices. |
| CO5 | Categorize the special semiconductor devices based on their applications |
| CO6 | Infer the knowledge of power devices and display devices |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 0 | 12 | 16 | 5 | 4 | 0 | 37 |
| CO2 | 2 | 12 | 3 | 0 | 0 | 0 | 17 |
| CO3 | 1 | 1 | 0 | 11 | 0 | 0 | 13 |
| CO4 | 0 | 12 | 8 | 0 | 0 | 0 | 20 |
| CO5 | 5 | 3 | 9 | 3 | 0 | 0 | 20 |
| CO6 | 0 | 5 | 0 | 4 | 8 | 0 | 17 |
|  | | | | | | | **124** |



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| **Course Code** | **20EC2003** | **Duration** | **3hrs** |
| **Course Name** | **SIGNALS AND SYSTEMS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define anti-symmetric signal. | | CO1 | R | 1 |
| 2. | Determine the fundamental period of a DT signal | | CO1 | A | 1 |
| 3. | Determine the number of samples at the output of a DT-LTI system whose input x[n]={-1,-1,2} and impulse response h[n]={2,2,2,3,4} | | CO2 | A | 1 |
| 4. | Write the equation of convolution sum. | | CO2 | A | 1 |
| 5. | List any two periodic processes. | | CO3 | R | 1 |
| 6. | State the Time shifting property of Continuous-Time Fourier Transform (CTFT). | | CO3 | R | 1 |
| 7. | Determine the Nyquist interval for the signal  x(t)=cos (1500πt)+cos(1200πt) | | CO4 | A | 1 |
| 8. | State the linearity property of Laplace Transform. | | CO4 | R | 1 |
| 9. | Calculate the DTFT of n-k]. | | CO5 | A | 1 |
| 10. | Calculate the Z transform of u[n-k]. | | CO6 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Determine the even component and odd component of  a CT signal  x(t)=cost sint+2cost+sint | | CO 1 | A | 3 |
| 12. | Test if the given system is linear or non-linear. | | CO 2 | An | 3 |
| 13. | List the conditions for convergence of Continuous-Time Fourier Transform | | CO3 | R | 3 |
| 14. | Compute the final value of the signal, | | CO4 | A | 3 |
| 15. | Calculate the DTFT of the following signal, | | CO5 | A | 3 |
| 16. | Determine z transform of the DT signal y[n]={1,-4,-5,6,7} | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Sketch the following signals,  (i  (ii)  (iii)  (iv) | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a | Test the properties of the system  a) Static or Dynamic  b) Linear or Non-linear  c) Time invariant or variant  d) Causal or Non- causal | CO2 | An | 6 |
|  | b. | Determine the response of the Discrete-Time System with the input  and impulse response  using  Graphical method. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Determine the Continuous Time Fourier Transform of | CO3 | A | 4 |
|  | b. | Determine the frequency response and impulse response of a causal LTI system that is represented by the following differential equation, | CO3 | A | 8 |
|  |  |  |  |  |  |
| 20. | a. | Explain the impulse train sampling with necessary diagrams. | CO4 | U | 8 |
|  | b. | Determine the Inverse Laplace transform for | CO4 | A | 4 |
|  |  |  |  |  |  |
| 21. | a. | Determine the frequency response and impulse response of a causal system that is represented by the following difference equation, | CO5 | A | 8 |
|  | b. | Determine the Fourier Transform of the DT signal | CO5 | A | 4 |
|  |  |  |  |  |  |
| 22. | a. | Explain the following properties of DTFT  Time Reversal  (ii) Time shifting  Parseval’s theorem  (iv) Convolution Property | CO5 | U | 8 |
|  | b. | Sketch the frequency response of a CT signal | CO3 | A | 4 |
|  |  |  |  |  |  |
| 23. | a. | State Sampling Theorem and discuss the effect of under sampling with relevant diagrams. | CO4 | R | 6 |
|  | b. | Determine the Laplace Transform and the ROC of the CT signal, | CO4 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Apply long division method and determine the inverse Z transform of   1. x(n) is causal 2. x(n) is non-causal | CO6 | A | 8 |
|  | b. | Compute the Z transform and ROC of the DT signal | CO6 | A | 4 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Analyze different types of signals for mathematical modelling |
| CO2 | Realize the system properties to build basic model |
| CO3 | Represent continuous time system using Fourier series and Fourier transform |
| CO4 | Investigate the sampling process and Laplace Transform |
| CO5 | Signify discrete time system using Fourier series and Fourier transform |
| CO6 | Familiarize the frequency analysis of discrete time system using Z transform |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | - | 16 | - | - | - | 17 |
| CO2 | - | - | 8 | 9 | - | - | 17 |
| CO3 | 5 | - | 16 | - | - | - | 21 |
| CO4 | 7 | 8 | 14 | - | - | - | 29 |
| CO5 | - | 8 | 16 | - | - | - | 24 |
| CO6 | - | - | 16 | - | - | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **20EC2004** | **Duration** | **3hrs** |
| **Course Name** | **COMPUTER ARCHITECTURE** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Identify the size of the memory that can be addressed by 12 bit address bus. | | CO1 | U | 1 |
| 2. | Determine the output Y when control input C=1, | | CO1 | A | 1 |
| 3. | Identify the type of addressing mode for the following 8086 instruction  MOV CX, AX | | CO2 | U | 1 |
| 4. | State, how many data lines are present in 8086 microprocessor? | | CO2 | R | 1 |
| 5. | Name the instruction which is used to call the subroutine. | | CO3 | R | 1 |
| 6. | Define main memory. | | CO4 | R | 1 |
| 7. | Indicate the advantage of pipeling | | CO6 | U | 1 |
| 8. | Analyze the following instruction format and determine the type of instruction.  0101 0111 0111 0111 | | CO4 | An | 1 |
| 9. | Name the counters in 8254 timer. | | CO5 | R | 1 |
| 10. | Analyze the following signal values in 8255 and tell which port will be selected for I/O or BSR mode of operation.  CS’=0, A1=1 and A0 =0 | | CO5 | An | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Sketch the basic block diagram of a digital computer. | | CO1 | A | 3 |
| 12. | State how the insert operation is done using logical micro operations. | | CO3 | R | 3 |
| 13. | List the different flags available in status register of 8086. | | CO2 | R | 3 |
| 14. | Explain how The control word register and counters are selected according to the signal values on lines A0 & A1 in 8254. | | CO5 | A | 3 |
| 15. | Develop and sketch the timing sequence for the following statement  for a sequence counter.  D3T4: SC🡨0 | | CO3 | A | 3 |
| 16. | Explain the following-   1. SIMD 2. MIMD 3. SISD | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain how the information is transferred between registers in a four registers configuration using common bus system. Draw the block diagram and also write the function table for the same. | CO1 | A | 10 |
|  | b. | State the function of the following registers:   1. Input Register 2. Instruction Register | CO1 | R | 2 |
|  |  |  |  |  |  |
| 18. | a. | Sketch the block diagram of maximum mode operation in 8086. | CO2 | A | 4 |
|  | b. | Explain different types of addressing modes in 8086. | CO2 | A | 8 |
|  |  |  |  |  |  |
| 19. | a. | Illustrate the fetch and decode phases in instruction cycle with neat  Diagram. | CO3 | U | 10 |
|  | b. | Write the instruction format of memory reference instruction. | CO4 | A | 2 |
|  |  |  |  |  |  |
| 20. |  | Explain pipeline processing. | CO6 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Explain determining the type of instruction in instruction cycle with suitable flowchart | CO4 | A | 10 |
|  | b. | Compare hardwired control and micro programmed control. | CO3 | U | 2 |
|  |  |  |  |  |  |
| 22. | a. | Sketch the diagram of 4-bit parallel adder circuit. | CO3 | A | 4 |
|  | b. | Explain subroutine with suitable example program. | CO3 | A | 8 |
|  |  |  |  |  |  |
| 23. |  | Sketch the architecture of 8086 and explain following units:   1. Bus Interfacing Unit 2. Execution Unit | CO2 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain serial communication interface 8251 with block diagram. | CO5 | A | 10 |
|  | b. | Write the control word format of BSR mode in 8255. | CO5 | A | 2 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Illustrate the basics of computer organization. |
| CO2 | Outline the architecture of 8086 microprocessor |
| CO3 | Implement micro operations and micro programming concepts. |
| CO4 | Formulate Memory hierarchy |
| CO5 | Demonstrate the concepts of I/O devices |
| CO6 | Outline the importance of pipelining |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | 1 | 14 | - | - | - | 17 |
| CO2 | 4 | 1 | 24 | - | - | - | 29 |
| CO3 | 4 | 12 | 15 | - | - | - | 31 |
| CO4 | 1 | - | 12 | 1 | - | - | 14 |
| CO5 | 1 | - | 15 | 1 | - | - | 17 |
| CO6 | - | 13 | 3 | - | - | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **20EC2005** | **Duration** | **3hrs** |
| **Course Name** | **IOT FOR COMMUNICATION ENGINEERING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Identify the given communication pattern. | | CO1 | R | 1 |
| 2. | Define MQTT. | | CO1 | R | 1 |
| 3. | Define “Range” in terms of selecting a transducer. | | CO2 | R | 1 |
| 4. | Define 6LOWPAN. | | CO2 | R | 1 |
| 5. | Define TCP/IP. | | CO2 | R | 1 |
| 6. | State the role of SDN in WSN. | | CO3 | R | 1 |
| 7. | Explain the function of a Base Station Node in WSN. | | CO3 | U | 1 |
| 8. | State the attacks that takes place in the transport layer. | | CO4 | R | 1 |
| 9. | List down your Understanding on Cryptography. | | CO4 | R | 1 |
| 10. | List any two applications of Fog Computing. | | CO5 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | List the three-tiered architecture of WoT. | | CO1 | R | 3 |
| 12. | Explain why Energy Harvesting is important. | | CO1 | U | 3 |
| 13. | List any two characteristics of WSN. | | CO3 | R | 3 |
| 14. | Explain Encapsulation. | | CO2 | U | 3 |
| 15. | Explain DDOS. | | CO4 | U | 3 |
| 16. | Differentiate between Fog computing and Edge computing. | | CO5 | An | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Illustrate the IoT stack and give a brief description of each component  in the IoT stack. | CO1 | U | 6 |
|  | b. | Explain the various communication patterns that are available. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Explain the Classifications of sensors. | CO2 | U | 6 |
|  | b. | Explain the various Protocol Functions that are available. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Explain the architecture of a WSN node and interpret the WSN challenges & constraints in detail. | CO3 | U | 6 |
|  | b | Explain Interoperability in IoT systems. Elaborate on the Interoperability types and Issues. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Explain the various types of attacks that can occur in all the phases of  an IoT system. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Explain the various types of Cloud service models. | CO5 | U | 6 |
|  | b. | Explain the various types of Deployment Models of a Cloud and give suitable examples for each. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Explain the types of Raspberry Pi Boards and elaborate on its properties. | CO4 | U | 6 |
|  | b. | Explain ISR with its methodology and a neat diagram of a real time implementation of the model. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Explain Fog Architecture and illustrate the layers with the help of a block diagram. | CO5 | A | 6 |
|  | b. | Explain the attacks that can occur in the components of an IoT system. | CO4 | An | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain Home Automation and illustrate the method with the help of a block diagram. | CO6 | A | 6 |
|  | b. | Explain Smart Parking and illustrate the method with the help of a block diagram. | CO6 | A | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the fundamental concepts of IoT, architecture and communication pattern. |
| CO2 | Analyse the various sensors/actuators and the various IoT protocols. |
| CO3 | Analyse WSN architecture, node behaviour and interoperability issues. |
| CO4 | Analyse the various network security issues and its prevention. |
| CO5 | Apply their understanding and to apply the IoT principles in real time applications. |
| CO6 | Examine various real time applications and case studies. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 5 | 15 | - | - | - | - | 20 |
| CO2 | 3 | 15 | - | - | - | - | 18 |
| CO3 | 4 | 7 | 6 | - | - | - | 17 |
| CO4 | 2 | 9 | 18 | 6 | - | - | 35 |
| CO5 | 1 | 12 | 6 | 3 | - | - | 22 |
| CO6 | - | - | 12 | - | - | - | 12 |
|  | | | | | | | **124** |



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| **Course Code** | **20EC2008** | **Duration** | **3hrs** |
| **Course Name** | **5G COMMUNICATIONS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define the term “Connection Density” in 5G. | | CO1 | R | 1 |
| 2. | Identify the switching technique that handles the voice calls in 2G. | | CO1 | U | 1 |
| 3. | From the broad list of 5G use cases, identify the use case with energy efficiency requirement of 10 years battery life. | | CO2 | U | 1 |
| 4. | Identify the IEEE 802 standard in the 60 GHz (mm-Wave) band. | | CO2 | U | 1 |
| 5. | Compare the bandwidth of OFDM with FDM. | | CO3 | An | 1 |
| 6. | State the advantage of analog beamforming architecture. | | CO3 | R | 1 |
| 7. | State the applications of OFDM. | | CO4 | R | 1 |
| 8. | Indicate the number of slots in one 5G NR sub-frame for 60KHz subcarrier frequency. | | CO4 | U | 1 |
| 9. | Indicate the percentage of UEs that benefit from JT CoMP. | | CO5 | U | 1 |
| 10. | Categorize MTC in 5G wireless systems. | | CO6 | An | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | List the spectrum bands used in 5G. | | CO1 | R | 3 |
| 12. | Compare Antenna – on – Chip (AoC) with Antenna – in – package (AiP). | | CO2 | An | 3 |
| 13. | Name the various 5G multiple access schemes. | | CO3 | R | 3 |
| 14. | Compare OQAM signaling with QAM. | | CO4 | U | 3 |
| 15. | State the key applications of relays and network coding. | | CO5 | R | 3 |
| 16. | List the 5G use cases of Low-Rate MTC. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Examine the crucial role of RAN virtualization in 5G. | CO1 | A | 6 |
|  | b. | Compare the requirements of any six 5G use cases. | CO1 | An | 6 |
|  |  |  |  |  |  |
| 18. | a. | With suitable figure describe 5G system architecture. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 19. | a. | Compare analog beamforming architecture with digital beamforming architecture. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 20. | a. | Describe the concept of Phantom cell. | CO2 | U | 6 |
|  | b. | Explain the concept of terminal-specific serving cluster to avoid shadowing. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | Explain the Discrete representation of an OFDM system with a suitable block diagram. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 22. | a. | Distinguish NOMA from other 5G multiple access schemes. | CO3 | E | 6 |
|  | b. | Illustrate successive interference cancellation in NOMA. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 23. | a. | Illustrate Coordinated multipoint in 5G. | CO5 | U | 6 |
|  | b. | Describe the role of cooperation clusters in interference floor shaping. | CO5 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Distinguish the various relay based techniques in 5G use cases and services. | CO6 | E | 6 |
|  | b. | Evaluate the two categories of MTC. | CO6 | E | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Describe the key part of the evolution to 5G, requirements of 5G, building blocks of 5G and  5G spectrum. |
| CO2 | Explain the Millimeter Wave Communications and massive MIMO. |
| CO3 | Discuss the 5G Radio Access Technologies and Modulation Techniques. |
| CO4 | Outline the significance New Radio Air Interface and wireless propagation channel models. |
| CO5 | Analyze the multi-point transmission and network coding in 5G. |
| CO6 | Acquire basic knowledge on 5G applications like Machine-type communications. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 4 | 13 | 6 | 6 | - | - | 29 |
| CO2 | - | 14 | - | 15 | - | - | 29 |
| CO3 | 4 | 18 | - | 1 | 6 | - | 29 |
| CO4 | 1 | 4 | - | - | - | - | 5 |
| CO5 | 3 | 13 | - | - | - | - | 16 |
| CO6 | 3 | - | - | 1 | 12 | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **20EC2009** | **Duration** | **3hrs** |
| **Course Name** | **ARTIFICIAL NEURAL NETWORKS AND DEEP LEARNING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Draw a typical biological neuron. | | CO1 | R | 1 |
| 2. | Relate the equivalence of synapse in artificial neural network. | | CO1 | U | 1 |
| 3. | Why is learning essential in an artificial neural network? | | CO2 | An | 1 |
| 4. | Identify the number of weights which needs to be learned for an artificial neural network with 7 input layer neurons and 3 output layer neurons. | | CO2 | U | 1 |
| 5. | Infer what happens when the learning rate of perceptron is too large. | | CO3 | U | 1 |
| 6. | Record the weight update equation of a back propagation algorithm. | | CO3 | R | 1 |
| 7. | Define loss function in training a feed forward neural network. | | CO3 | R | 1 |
| 8. | Indicate the significance of momentum based gradient descent over the conventional gradient descent. | | CO4 | U | 1 |
| 9. | Trace the significance of maxpooling in deep learning | | CO5 | R | 1 |
| 10. | Name the components of an autoencoder. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Paraphrase the characteristics of a McCulloh-Pitts model | | CO2 | U | 3 |
| 12. | List the major differences between sigmoidal activation function and tangential hyperbolic activation function. | | CO2 | R | 3 |
| 13. | Appraise the limitations of perceptron. | | CO2 | An | 3 |
| 14. | Illustrate the network paralysis problem in a back propagation network. | | CO4 | An | 3 |
| 15. | List the hyperparameters of a deep feed forward neural network. | | CO5 | R | 3 |
| 16. | Quote few applications of autoencoders. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Compare the salient features of an artificial neural network and a biological neural network. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Explain the supervised and unsupervised learning with suitable example. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. | a. | Compute the converged weights of a perceptron to behave as a two input AND gate. Assume suitable initial weights, target, activation function, threshold and target value. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Discuss the back propagation algorithm for a feed forward neural network consisting of one input layer, one hidden layer and an output layer. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Summarize on gradient descent learning method used in deep feed forward neural network. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. | a. | Describe how action potential is initiated and propagated in a biological neuron for coordinating reflex actions. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Explain the Hopfield neural network with neat architecture and training algorithm. | CO2 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Construct a Convolutional Neural Network (CNN) to solve a 10-class classification problem and explain its operation. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Compare and comprehend the functioning of human brain and ANN. |
| CO2 | Gain an understanding about training methodologies of neural networks. |
| CO3 | Summarize the pros and cons of different single layer ANN. |
| CO4 | Apply artificial neural networks for solving engineering problems. |
| CO5 | Outline the basic concepts and applications of deep learning. |
| CO6 | Make use of different Deep networks for real time applications. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 25 |  |  |  |  | 26 |
| CO2 | 3 | 26 |  | 16 |  |  | 45 |
| CO3 | 1 | 1 | 12 |  |  |  | 14 |
| CO4 |  | 13 |  | 3 |  |  | 16 |
| CO5 | 4 | 12 |  |  |  |  | 16 |
| CO6 | 4 |  | 12 |  |  |  | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **20EC2015** | **Duration** | **3hrs** |
| **Course Name** | **ELECTRICAL AND ELECTRONICS IN CIVIL ENGINEERING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Two air conditioners have star ratings of 3 stars and 5 stars. Show the significance of 5-star AC when compared to 3-star. | | CO1 | U | 1 |
| 2. | Indicate the battery that is used in UPS. | | CO1 | U | 1 |
| 3. | List the applications of nano-motors. | | CO2 | R | 1 |
| 4. | Represent the motor used in electric trains. | | CO2 | U | 1 |
| 5. | Sketch the symbol of fixed and variable capacitors. | | CO3 | A | 1 |
| 6. | Give examples of trivalent impurity. | | CO3 | U | 1 |
| 7. | Identify the logic circuit that can remember a previous output. | | CO4 | U | 1 |
| 8. | Indicate the function of ALU. | | CO4 | U | 1 |
| 9. | Name the sensor used in altitude and pressure measurement in aircraft. | | CO5 | R | 1 |
| 10. | Represent the generation in which the SIM card was first introduced in mobile technology. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | If there is a 6A current through the filament of a lamp, compute the coulombs of charge move through the filament 1.75 s. | | CO1 | A | 3 |
| 12. | Discuss the applications of the generator. | | CO2 | U | 3 |
| 13. | Determine the color bands on the following value of resistors all of which have a 5% tolerance.   1. 22 kΩ 2. 150 kΩ | | CO3 | A | 3 |
| 14. | Compare sequential and combinational circuits. | | CO4 | U | 3 |
| 15. | List the applications of biosensors. | | CO5 | R | 3 |
| 16. | Compare and contrast 4G and 5G mobile technologies. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. |  | Explain the workings of a thermal power plant with a neat diagram. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. |  | Sketch neatly and explain the construction and working of DC motor. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. |  | Explain the construction and operation of the PN junction diode using the suitable circuit diagram and VI characteristics. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. |  | Articulate the Boolean expressions of a Half Adder and a Full Adder with proper truth tables and logical circuit diagrams. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. |  | Elaborate on the imaging techniques involved in Ultrasound scanners using block diagram and working principle. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. |  | Differentiate active and passive components. Explain four different passive components in detail. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 23. |  | Describe the working of the voltage stabilizer and electric heater in detail. | CO1 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Explain briefly the various blocks of satellite communication with relevant diagram. | CO6 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Recognize the importance and judicious use of energy systems in everyday life. |
| CO2 | Identify the types of electrical machines used for various applications. |
| CO3 | Understand and apply the concept of electronics to design simple circuits. |
| CO4 | Understand and relate various digital circuits. |
| CO5 | Understand the various sensing and instrumentation applications. |
| CO6 | Identify the various generations of wireless communication. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 26 | 3 | - | - | - | 29 |
| CO2 | 1 | 4 | 12 | - | - | - | 17 |
| CO3 | - | 25 | 4 | - | - | - | 29 |
| CO4 | - | 17 | - | - | - | - | 17 |
| CO5 | 4 | 12 | - | - | - | - | 16 |
| CO6 | - | 16 | - | - | - | - | 16 |
|  | | | | | | | **124** |



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| **Code :** | **20EC2018** | **Duration :** | **3hrs** |
| **Sub. Name :** | **FUNDAMENTALS OF PRINTED CIRCUIT AND ARDUINO BOARD DESIGN** | **Max. Marks :** | **100** |

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| **Q. No.** | **Questions** | **CO/BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | |
| 1. | Identify the fuel used in thermal power plants for heat generation. | CO1 / A | 1 |
| 2. | Name the unit in which an energy meter measures energy usage. | CO1 / R | 1 |
| 3. | What is the unit of resistance? | CO2 / R | 1 |
| 4. | Mention the process of adding impurities to a semiconductor. | CO2 / R | 1 |
| 5. | What is the difference between microprocessors and microcontrollers? | CO3 / R | 1 |
| 6. | Which of the logic gate has the exact inverse output of the OR gate for all possible input combinations? | CO3 / R | 1 |
| 7. | Which PCBs are made up of paper and phenol compounds in single layer? | CO4 / R | 1 |
| 8. | Give an example for EDA tool used for PCB design. | CO4 / R | 1 |
| 9. | What are the voltages used on an Arduino UNO board? | CO5 / R | 1 |
| 10. | How the ultrasonic sensor does measures objects? | CO5 / R | 1 |

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| **PART – B (6 X 3 = 18 MARKS)** | | | |
| 11. | What is a solenoid? How does it work? | CO1 / R | 3 |
| 12. | Discuss the advantages and disadvantages of electronics. | CO2 / C | 3 |
| 13. | Name the three basic logic gates. | CO3 / R | 3 |
| 14. | Explain PCB. Summarize its uses. | CO4 / U | 3 |
| 15. | Define Internet of Things. How does it work? | CO5 / R | 3 |
| 16. | Identify the components required for a obstacle avoidance robot. | CO6 / A | 3 |

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| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.no 17 to 23. Q.No 24 is Compulsory)** | | | | |
| 17. | a. | Examine a) Single Pole Single Throw, b) Single Pole Double Throw, c) Double Pole Single Throw, and d) Double Pole Double Throw switches. | CO1 / An | 4 |
| b. | Compare and contrast generators and motors. | CO1 / An | 4 |
| c. | Discuss the main reasons for technical losses in electrical power transfer. | CO1 / C | 4 |
|  |  |  |  |  |
| 18. | a. | Outline the types of resistors. | CO2 / U | 6 |
| b. | Explain the working of a transistor. | CO2 / U | 6 |
|  |  |  |  |  |
| 19. | a. | Analyze the working of AND, OR, and NOT gates using truth tables. | CO3 / An | 6 |
| b. | Discuss the operation of any three sensors. | CO3 / C | 6 |
|  |  |  |  |  |
| 20. | a. | Examine the three types of PCBs. | CO4 / An | 6 |
| b. | Explain the steps involved in PCB fabrication. | CO4 / U | 6 |
|  |  |  |  |  |
| 21. | a. | List any twelve modern day applications of Internet of Things. | CO5 / An | 12 |
|  |  |  |  |  |
| 22. | a. | Compare and contrast: a) solar, b) wind, c) tidal, d) nuclear, e) coal-fired, and f) hydroelectric power plants. | CO1 / An | 12 |
|  |  |  |  |  |
| 23. | a. | Illustrate the components of IoT a) IoT device, b) IoT Gateway, c) Network, d) Cloud | CO5 / U | 8 |
| b. | List the types of UPSs. | CO1 / An | 4 |
|  |  | **Compulsory:** | | |
| 24. | a. | Write the uses of a robotic arm. What are the components required for its construction? | CO6 / R | 4 |
| b. | Explain the working of an Obstacle Avoiding Robot. | CO6 / U | 4 |
| c. | Plan the construction and working of a line following robot. | CO6 / C | 4 |

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|  | **COURSE OUTCOMES** |
| CO1 | Recognize the importance of electro mechanical systems in everyday life. |
| CO2 | Understand the properties of semiconductor devices. |
| CO3 | Understand and relate various digital concepts and circuits. |
| CO4 | Acquire the knowledge about the packages of Electronic components, types of PCBs and history of PCBs |
| CO5 | Understand the design and programming of Arduino boards. |
| CO6 | Acquire the knowledge and skills to implement various smart systems application. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 4 |  | 1 | 24 |  | 4 | 33 |
| CO2 | 2 | 12 |  |  |  | 3 | 17 |
| CO3 | 5 |  |  | 6 |  | 6 | 17 |
| CO4 | 2 | 9 |  | 6 |  |  | 17 |
| CO5 | 5 | 8 |  | 12 |  |  | 25 |
| CO6 | 4 | 4 | 3 |  |  | 4 | 15 |
|  | | | | | | | **124** |



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| **Course Code** | **20EC3001** | **Duration** | **3hrs** |
| **Course Name** | **DIGITAL SYSTEM DESIGN USING HDL** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Explain 2-bit magnitude comparator with the circuit diagram. | CO1 | U | 8 |
|  | b. | Design Mod 4 synchronous counter using T flip flop. | CO1 | C | 8 |
|  |  |  |  |  |  |
| 2. | a. | Construct the state diagram for the system described in the state Table 1 given below. Note that x is the input and A and B are the state variables.   |  |  | | --- | --- | | Present State  x(t) A(t) B(t) | Next state  A (t+1) B (t+1) | | 0 0 1  0 0 0  0 1 1  0 1 0  1 0 1  1 0 0  1 1 0  1 1 1 | 0 0  1 1  1 0  0 1  1 1  1 0  0 1  0 0 | | CO1 | A | 6 |
|  | b. | Design a BCD to excess-3 code converter using a suitable PLA. | CO2 | C | 10 |
|  |  |  |  |  |  |
| 3. | a. | List the various VHDL operators and explain its operation in VHDL. | CO3 | R | 10 |
|  | b. | Design a 3 : 8 Decoder in Behavioral modeling using VHDL. | CO3 | C | 6 |
|  |  |  |  |  |  |
| 4. | a. | Explain briefly about sub programs in VHDL | CO5 | U | 6 |
|  | b. | Write a VHDL test bench code for full adder. | CO5 | A | 10 |
|  |  |  |  |  |  |
| 5. | a. | Summarize about the integer and real data types in Verilog HDL with suitable syntax. | CO4 | E | 6 |
|  | b. | Distinguish the different operators used in Verilog. | CO4 | An | 10 |
|  |  |  |  |  |  |
| 6. | a. | Design a code converter circuit to convert Binary to Gray Code. | CO1 | C | 8 |
|  | b. | Distinguish all types of wait statements in VHDL. | CO3 | E | 8 |
|  |  |  |  |  |  |
| 7. | a. | Write notes on programmable logic array (PLA) and Programmable array logic (PAL). | CO2 | A | 6 |
|  | b. | Describe briefly about gate delays in Verilog HDL with necessary syntax. | CO4 | R | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. | a. | Write the Verilog HDL code for the following circuits using Switch level modelling.   1. CMOS-NAND 2. CMOS-NOR | CO6 | C | 14 |
|  |  | Explain about delay specification for MOS and CMOS switches in Verilog HDL switch level modelling. | CO6 | An | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Design Digital circuits |
| CO2 | Construct ASM chart and Design Circuits using PLDs |
| CO3 | Develop Combinational and sequential circuits using VHDL statements. |
| CO4 | Build Combinational and sequential circuits using in Verilog HDL statements. |
| CO5 | Create Test bench, VHDL packages and sub programs in VHDL. |
| CO6 | Illustrate the switch level design of Digital circuits in Verilog HDL |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 8 | 6 | - | - | 16 | 30 |
| CO2 | - | - | 6 | - | - | 10 | 16 |
| CO3 | 10 | - | - | - | 8 | 6 | 24 |
| CO4 | 10 | - | - | 10 | 6 | - | 26 |
| CO5 | - | 6 | 10 | - | - | - | 16 |
| CO6 | - | - | - | 6 | - | 14 | 20 |
|  | | | | | | | **132** |



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| **Course Code** | **20EC3004** | **Duration** | **3hrs** |
| **Course Name** | **SOLAR CELLS AND THEIR APPLICATIONS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Discuss the physical mechanisms and innovative strategies to improve the photovoltaic effect of a solar cell with necessary diagrams and equations. | CO1 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Analyze the impact of semiconductor properties on the performance of solar cells. | CO1 | An | 10 |
|  | b. | Evaluate the practical significance of understanding the I-V characteristics for optimizing PV system performance and reliability. | CO2 | E | 10 |
|  |  |  |  |  |  |
| 3. | a. | Explain the fabrication processes and growth mechanisms involved in manufacturing the microcrystalline silicon materials. | CO2 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Discuss the research advancements and innovations in a-Si:H technology in comparison with other thin-film silicon-based solar cells. | CO3 | U | 20 |
|  |  |  |  |  |  |
| 5. | a. | Discuss the emerging innovations and research efforts aimed at enhancing the performance and sustainability of CdTe-based solar cells. | CO4 | U | 10 |
|  | b. | Evaluate the advanced characterization techniques and modeling approaches of CdTe solar cells. | CO4 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Analyze the governing light absorption, charge separation and recombination mechanisms of DSSCs and evaluate the significance of these processes for the device's performance. | CO5 | A | 20 |
|  |  |  |  |  |  |
| 7. | a. | Analyze the impact of energy levels on the photo generated carrier dynamics and the overall efficiency of a solar cell. | CO1 | An | 12 |
|  | b. | Discuss the advanced techniques and tools used in characterizing the I-V response of PV modules. | CO2 | U | 8 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Explain the key challenges of CdTe solar cell technology and its potential applications. | CO4 | A | 10 |
|  | b. | Summarize the applications of amorphous Silicon solar cells. | CO3 | U | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Develop an innovative and sustainable solar array design for space applications by considering the requirements and constraints of space missions. | CO6 | An | 10 |
|  | b. | Discuss the exceptional characteristics of multi-junction solar cells used in satellites. | CO6 | U | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Demonstrate the basics of solar cells |
| CO2 | Estimate and analyse the performance characteristics of solar cells |
| CO3 | Evaluate the characteristics of different silicon solar cells |
| CO4 | Assess the performance of Cadmium Telluride Thin Film Solar Cells |
| CO5 | Analyze the performance of Dye Sensitized Solar Cell and Polymer Organic Thin-Film Solar cells |
| CO6 | Demonstrate knowledge of solar cells for space applications |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 20 | - | 22 | - | - | 42 |
| CO2 | - | 8 | 20 | - | 10 | - | 38 |
| CO3 | - | 30 | - | - | - | - | 30 |
| CO4 | - | 10 | 10 | - | 10 | - | 30 |
| CO5 | - | - | 20 | - | - | - | 20 |
| CO6 | - | 10 | - | 10 | - | - | 20 |
|  | | | | | | | **180** |



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| **Course Code** | **20EC3008** | **Duration** | **3hrs** |
| **Course Name** | **ASIC Design** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Explain the N-well based CMOS design rules with neat diagrams. | CO1 | U | 10 |
|  | b. | Describe the different types of Gate-Array-Based ASICs with neat diagrams. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 2. | a. | Explain the architecture of Xilinx XC 3000 Configurable Logic Block (CLB). | CO2 | U | 10 |
|  | b. | Design Z = A' · B · C + A · B' · C' + A' · B · C' + A' · B' · C' using Programmable Logic Array with neat diagram. | CO2 | C | 6 |
|  |  |  |  |  |  |
| 3. | a. | Calculate the RC delay in antifuse connections and antifuse parasitic capacitance using Elmore’s time constant. | CO3 | A | 10 |
|  | b. | Sketch the Altera FLEX architecture. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 4. | a. | Discuss the hierarchical Xilinx LCA interconnect architecture. | CO3 | U | 6 |
|  | b. | Explain the organization of logic and interconnect, LAB and macrocell of Altera MAX with logic expanders. | CO2 | U | 10 |
|  |  |  |  |  |  |
| 5. | a. | With relevant equations, construct the connectivity matrix for the network shown below using KL algorithm. Also find the gain in the network graph if (a) nodes 1 and 6 are swapped with proper explanation using KL algorithm. | CO4 | C | 16 |
| 6. | a. | Summarize the improvement in the Iterative Placement algorithm by using various placement improvement methods. | CO5 | E | 16 |
|  |  |  |  |  |  |
| 7. | a. | Illustrate the goals, objectives and different types of Global routing methods with neat diagrams. | CO5 | An | 16 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. | a. | Illustrate the functional blocks of Digital camera with neat diagrams. | CO6 | A | 14 |
|  | b. | Explain the sub-blocks of delta–sigma modulator suitable for delta-sigma ADC. | CO6 | A | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Explain ASIC types, design tool flow and programmable technologies. |
| CO2 | Describe the issues involved in ASIC logic cells and I/O cells design. |
| CO3 | Gain Knowledge about programmable ASIC Interconnects. |
| CO4 | Analyse the issues in ASIC partitioning and floorplanning. |
| CO5 | Explain the algorithms used for ASIC placements and routing. |
| CO6 | Synthesize high performance algorithms available for ASICs. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 16 | - | - | - | - | 16 |
| CO2 | - | 20 | - | - | - | 6 | 26 |
| CO3 | - | 6 | 16 | - | - | - | 22 |
| CO4 | - | - | - | - | - | 16 | 16 |
| CO5 | - | - | - | 16 | 16 | - | 32 |
| CO6 | - | - | 20 | - | - | - | 20 |
|  | | | | | | | **132** |



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| **Course Code** | **21EC1001** | **Duration** | **3hrs** |
| **Course Name** | **ELECTRONICS FOR EVERYDAY LIFE** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Name any two components used to control electrons. | | CO1 | R | 1 |
| 2. | Give two examples of the application of electronic instrumentation. | | CO1 | U | 1 |
| 3. | List the different types of loudspeakers. | | CO2 | R | 1 |
| 4. | Describe signal to noise ratio. | | CO2 | U | 1 |
| 5. | Define aspect ratio. | | CO3 | R | 1 |
| 6. | Indicate the need for a slanted video recording/playback head in a VCR. | | CO3 | U | 1 |
| 7. | Name the access technology used in 3G mobile communication. | | CO4 | R | 1 |
| 8. | List the types of washing machines. | | CO5 | R | 1 |
| 9. | Give two examples for diagnostic equipment. | | CO6 | U | 1 |
| 10. | Identify the use of a pacemaker. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Show the hierarchy of electronics with an appropriate diagram. | | CO1 | U | 3 |
| 12. | Illustrate omnidirectional and bidirectional directivity patterns. | | CO2 | U | 3 |
| 13. | Discuss the disadvantages of magnetic tapes. | | CO3 | U | 3 |
| 14. | Describe the working of GPS. | | CO4 | U | 3 |
| 15. | Explain the working of a barcode scanner. | | CO5 | U | 3 |
| 16. | Discuss the working of a finger-tip pulse oximeter. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the working of the electronics industry with a suitable block diagram. | CO1 | U | 6 |
|  | b. | Discuss the five major sectors of the electronics industry with examples. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Illustrate the construction and operation of moving coil microphones. | CO2 | U | 6 |
|  | b. | Explain the block diagram of a complete public address system. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Discuss the various characteristics of loudspeakers. | CO2 | U | 6 |
|  | b. | Analyze the difference between AM and FM radio systems. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 20. | a. | Illustrate the working of a television receiver with a neat block diagram. | CO3 | U | 6 |
|  | b. | Report on the components and working of a CATV system. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | Explain the recording and playback processes in a VCD. | CO3 | U | 6 |
|  | b. | Describe the structure of a 3G cell phone using suitable block diagram. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Discuss the cellular concept and describe how a cell phone call works. | CO4 | U | 6 |
|  | b. | Explain the working of refrigerators. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 23. | a. | Describe the operation of a microwave oven and mention its advantages. | CO5 | U | 6 |
|  | b. | Examine the working of a barcode scanner and a flatbed scanner. | CO5 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Analyze the parts of an ECG signal and explain the inferences that can be made from ECG. | CO6 | An | 6 |
|  | b. | Report on the two methods by which blood pressure can be measured. | CO6 | U | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Define the components in an electronic system. |
| CO2 | Understand the working of audio systems. |
| CO3 | Explain the various standards and technology in video systems. |
| CO4 | Understand the telephone network and mobile phone systems. |
| CO5 | Demonstrate the working of office and domestic appliances. |
| CO6 | Comprehend the functioning of medical equipments. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 16 |  |  |  |  | 17 |
| CO2 | 1 | 22 |  | 6 |  |  | 29 |
| CO3 | 1 | 22 |  |  |  |  | 23 |
| CO4 | 1 | 15 |  |  |  |  | 16 |
| CO5 | 1 | 15 | 6 |  |  |  | 22 |
| CO6 |  | 11 |  | 6 |  |  | 17 |
|  | | | | | | | **124** |



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| **Course Code** | **21EC1003** | **Duration** | **3hrs** |
| **Course Name** | **PROBLEM SOLVING AND ALGORITHMIC THINKING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Infer your perception on problem solving and algorithmic thinking. | | CO5 | U | 1 |
| 2. | List the correct sequence in problem solving. | | CO3 | R | 1 |
| 3. | Construct a C program to display the elements in an array. | | CO3 | A | 1 |
| 4. | Identify the **cause and effect** for the following based on the 'Cause - Effect relationship'.  “IF the song has just finished playing, THEN begin playing the next song in the playlist”. | | CO5 | A | 1 |
| 5. | Analyze the bugs and correct them.  #include<string.h>  {  int a, b;  a=10.5;  print(“A is %s” a);  } | | CO6 | An | 1 |
| 6. | Identify the category **(Sequencing/Selection/Iteration)** in the below algorithm:  firstname = INPUT ("What is your firstname?")  lastname = INPUT ("What is your lastname?")  PRINT ("Hello " + firstname + " " + lastname + "!") | | CO1 | U | 1 |
| 7. | Extend your perception on ‘circularly linked list’. | | CO2 | U | 1 |
| 8. | Relate LIFO with an example. | | CO2 | U | 1 |
| 9. | Infer on dynamic binding. | | CO4 | U | 1 |
| 10. | Define space complexity. | | CO4 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Explain about cause - effect relationship with an example. | | CO1 | U | 3 |
| 12. | Compare the various types of logical reasoning techniques with examples. | | CO1 | U | 3 |
| 13. | Illustrate an algorithm to print the numbers from 1 to 50. | | CO2 | U | 3 |
| 14. | Examine the constituents of the algorithm. | | CO4 | A | 3 |
| 15. | Illustrate the significance of linear and non linear data structure. | | CO4 | U | 3 |
| 16. | Explain the recursion concept with an example flowchart. | | CO2 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Extend the concept of problem solving and explain the strategies employed by computer scientists for problem solving. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Explain about problem solving tools and construct an algorithm for building the below flowchart. Also, write a C program for the same. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Explain the concept of abstraction with an example case diagram. | CO1 | U | 6 |
|  | b. | Infer on the concepts of formulating objective trees with suitable examples. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Explain about the various types of linked lists with relevant diagrams. Also, implement a C program to demonstrate the add and delete operations in a single linked list. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Apply Kruskal’s algorithm to find the minimum spanning tree for the following graph. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Explain any merge sort algorithm with an example. | CO1 | U | 6 |
|  | b. | Explain any Search algorithm with a C program. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 23. | a. | Construct a C programme to perform a 2x2 matrix addition using the concept of arrays. | CO6 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Describe the idea of modularity and then use it to create a C programme to maintain a student database. | CO3 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Apply algorithmic thinking to understand, define and solve problems |
| CO2 | Design and implement algorithm(s) for a given problem |
| CO3 | Apply the basic programming constructs for problem solving |
| CO4 | Understand an algorithm by tracing its computational states |
| CO5 | Identifying bugs in algorithms |
| CO6 | Analyze the bugs and correct them |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  | 25 | 12 |  |  |  | 37 |
| CO2 |  | 14 |  |  |  |  | 14 |
| CO3 | 1 | 12 | 13 |  |  |  | 26 |
| CO4 |  | 5 | 15 |  |  |  | 20 |
| CO5 |  | 1 | 13 |  |  |  | 14 |
| CO6 |  |  | 12 | 1 |  |  | 13 |
|  | | | | | | | **124** |



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| **Course Code** | **21EC1004** | **Duration** | **3hrs** |
| **Course Name** | **PYTHON PROGRAMMING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Recall the use of IDE. | | CO1 | R | 1 |
| 2. | Show the output of print(“Hello”,“World”, sep = “---”) | | CO2 | R | 1 |
| 3. | Show the output of the following program:  List = [1, “hi”, “Python”,2]  Print(List[0:2]) | | CO2 | U | 1 |
| 4. | Infer 1,2,3&4 in the statement d = {1:'Jimmy',2:'Alex',3:'John',4:'Mike'} | | CO1 | U | 1 |
| 5. | State the use of pass statement. | | CO1 | R | 1 |
| 6. | Write a program to change “gOOD mORNING” to “Good Morning”. | | CO2 | A | 1 |
| 7. | Define local scope. | | CO4 | R | 1 |
| 8. | Indicate the function that allows to extend the behavior of a function without explicitly modifying it. | | CO4 | U | 1 |
| 9. | State the function used to list all that a module contains. | | CO5 | R | 1 |
| 10. | Recall the constructor function to initialize values inside a class. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Compare iteration and recursion strategies in terms of stopping condition, speed and memory. | | CO1 | U | 3 |
| 12. | List any three constants used in math module. | | CO3 | R | 3 |
| 13. | Write the output of the following bitwise operators: a & b, a | b and a >> 1, where a = 10, b = 4 | | CO2 | A | 3 |
| 14. | Differentiate fruitful and void functions with suitable example. | | CO4 | U | 3 |
| 15. | Recall the components of string module. | | CO5 | R | 3 |
| 16. | Discuss inheritance and its types. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Write a program in Python to calculate the area of a triangle of sides  a = 5 cm, b = 6 cm and c = 7 cm using semi-perimeter | CO2 | A | 7 |
|  | b. | Enumerate the algorithm to calculate factorial of a number using recursion strategy | CO1 | R | 5 |
|  |  |  |  |  |  |
| 18. | a. | Distinguish between linear and binary search. | CO1 | U | 5 |
|  | b. | Write a program in Python to find the sum of elements in a given array | CO2 | A | 7 |
|  |  |  |  |  |  |
| 19. | a. | Write a program in Python to assign grades (A, B, C) based on marks obtain by a student using the following: if…elif…else and nested if statements | CO2 | A | 8 |
|  | b. | Discuss the type conversions in Python | CO1 | U | 4 |
|  |  |  |  |  |  |
| 20. | a. | Write Python program to demonstrate default and keyword arguments of functions. | CO4 | A | 6 |
|  | b. | Discuss on local and global scope with supporting Python program | CO4 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | Analyze the output of printing the string s = ' Welcome TO \n\n Karunya ' normally as well as using the string module utility function capwords( ). | CO5 | An | 7 |
|  | b. | Illustrate the use of slice( ) function on a string with a Python code. | CO2 | U | 5 |
|  |  |  |  |  |  |
| 22. | a. | Show how module and packages can be created and accessed in Python. | CO5 | U | 8 |
|  | b. | State the Python libraries with features for visualizing data. | CO5 | R | 4 |
|  |  |  |  |  |  |
| 23. | a. | Infer the benefits of inheritance | CO6 | An | 4 |
|  | b. | Write a program in Python to create a class and object with class and instance attributes | CO6 | A | 8 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Analyze the Python programs to sum an array of numbers using for and while loop | CO1 | An | 8 |
|  | b. | Report the output of the following statements on T = ("hi", "Python", 2): type(T), print(T[0:]), print(T[0:1]), print(T+T) | CO2 | U | 4 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the basics of programming using python |
| CO2 | Write and execute python programs |
| CO3 | Understand the concepts of using math library |
| CO4 | Adopt different techniques using functions in the program |
| CO5 | Formulate algorithms and write programs using modules, packages and strings |
| CO6 | Apply python for real time application using object oriented approach |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 7 | 13 | - | 8 | - | - | 28 |
| CO2 | 1 | 10 | 26 | - | - | - | 37 |
| CO3 | 3 | - | - | - | - | - | 3 |
| CO4 | 1 | 10 | 6 | - | - | - | 17 |
| CO5 | 8 | 8 | - | 7 | - | - | 23 |
| CO6 | 1 | 3 | 8 | 4 | - | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **INTRODUCTION TO COMPUTER ENGINEERING** | **Duration** | **3hrs** |
| **Course Name** | **21EC1006** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Identify the register that is a part of the arithmetic and logic unit. | | CO1 | U | 1 |
| 2. | Name the flag register that sets the CPU in on-chip debugging mode. | | CO1 | R | 1 |
| 3. | Indicate the signal that initiates micro-operations that the CPU must perform carry out the instruction’s operation. | | CO2 | U | 1 |
| 4. | Define data path. | | CO2 | R | 1 |
| 5. | Compute the instruction length of MVIA, 25H. | | CO3 | A | 1 |
| 6. | List the elements of a machine instruction. | | CO3 | R | 1 |
| 7. | Infer the functionality of I/O module in a computer system. | | CO5 | U | 1 |
| 8. | Write the disadvantage of programmed I/O. | | CO5 | R | 1 |
| 9. | Predict which category of Flynn’s Taxonomy is the most versatile and commonly used in modern computer systems. | | CO4 | U | 1 |
| 10. | In a computer system, which level of cache is the largest in terms of storage capacity? | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Paraphrase on the functions of a CPU. | | CO1 | U | 3 |
| 12. | List down the disadvantages of hardwired control unit. | | CO2 | R | 3 |
| 13. | Identify the three key places where operands are typically available during program execution. | | CO3 | U | 3 |
| 14. | Indicate how pipelining improve performance of instruction execution. | | CO4 | U | 3 |
| 15. | Distinguish Multi-Core system and Multi-CPU system. | | CO5 | U | 3 |
| 16. | Discriminate the concept of virtual memory from physical memory. | | CO6 | An | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the flags in flag register and provide the scenarios in which they are set and reset in a computer system. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 18. | a. | Explain the concept of micro-programmed control unit with neat sketch. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 19. | a. | Represent the structure and functions of an IO module with a block diagram. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 20. | a. | Write an 8085-assembly language program to add two 8-bit numbers stored in the memory location 8000 H and 8001 H respectively. Store the result in the memory location 8085 H. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Explain the concept of addressing modes and provide specific examples of instructions for each addressing mode. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 22. | a. | Explain the DMA techniques and discuss the scenario in which it significantly improves the system performance. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Describe the different forms of parallel computing. | CO4 | U | 5 |
|  | b. | How does Flynn’s Taxonomy help in understanding and categorizing the parallelism in various computer systems? | CO4 | U | 7 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the semiconductor memory technologies and suggest the best technology for storage devices. | CO6 | An | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Understand the basics structure of computers, operations and instructions |
| CO2 | Design arithmetic and logic unit |
| CO3 | Understand pipelined execution and design control unit |
| CO4 | Understand parallel processing architectures |
| CO5 | Understand the various memory systems and I/O communication |
| CO6 | Design Memory Systems |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 4 |  | 12 |  |  | 17 |
| CO2 | 4 | 13 | 12 |  |  |  | 29 |
| CO3 | 1 | 15 | 1 |  |  |  | 17 |
| CO4 |  | 16 |  |  |  |  | 16 |
| CO5 | 1 | 16 | 12 |  |  |  | 29 |
| CO6 |  | 1 |  | 15 |  |  | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **21EC1007** | **Duration** | **3hrs** |
| **Course Name** | **SOFTWARE ENGINEERING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define a software. | | CO1 | R | 1 |
| 2. | Write an example for application domain in software engineering. | | CO1 | R | 1 |
| 3. | List the problems involved in the elicitation process. | | CO2 | R | 1 |
| 4. | Define requirements engineering. | | CO2 | R | 1 |
| 5. | Spell out the commonly used architectural styles. | | CO3 | R | 1 |
| 6. | Compare transform flow and transaction flow. | | CO3 | U | 1 |
| 7. | Differentiate direct measures and indirect measures. | | CO4 | U | 1 |
| 8. | Define smoke testing. | | CO4 | R | 1 |
| 9. | List the software quality attributes. | | CO5 | R | 1 |
| 10. | Enumerate alpha testing. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Sketch the failure curve for software and hardware. | | CO1 | A | 3 |
| 12. | Indicate the functions of use case with an example. | | CO2 | U | 3 |
| 13. | Sketch the diagram for translating the requirements model into the design model. | | CO3 | A | 3 |
| 14. | Compare unit testing and integration testing. | | CO4 | U | 3 |
| 15. | Illustrate the role of people in a management spectrum. | | CO5 | U | 3 |
| 16. | Distinguish between verification and validation. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the generic process model and the different types of process flow in detail. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Describe the different elements of the requirements model in detail. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. | a. | Discuss the different types of architectural styles that exist for software in detail. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. | a. | Summarize the tasks that represent a rudimentary workflow for WebApp interface design. | CO3 | U | 6 |
|  | b. | Explain the different user interface design models in detail. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | Discuss the testing strategies that are used for a conventional software. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 22. | a. | Discuss the four P’s in an effective software project management system in detail. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Explain the agile process and the agility principles in detail. | CO1 | U | 8 |
|  | b. | Summarize the Extreme programming (XP) values with brief description. | CO1 | U | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Discuss the validation testing in detail. | CO6 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the software engineering and agile development processes. |
| CO2 | Formulate requirements and validate them. |
| CO3 | Make use of different software design methodologies. |
| CO4 | Determine suitable tests for testing and debugging a software. |
| CO5 | Apply appropriate methods to manage and maintain a software. |
| CO6 | Ensure that the software meets the required standards. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | 24 | 3 | - | - | - | 29 |
| CO2 | 2 | 15 | - | - | - | - | 17 |
| CO3 | 1 | 25 | 3 | - | - | - | 29 |
| CO4 | 1 | 16 | - | - | - | - | 17 |
| CO5 | 1 | 15 | - | - | - | - | 16 |
| CO6 | 1 | 15 | - | - | - | - | 16 |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **21EC2001** | **Duration** | **3hrs** |
| **Course Name** | **OBJECT ORIENTED PROGRAMMING IN C++** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Name and describe the key role of C++ escape sequences in character strings. Provide an example of a commonly used escape sequence. | | CO1 | R | 1 |
| 2. | List the characteristics of Object-Oriented Programming (OOP) languages. | | CO1 | R | 1 |
| 3. | Explain the purpose of the switch-case statement in C++. | | CO1 | U | 1 |
| 4. | Infer the output in the below C++ source code:  #include <iostream>  using namespace std;  int main()  {  cout<<"Hello World";  main();  return 0;  } | | CO1 | U | 1 |
| 5. | Write a C++ code snippet to initialize an array of integers with values 1, 2, 3, and 4. | | CO1 | A | 1 |
| 6. | Write a C++ program that reads a string from the user, and then writes the same string in reverse order. | | CO1 | A | 1 |
| 7. | Describe what a C++ structure is and how it differs from an array. | | CO4 | R | 1 |
| 8. | Identify the key role of pointers in C++ programming. | | CO1 | U | 1 |
| 9. | State the significance of functions in C++ programming. | | CO4 | R | 1 |
| 10. | Identify one of the standard library functions typically used for writing data to a file in C++. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Write a C++ program that prompts the user to enter two integers, calculates their sum, and displays the result using the cin and cout statements. | | CO1 | U | 3 |
| 12. | Develop a C++ program to implement a simple arithmetic calculator. | | CO1 | A | 3 |
| 13. | Describe the fundamental differences between a simple C++ classes and object. | | CO2 | U | 3 |
| 14. | Write a C++ program that simulates a simple banking system using classes and objects. | | CO2 | U | 3 |
| 15. | Examine the concepts of dynamic memory allocation in C++ using the new and delete operators. | | CO3 | A | 3 |
| 16. | Develop a comprehensive C++ program that showcases the creation and opening of files using stream classes. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Develop C++ example programs for the below operators in C++:  Arithmetic Operators,  Logical operators  Relational Operators  Bit wise operators | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Construct an arithmetic calculator using switch-case statement. | CO1 | A | 9 |
|  | b. | Discuss about manipulators in C++ with an example. | CO1 | U | 3 |
|  |  |  |  |  |  |
| 19. | a. | Write a C++ program that defines a class representing a "Student" with attributes such as name, roll\_no, and CGPA. Implement a parameterized constructor and a default constructor for the class. Illustrate how each constructor can be used to create instances of the "Student" class. Additionally, demonstrate how to access and modify the attributes of these instances within the program. | CO3 | E | 8 |
|  | b. | List the features of constructors. | CO2 | R | 4 |
|  |  |  |  |  |  |
| 20. | a. | Discuss the fundamentals of arrays in C++ and explain the process of initializing arrays. Develop a C++ program that demonstrates the initialization of a one-dimensional integer array and a two-dimensional character array. | CO1 | U | 8 |
|  | b. | Explain the concept of strings in C++ and distinguish between string variables and string constants. | CO1 | U | 4 |
|  |  |  |  |  |  |
| 21. | a. | Explain the concept of operator overloading in C++ with a focus on binary operators. Provide examples of how binary operators, like addition and subtraction, can be overloaded in C++ to work with user-defined data types. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Develop a C++ program that includes a base class and a derived class, demonstrating the use of access specifiers. Evaluate how access specifiers influence the accessibility of class members in the derived class and discuss their importance in controlling data encapsulation and information hiding. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | Explain the concept of pointers in C++, highlighting the significance of memory addresses and their role in data manipulation. | CO4 | U | 6 |
|  | b. | Develop a C++ program that demonstrates polymorphism using base and derived classes with virtual functions. Analyze the program's structure, emphasizing how virtual functions enable dynamic binding and runtime method selection. | CO3 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Describe the concept of friend functions in C++ and their relationship with classes. Provide a C++ program with examples of friend functions and explain how they can access private members of a class. | CO6 | U | 6 |
|  | b. | Analyze the use of templates in C++, including function templates and class templates. | CO6 | An | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Exhibit basic knowledge in object oriented programming for developing programming skills. |
| CO2 | Recognize features of object-oriented design such as encapsulation, inheritance, and composition of systems based on object identity for appropriate applications. |
| CO3 | Illustrate the concept of polymorphism and exceptions using object oriented approach. |
| CO4 | Specify simple data types and design implementations, using functions to document them. |
| CO5 | Create applications using inheritance in C++. |
| CO6 | Choose the appropriate techniques in algorithmic design strategies for real time application development. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | 21 | 26 |  |  |  | 49 |
| CO2 | 4 | 6 |  |  |  |  | 10 |
| CO3 |  |  | 21 |  | 8 |  | 29 |
| CO4 | 2 |  | 6 |  |  |  | 8 |
| CO5 |  |  | 12 |  |  |  | 12 |
| CO6 | 1 | 6 | 3 | 6 |  |  | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **21EC2003** | **Duration** | **3hrs** |
| **Course Name** | **ELECTRONIC DEVICES AND CIRCUITS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define fermi energy. | | CO1 | R | 1 |
| 2 | State the factors that influences the position of fermi energy level. | | CO1 | R | 1 |
| 3. | FET is an unipolar device. Justify. | | CO2 | E | 1 |
| 4. | State the reason for preferring NPN transistor compared to PNP transistor. | | CO2 | R | 1 |
| 5. | Identify the semiconductor device that converts light energy into electrical energy. | | CO3 | U | 1 |
| 6 | Write the ripple factor of half wave rectifier. | | CO4 | A | 1 |
| 7. | Name the circuit that maintains a constant DC output voltage irrespective of the fluctuations in AC input voltage or load current. | | CO4 | R | 1 |
| 8. | Identify the power amplifier that conduct more than half cycle but less than the full cycle of the input signal. | | CO5 | U | 1 |
| 9. | State the applications of positive feedback amplifier. | | CO6 | R | 1 |
| 10. | Identify the type of amplifier that accepts certain frequencies and rejects other frequencies. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Define drift and diffusion current. | | CO1 | R | 3 |
| 12. | Compare the transistor configurations of CB, CE and CC. | | CO2 | U | 3 |
| 13. | Explain the working principle of varactor diode. | | CO3 | A | 3 |
| 14. | Sketch the circuit diagram of bridge wave rectifier. | | CO4 | A | 3 |
| 15. | List out the significance of negative feedback amplifier. | | CO5 | R | 3 |
| 16. | State Barkhausen criterion for oscillation. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the various methods of generation and recombination of electron-hole pairs. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Explain the common-emitter configuration using npn transistor and its static characteristics. | CO2 | U | 6 |
|  | b. | Describe the construction of pn diode and explain the V-I characteristics. | CO2 | U | 6 |
| 19. | a. | Explain the construction, equivalent circuit, working and characteristics of SCR. | CO3 | A | 8 |
|  | b. | Discuss the application of Zener diode as a shunt voltage regulator. | CO3 | U | 4 |
|  |  |  |  |  |  |
| 20. | a. | Explain the operation of full wave rectifier with neat circuit diagram and derive its efficiency and ripple factor. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Explain the working principle of Class A amplifier and derive the collector efficiency with necessary diagrams. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. | a. | Summarize the voltage divider biasing technique used in BJT and find the Q-point through load line analysis. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Explain the working of RC Coupled amplifier with neat diagram and sketch its frequency response. | CO5 | A | 8 |
|  | b. | Calculate the input impedance of voltage series feedback amplifier if β=0.01, A=100 and Zi=2.87kΩ. | CO5 | A | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Discuss the merits, demerits and applications of single tuned amplifier with neat circuit diagram. | CO6 | U | 6 |
|  | b. | Explain the principle of operation of Hartley oscillator with a neat circuit diagram. | CO6 | U | 6 |

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|  | **COURSE OUTCOMES** |
| CO1 | Describe the basic properties of semiconductor physics |
| CO2 | Identify and differentiate the functioning of diode, BJT and FET |
| CO3 | Define the fundamental operation principles and applications of special semiconductor devices |
| CO4 | Demonstrate the functioning of DC Power supply |
| CO5 | Analyze the biasing property and frequency response of amplifier circuits |
| CO6 | Distinguish between amplifiers and oscillators |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 5 | - | 12 | - | - | - | 17 |
| CO2 | 1 | 15 | - | - | 1 | - | 17 |
| CO3 | - | 5 | 11 | - | - | - | 16 |
| CO4 | 1 | - | 16 | - | - | - | 17 |
| CO5 | 3 | 25 | 12 | - | - | - | 40 |
| CO6 | 5 | 12 | - | - | - | - | 17 |
|  | | | | | | | **124** |



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| **Course Code** | **21EC2005** | **Duration** | **3hrs** |
| **Course Name** | **OPERATING SYSTEM** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Can privileged instructions be executed by device drivers in user space? Justify your answer. | | CO1 | U | 1 |
| 2. | Define Trap. | | CO1 | R | 1 |
| 3. | Recall any two types of semaphores used in process synchronization. | | CO2 | R | 1 |
| 4. | Summarize the functions of dispatcher module in operating system. | | CO2 | U | 1 |
| 5. | Give any two examples of CPU scheduling criteria. | | CO3 | U | 1 |
| 6. | Define static linking. | | CO3 | R | 1 |
| 7. | List down the different stages of address binding. | | CO4 | R | 1 |
| 8. | Define starvation. | | CO4 | R | 1 |
| 9. | Give any two examples of components of resource allocation graph. | | CO5 | U | 1 |
| 10. | List any four file operations in file management. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Sketch the stages of instruction execution with interrupt. | | CO1 | A | 3 |
| 12. | List down the different operations performed on a process. | | CO2 | R | 3 |
| 13. | Differentiate preemptive and non-preemptive scheduling. | | CO3 | U | 3 |
| 14. | List down the conditions to avoid deadlock in system. | | CO4 | R | 3 |
| 15. | Distinguish between internal and external memory fragmentation. | | CO5 | U | 3 |
| 16. | Determine the most common schemes for defining the logical structure of a directory. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the working modes of operating system in detail. | CO1 | U | 6 |
|  | b. | Discuss all the layers in operating system. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Discuss any two types of inter processing communication in operating system with examples. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. | a. | Consider the following set of processes, with the length of the CPU burst given in milliseconds:   |  |  |  | | --- | --- | --- | | Process | Burst Time | Priority | | P1 | 2 | 2 | | P2 | 1 | 1 | | P3 | 8 | 5 | | P4 | 4 | 4 | | P5 | 5 | 3 |   The processes are assumed to have arrived in the order P1, P2, P3, P4, P5, all at time 0.   1. Sketch the Gantt charts that illustrate the execution of priority scheduling algorithm. Priority (a larger priority number implies a higher priority). 2. Determine the turnaround time of each process for each of the Scheduling algorithms in part a? 3. Determine the waiting time of each process being scheduled? | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Explain the procedure followed in Bankers algorithm with example to avoid deadlock in operating system. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | With neat sketch, explain the modified paging hardware to solve two level memory allocation problems. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Consider the following requests are in the disk queue:  98, 183, 37,122, 14, 124, 65, 67  Head starts at: 53  Explain the procedure to provide services for above request sequence with the help of following disk scheduling algorithm.   1. SCAN scheduling 2. C-SCAN Scheduling 3. Look Scheduling   (Use appropriate scheduling graph) | CO5 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | With neat sketch, explain the segmentation hardware in memory management. | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Describe in detail.   1. I/O scheduling 2. Buffering 3. Caching 4. Spooling and Device Reservation. | CO6 | R | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Basic concepts and functions of operating systems. |
| CO2 | Design Processes and Threads |
| CO3 | Analyze Scheduling algorithms. |
| CO4 | Explain the concept of Deadlocks. |
| CO5 | Analyze various memory management schemes. |
| CO6 | Construct I/O management and File systems. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 13 | 3 | - | - | - | 17 |
| CO2 | 4 | 13 |  | - | - | - | 17 |
| CO3 | 1 | 4 | 12 | - | - | - | 17 |
| CO4 | 5 | 12 |  | - | - | - | 17 |
| CO5 | - | 4 | 36 | - | - | - | 40 |
| CO6 | 13 | - | 3 | - | - | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **21EC2006** | **Duration** | **3hrs** |
| **Course Name** | **MATHEMATICS FOR SIGNAL ANALYSIS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Calculate the eigen value for the following 2×2 matrix. | | CO1 | A | 1 |
| 2. | State the condition for a signal to be an even signal. | | CO1 | R | 1 |
| 3. | Calculate the number of samples in the output y[n] if input  x[n] = [2, 1, 0] and impulse response h[n] = [1, 2] | | CO2 | A | 1 |
| 4. | Define a static system. | | CO2 | R | 1 |
| 5. | Enumerate the conditions for existence of Fourier transform. | | CO3 | R | 1 |
| 6. | Compute the Fourier transform of x(-t) if the Fourier transform of x(t) is X(jω). | | CO3 | A | 1 |
| 7. | Define Nyquist rate. | | CO4 | R | 1 |
| 8. | Apply the differentiation property in s domain to find the inverse Laplace Transform of *X(s)* = . | | CO4 | A | 1 |
| 9. | Compute the Fourier transform of u | | CO5 | A | 1 |
| 10. | Indicate the ROC for a causal sequence x(n). | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Test whether the following signal is an energy signal or not.  *x(n) =* | | CO1 | An | 3 |
| 12. | Determine the linear convolution of the given sequences:  *x(n) = {1, 2, 3} and h(n) = {1, 3}.* | | CO2 | A | 3 |
| 13. | Examine the Fourier transform for the signal *x(t)=e -|t*| | | CO3 | A | 3 |
| 14. | Predict the initial value of if . | | CO4 | A | 3 |
| 15. | Estimate the spectral coefficients for *x(n) = Cos (πn/4).* | | CO5 | U | 3 |
| 16. | Compute the Z transform of and find the ROC. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Let be a signal with  Sketch the following signals. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Test whether the system *y(n) = x(n).x(n*-1*)* is   1. Static or dynamic 2. Causal or non-causal 3. Time variant or Invariant 4. Linear or non - linear | CO2 | An | 8 |
|  | b. | Summarize the properties of convolution sum. | CO2 | U | 4 |
|  |  |  |  |  |  |
| 19. | a. | Consider a stable LTI system characterized by the differential equation + 6+ = 2x(t). Apply Fourier transform and find  (i) the impulse response of the system.  (ii) the response of the system if x(t) = t. e -2t u(t). | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Explain the impulse train sampling with the effect of aliasing and necessary spectrum representations. | CO4 | U | 6 |
|  | b. | Analyze the output for a system described by its transfer function  *H(s)* = for a step input. | CO4 | An | 6 |
|  |  |  |  |  |  |
| 21. | a. | Consider a LTI system which is characterized by the difference equation *y(n) - (3/4) y(n-1) + (1/8) y(n-2) =2x(n).* Determine the output of the system for the input *x(n)= (1/4) nu(n).* | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | State and prove any five properties of Laplace transform. | CO4 | R | 12 |
|  |  |  |  |  |  |
| 23. | a. | Explain the different classification of signals in detail. | CO1 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Determine the impulse response for the following system.  . | CO6 | A | 6 |
|  | b. | The difference equation of a discrete time system is given below: *y(n) - 0.75 y(n-1) + 0.25 y(n-2) = x(n) +0.5 x(n-1).* Construct the direct form II realization. | CO6 | A | 6 |

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|  | **COURSE OUTCOMES** |
| CO1 | Analyze different types of matrices, signals for mathematical modelling |
| CO2 | Realize the system properties to build basic model |
| CO3 | Represent continuous time system using Fourier series and Fourier transform |
| CO4 | Investigate the sampling process and Laplace Transform |
| CO5 | Signify discrete time system using Fourier series and Fourier transform |
| CO6 | Familiarize the frequency analysis of discrete time system using Z transform |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 12 | 13 | 3 | - | - | 29 |
| CO2 | 1 | 4 | 4 | 8 | - | - | 17 |
| CO3 | 1 | - | 16 | - | - | - | 17 |
| CO4 | 13 | 6 | 4 | 6 | - | - | 29 |
| CO5 | - | 3 | 13 | - | - | - | 16 |
| CO6 | - | 1 | 15 | - | - | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **21EC2007** | **Duration** | **3hrs** |
| **Course Name** | **DATA STRUCTURES AND ALGORITHMS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | **Define Big ‘O’ Notation.** | | CO1 | R | 1 |
| 2. | Name the methods to represent stack Data structure. | | CO3 | R | 1 |
| 3. | State the working principle of Queue data structure. | | CO3 | R | 1 |
| 4. | Define the term divide and conquer algorithm. | | CO2 | R | 1 |
| 5. | List any two disadvantages of linear search. | | CO2 | R | 1 |
| 6. | Calculate the Height of a node in a tree. | | CO4 | A | 1 |
| 7. | Predict the least number of spanning tree possible for the 10 vertices complete graph. | | CO3 | U | 1 |
| 8. | Name the shortest path algorithm to find the path from a source node to all other nodes in a positive weighted graph. | | CO3 | R | 1 |
| 9. | Distinguish NP hard and NP completeness. | | CO4 | U | 1 |
| 10. | Define recursion. | | CO5 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Differentiate linear and non-linear data structure. | | CO1 | U | 3 |
| 12. | Write any three queue applications. | | CO3 | A | 3 |
| 13. | Summarize the algorithm for linear search. | | CO2 | U | 3 |
| 14. | Define path in a graph with suitable example. | | CO3 | R | 3 |
| 15. | Explain topological sorting. | | CO5 | An | 3 |
| 16. | Discuss the applications of recursive algorithms. | | CO5 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the following operations performed in the Doubly linked List.   * Insert at the front * Insert in the middle * Delete the first element. * Delete the middle element. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Explain the basic operations of stack with an example. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 19. | a. | Write a selection sort algorithm and apply the input 90, 20, 70, 10, 50, 40, 30 on the algorithm and show each step for sorting the numbers in ascending order. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Explain in detail about the Graph traversal methods. | CO3 | An | 6 |
|  | b. | Consider the following specification of a graph G  V (G) = {a, b, c, d}  E (G) = {(a, b), (a, c), (c, c), (c, d), (d, a)}  a. Draw an undirected graph.  b. Draw its adjacency matrix | CO3 | E | 6 |
|  |  |  |  |  |  |
| 21. | a. | Write Prim’s Algorithm for constructing a minimum spanning tree and show the spanning tree construction with a suitable example. | CO5 | C | 12 |
|  |  |  |  |  |  |
| 22. | a. | Describe the binary searching technique for searching an ordered list of elements with the algorithm and relevant example. | CO2 | R | 12 |
|  |  |  |  |  |  |
| 23. | a. | Evaluate the insert, delete and display functions of queue data structure with suitable example. | CO3 | E | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Write the Single Source Shortest path algorithm and explain with a suitable example. | CO6 | C | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** | | | | | | | |
| CO1 | Analyze the time and space efficiency of data structures and algorithms and apply this analysis to select the best tools for solving particular problems. | | | | | | | |
| CO2 | Implement a variety of algorithms for searching and sorting, including linear search, binary search, insertion sort, selection sort, merge sort, quicksort, and heap sort. | | | | | | | |
| CO3 | Describe, explain, and use abstract data types including stacks, queues, lists, sets, maps and graphs. | | | | | | | |
| CO4 | Implement those data types using both contiguous and linked representations. | | | | | | | |
| CO5 | Read and write recursive algorithms. Understand when recursion is, and is not, appropriate. | | | | | | | |
| CO6 | Implement an advanced algorithm using Elementary and Greedy Method with Single Source Shortlist Paths. | | | | | | | |
| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | | | |
| **CO / P** | | **R** | **U** | **A** | **An** | **E** | **C** | **Total** | |
| CO1 | | 1 | 3 | - | - | - | - | 4 | |
| CO2 | | 14 | 3 | 12 | - | - | - | 29 | |
| CO3 | | 6 | 1 | 3 | 18 | 18 | - | 46 | |
| CO4 | | - | 13 | 1 | - | - | - | 14 | |
| CO5 | | 1 | 3 | - | 3 | - | 12 | 19 | |
| CO6 | | - | - | - | - | - | 12 | 12 | |
|  | | | | | | | | **124** | |



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| --- | --- | --- | --- |
| **Course Code** | **21EC2009** | **Duration** | **3hrs** |
| **Course Name** | **FUNDAMENTALS OF JAVA PROGRAMMING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | | |
| 1. | Identify the keyword used to represent the invoking object. | | CO1 | U | | 1 |
| 2. | Predict the output of the following program:  class Test{  public static void main(String[] args) {  int a=4;  System.out.println(a++ + ++a +a++);  }  } | | CO1 | R | | 1 |
| 3. | State the acronym of JDK and JRE. | | CO1 | R | | 1 |
| 4. | Quote the term garbage collector. | | CO2 | R | | 1 |
| 5. | List any two methods from the thread class. | | CO4 | R | | 1 |
| 6. | Construct a user-defined exception. | | CO4 | R | | 1 |
| 7. | Define an abstract class with one abstract and two non-abstract methods. | | CO3 | U | | 1 |
| 8. | Summarize the use of collections in Java. | | CO5 | R | | 1 |
| 9. | State the two methods used from the Iterator interface. | | CO5 | U | | 1 |
| 10. | Illustrate a frame creation with its necessary settings. | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | | |
| 11. | Write a program to find an element in a 2-D array using Java. | | CO1 | | A | 3 |
| 12. | Demonstrate the use of break and continue statements. | | CO2 | | A | 3 |
| 13. | Infer the term “Garbage Collector.” | | CO3 | | U | 3 |
| 14. | Identify the need for method overloading and overriding with suitable examples. | | CO3 | | R | 3 |
| 15. | Illustrate the creation of a stack object to store three floating point values and display the same. | | CO5 | | A | 3 |
| 16. | Represent any three components of JSwing. | | CO6 | | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | | |
| 17. | a. | List down the Object-oriented concept with the necessary definition. | CO1 | | R | 6 |
|  | b. | Construct the necessary snippets to showcase the control structures used in Java. | CO1 | | A | 6 |
|  |  |  |  | |  |  |
| 18. | a. | Develop a program to find whether a student has cleared an integrated course by getting internal and end-semester marks of lab and theory. | CO2 | | A | 6 |
|  | b. | Discuss the purpose of the arithmetic and relational operator in Java. | CO1 | | R | 6 |
|  |  |  |  | |  |  |
| 19. | a. | List down the use of the final keyword with suitable examples. | CO3 | | R | 6 |
|  | b. | Create a class called “Schedule” with Event\_name, date, and time as data members. Develop the member functions such as add\_schedule, edit\_schedule, and display\_schedule. Demonstrate the above-mentioned class with five arrays of objects. | CO2 | | A | 6 |
|  |  |  |  | |  |  |
| 20. | a. | Demonstrate the five keywords of exception handling in Java. | CO4 | | A | 6 |
|  | b. | Create an interface called Banking with two services deposit(), withdraw(). Illustrate the banking operations via interface by creating SBI & AXIS bank classes and demonstrate dynamic method dispatch. | CO3 | | A | 6 |
|  |  |  |  | |  |  |
| 21. | a. | Create a class to print any multiplication table. Construct two threads to share the multiplication table class to print fifth and tenth multiplication table without colliding each table. | CO4 | | A | 6 |
|  | b. | Describe the following concepts,   * Super Keyword * Nested classes | CO3 | | R | 6 |
|  |  |  |  | |  |  |
| 22. | a. | Enumerate any five events with their participant\_count and registration fee using the enum class. Also, include constructors and methods as per the need. Get the name of the event from the user and print its detail through the enumerated object. | CO5 | | R | 6 |
|  | b. | Demonstrate the file handling operations as per the following.   * Create a new file. * Write your name and regno into a file. * Verify whether the file can be used for read and write operations. * Get the size of the file * Delete the file. | CO5 | | A | 6 |
|  |  |  |  | |  |  |
| 23. | a. | Develop a Java application to perform the following functionalities in HashTable.   * Create a HashTable to hold the product names of the data type String with product costs of data type Integer. * Add five different product names. * Get an element using a key. * Remove a particular product from HashTable. * Replace the existing element with a new element in the HashTable. | CO5 | | A | 6 |
|  | b. | Demonstrate the significance of the generic method by searching an element in a similar data array. | CO5 | | A | 6 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. | a. | Construct a GUI program using Java Swing API to create a frame containing two text boxes with labels. When the button Add is pressed, the message “The sum of two inputs given on the text box“ gets displayed in the dialog box. On pressing the OK button frame dialog gets closed. | CO6 | | A | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the basics of Object-Oriented design |
| CO2 | Identify classes, abstract classes, objects, and members needed for the specific application |
| CO3 | Create JAVA application programs using sound OOP practices |
| CO4 | Develop programs using multitasking applications |
| CO5 | Analyse real-time applications |
| CO6 | Apply the skills for designing GUI-based applications |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 14 | 1 | 9 | - | - | - | 24 |
| CO2 | - | 1 | 15 | - | - | - | 16 |
| CO3 | 15 | 4 | 6 | - | - | - | 25 |
| CO4 | 2 | - | 12 | - | - | - | 14 |
| CO5 | 7 | 1 | 21 | - | - | - | 29 |
| CO6 | - | 4 | 12 | - | - | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **21EC2010** | **Duration** | **3hrs** |
| **Course Name** | **LINEAR INTEGRATED CIRCUITS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Indicate the input impedance and output impedance of an ideal op-amp. | | CO1 | U | 1 |
| 2. | Represent the unit of offset voltage thermal drift. | | CO1 | U | 1 |
| 3. | Record the output waveform of a schmitt trigger circuit, when the sine input signal is applied to the inverting input terminal of Op-Amp. | | CO2 | A | 1 |
| 4. | Indicate the application of opamp as a differential amplifier. | | CO2 | U | 1 |
| 5. | State the number of quasi-stable states in a monostable multivibrator. | | CO3 | R | 1 |
| 6. | Report the phase shift introduced by the feedback network in the RC phase shift oscillator using op-amp. | | CO3 | U | 1 |
| 7. | State the characteristics of the notch filter. | | CO4 | R | 1 |
| 8. | Represent one advantage of Op-amp as a filter. | | CO4 | U | 1 |
| 9. | List the applications of the phase-locked loop (PLL). | | CO5 | R | 1 |
| 10. | Differentiate between direct-type and integrating-type in ADC converters. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Show the advantages of integrated circuits over discrete components. | | CO1 | U | 3 |
| 12. | Determine the output voltage for the op-amp circuit shown below. | | CO2 | A | 3 |
| 13. | Compute the frequency of oscillation obtained from an RC phase shift oscillator if R = 6 Kohm and C = 0.1 microfarad. | | CO3 | A | 3 |
| 14. | Sketch the frequency plot of low-pass and band-reject filters. | | CO4 | A | 3 |
| 15. | Define lock-in range and capture range in PLL. | | CO5 | R | 3 |
| 16. | Illustrate the transfer characteristics of a 3-bit ADC. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Discuss in detail the AC performance characteristics of an op-amp. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Discover, sketch, and explain the Op-Amp-based circuit to perform the operation as shown below figure. Provide related mathematical analysis. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Sketch neatly a free-running multivibrator circuit using op-amp. Show the time duration in which the multivibrator remains in a quasi-stable state. | CO3 | A | 6 |
|  | b. | With a suitable functional diagram, explain the function of the low voltage regulator using IC 723. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Design and analyze the frequency response of a first-order high-pass filter. Also, provide its overall transfer function. | CO4 | C | 12 |
|  |  |  |  |  |  |
| 21. | a. | Describe the functional block diagram of 555 timer monostable operation with a neat diagram and timing pulses. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. | a. | Develop a non-inverting and inverting amplifier circuit and obtain the expressions for its output voltage and gain. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | Sketch the circuit diagram of the Wien bridge oscillator and explain its function. Derive the expression for the frequency of oscillation. | CO3 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | With a neat block diagram, explain the operation of successive approximation type A/D converter. | CO6 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the fundamentals of OP-AMP and its characteristics. |
| CO2 | Use OP-AMP to design circuits such as Amplifiers, differentiator and Integrator. |
| CO3 | Infer the significance of OP-AMP in Multivibrators and Oscillators. |
| CO4 | Design filters using OP-AMP. |
| CO5 | Explore the usefulness of IC555 timer and Phase Locked Loop |
| CO6 | Design ADC, DAC and understand the IC fabrication |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 17 | - | - | - | - | 17 |
| CO2 | - | 1 | 28 | - | - | - | 29 |
| CO3 | 1 | 7 | 21 | - | - | - | 29 |
| CO4 | 1 | 1 | 3 | - | - | 12 | 17 |
| CO5 | 4 | 12 | - | - | - | - | 16 |
| CO6 | - | 16 | - | - | - | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **21EC2011** | **Duration** | **3hrs** |
| **Course Name** | **ANALOG ELECTRONICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Name the process for producing single crystal silicon ingots. | | CO1 | R | 1 |
| 2. | Identify the basic chemical reaction used for Epitaxial growth. | | CO1 | R | 1 |
| 3. | Name the layer isolates terminal gate from semiconductor. | | CO2 | R | 1 |
| 4. | Recall the types of MOSFET configuration. | | CO2 | R | 1 |
| 5. | Show the modified circuit symbols of PMOSFET. | | CO3 | R | 1 |
| 6. | Label the alternate name of common drain amplifier. | | CO3 | R | 1 |
| 7. | Predict the regions of MOSFET acts as a switch. | | CO4 | U | 1 |
| 8. | Define current mirror. | | CO5 | R | 1 |
| 9. | List out the advantages of differential amplifier. | | CO5 | R | 1 |
| 10. | What CMOS stands for? | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Describe aluminium is used for the metallization of most IC. | | CO1 | R | 3 |
| 12. | Compare JFET and MOSFET. | | CO2 | An | 3 |
| 13. | Show the ID-VGS and ID-VDS characteristics for NMOSFET. | | CO3 | U | 3 |
| 14. | List out the applications of Common Source MOSFET amplifier. | | CO4 | R | 3 |
| 15. | Visualize cascode MOS mirror circuit. | | CO5 | R | 3 |
| 16. | State the features of CMOS technology. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Illustrate the photolithography process used for IC fabrication. | CO1 | U | 8 |
|  | b. | State the advantages of Ion Implantation technique used for IC planar process. | CO1 | R | 4 |
|  |  |  |  |  |  |
| 18. | a. | Discuss in detail about CMOS p-well process with neat diagram. | CO1 | U | 10 |
|  | b. | Identify the circuit symbol and truth table of CMOS Invertor. | CO1 | R | 2 |
|  |  |  |  |  |  |
| 19. | a. | Explain device structure and physical operation and characteristics for an enhancement type NMOS transistor with diagram. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 20. | a. | Determine the characteristic parameters and overall voltage gain of Common Source amplifier with necessary equivalent circuit. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Discuss the following MOS device models with necessary equations.  i)Large signal model ii)Small signal model | CO2 | U | 12 |
|  |  |  |  |  |  |
| 22. | a. | Sketch and explain the basic MOS current mirror circuit with necessary equations. | CO4 | A | 6 |
|  | b. | Describe the Widlar current source mirror circuit and find the expression of emitter resistance(RE). | CO5 | U | 6 |
|  |  |  |  |  |  |
| 23. | a. | Explain the operation of MOS differential pair with common mode input voltage with neat circuit diagram. | CO5 | An | 8 |
|  | b. | Compare between CMOS and Bipolar technologies. | CO6 | An | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Discuss the following CMOS amplifier topology.  i)Common-source with resistive load  ii)Common source with diode connected load. | CO6 | U | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the basics of MOSFETs. |
| CO2 | Analyze the Transistor amplifier |
| CO3 | Understand the configurations of MOSFET |
| CO4 | Adopt different techniques in Cascode amplifiers. |
| CO5 | Demonstrate the current mirrors and Differential amplifiers |
| CO6 | Apply the entire concepts to design CMOS amplifiers. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 11 | 18 | - | - | - | - | 29 |
| CO2 | 2 | 12 | - | 15 | - | - | 29 |
| CO3 | 2 | 3 | 12 | - | - | - | 17 |
| CO4 | 3 | 1 | 6 | - | - | - | 10 |
| CO5 | 5 | 6 | - | 8 | - | - | 19 |
| CO6 | 4 | 12 | - | 4 | - | - | 20 |
|  | | | | | | | **124** |



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| **Course Code** | **21EC2012** | **Duration** | **3hrs** |
| **Course Name** | **VOICE AND VISION PROCESSING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Sketch the DT signal 3u[n-3]. | | CO1 | A | 1 |
| 2. | List any two properties of discrete time systems. | | CO1 | R | 1 |
| 3. | Write the equation for calculating “twiddle factor”. | | O2 | A | 1 |
| 4. | Tabulate the 8 point sequence x[n]={2,-3,4,5,-6,7,1,8}in bit reversed order. | | CO2 | R | 1 |
| 5. | Sketch the magnitude response of band pass filter. | | CO3 | A | 1 |
| 6. | Define frequency warping. | | CO3 | R | 1 |
| 7. | Sketch the constant multiplier element of filter realizations. | | CO4 | A | 1 |
| 8. | List the characteristics of FIR filter. | | CO4 | R | 1 |
| 9. | Define limit cycle oscillaions. | | CO5 | R | 1 |
| 10. | Sketch Harvard architecture. | | CO6 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Determine the circular convolution of two finite duration sequences using graphical method.  x1[n]={1,-1,2,-2}  x2[n]= {1,2,3} | | CO1 | A | 3 |
| 12. | Determine the 4-point DFT of the sequence x[n] = {2,1,2,3}. | | CO2 | A | 3 |
| 13. | Apply impulse invariant transformation technique to design a digital filter.  Given and sampling time T=0.2 sec. | | CO3 | A | 3 |
| 14. | Compare FIR and IIR filters. | | CO4 | U | 3 |
| 15. | List the effects of finite word length. | | CO5 | R | 3 |
| 16. | Compare CISC, RISC and VLIW architectures. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Determine sectioned convolution using overlap add method  X[n]={3,-1,2,4,5,2,5,3,1,4,2}, h[n]={1,1,1} | CO1 | A | 9 |
|  | b. | Compare overlap add and overlap save methods. | CO1 | U | 3 |
|  |  |  |  |  |  |
| 18. | a | Compute 8 point DFT of a sequence x[n]=[1,2,3,4,1,2,3,4] using radix-2 DIT-FFT algorithm. Draw the signal flow graph and tabulate the intermediate stage results. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Determine a Butterworth digital IIR filter using bilinear transformation technique for the followingspecifications:  Assume T = 1 sec. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Determine the transfer function of digital FIR filter using Hanning window with the length N=11. The desired response of the filter is | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Discuss the effect of coefficient quantization on pole locations when the co-efficient are quantized using (i) 3 bits (ii) 4 bits.  Consider the second order IIR filter with system function, | CO5 | U | 8 |
|  | b. | Discuss the effects of quantization errors in digital filter design. | CO5 | U | 4 |
|  |  |  |  |  |  |
| 22. | a. | Sketch the linear phase realization and transversal realization of FIR filter governed by the following equations, | CO4 | A | 8 |
|  | b. | Determine the frequency response, phase delay and group delay of the FIR filter governed by the equation, | CO4 | A | 4 |
|  |  |  |  |  |  |
| 23. | a. | Sketch the direct form-1 and direct form-II realization of the LTI system governed by the equation, | CO3 | A | 10 |
|  | b. | List the factors that influence the choice of structure for realization of filter systems. | CO3 | R | 2 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain LMS adaptive algorithm with suitable real-time application. | CO6 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Define signals and system mathematically in discrete time domain. |
| CO2 | Formulate the Discrete-Fourier Transform (DFT) and the FFT algorithms. |
| CO3 | Explain the various transformations for digital IIR filter design procedures. |
| CO4 | Design FIR digital filters for various applications. |
| CO5 | Demonstrate the signal processing concepts and the practical issues with the help of finite word length effects. |
| CO6 | Compare and select the DSP processor and techniques, suitable for the analysis of real-life signals |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 3 | 13 | - | - | - | 17 |
| CO2 | 1 | - | 16 | - | - | - | 17 |
| CO3 | 3 | - | 26 | - | - | - | 29 |
| CO4 | 1 | 3 | 25 | - | - | - | 29 |
| CO5 | 4 | 12 | 0 | - | - | - | 16 |
| CO6 | - | 15 | 1 | - | - | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **21EC2014** | **Duration** | **3hrs** |
| **Course Name** | **MICROPROCESSORS AND MICROCONTROLLERS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Indicate the size of stack pointer in 8085 microprocessor. | | CO1 | U | 1 |
| 2. | Predict the content of accumulator, after the execution of the following instruction in 8086 microprocessor.  MOV AL, 94H  NEG AL | | CO1 | A | 1 |
| 3. | Differentiate Timer from counter in 8051 microcontroller. | | CO2 | U | 1 |
| 4. | Calculate the clock frequency of 8051 microcontroller, if the crystal frequency is 20MHz. | | CO2 | A | 1 |
| 5. | Identify the wrong instruction from the following program segment in 051 microcontroller.  MOV B, #45H  MOV A, 45 H  MOVX B, @DPTR | | CO3 | R | 1 |
| 6. | Write a control word to reset PC6 in 8255 PPI. | | CO4 | A | 1 |
| 7. | Indicate the number of interrupts can be accessed when three 8259 interrupt controllers are cascaded. | | CO4 | U | 1 |
| 8. | Differentiate status register from control register. | | CO5 | U | 1 |
| 9. | List the two logic signals used in I2C bus. | | CO6 | R | 1 |
| 10. | Determine the number of address lines needed to access 64K memory. | | CO6 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | List the interrupts in 8085 microprocessor. | | CO1 | R | 3 |
| 12. | Explain the PSW register of 8051 microcontroller. | | CO2 | U | 3 |
| 13. | Write an 8051 C program to send values 00 – FF to port P2. | | CO3 | A | 3 |
| 14. | Predict the control word in 8255 PPI, when Group A ports are connected to display and Group B ports are connected to Keyboard mode 0. | | CO4 | E | 3 |
| 15. | Explain the four logic signals used in SPI bus interface. | | CO5 | U | 3 |
| 16. | Define assembler and compiler. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Describe the features of 8086 microprocessor with its architecture. | CO1 | U | 9 |
|  | b. | Name the registers present in 8085 microprocessor and indicate their size. | CO1 | R | 3 |
|  |  |  |  |  |  |
| 18. | a. | Discuss the functions of ports in 8051 with relevant diagram. | CO2 | U | 9 |
|  | b. | Illustrate the internal RAM structure of 8051 microcontroller. | CO2 | A | 3 |
|  |  |  |  |  |  |
| 19. | a. | Interpret the addressing modes of 8051 microcontroller with an example | CO2 | A | 8 |
|  | b. | Write an assembly language program segment for a delay of 20ms in timer. | CO3 | A | 4 |
|  |  |  |  |  |  |
| 20. | a. | Discuss the different modes of operation of 8253 timer with a block diagram. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Describe the internal block diagram of 8251 serial communication interface. Also write the status word. | CO4 | R | 8 |
|  | b. | Develop an assembly language program to implement the following logic diagram. | CO3 | C | 4 |
|  |  |  |  |  |  |
| 22. | a. | Discuss the significance of digital to analog convertor in real time applications. | CO5 | R | 8 |
|  | b. | Differentiate EEPROM from other memories | CO5 | U | 4 |
|  |  |  |  |  |  |
| 23. | a. | Develop an interfacing circuit of 16K RAM and 8K ROM with any microprocessors/microcontroller. Also Write the memory mapping. | CO6 | C | 9 |
|  | b. | List the importance of CAN bus. | CO5 | R | 3 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Illustrate the principle of sensor interfacing with relevant diagram. | CO6 | U | 8 |
|  | b. | Describe Zigbee interfacing protocol. | CO5 | R | 4 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the microprocessor architecture and its interfacing techniques |
| CO2 | Describe the architecture of 8051 controller. |
| CO3 | Execute basic and advanced Assembly language and C programs |
| CO4 | Interface I/O devices with Microcontroller |
| CO5 | Describe various communication Interface |
| CO6 | Recognize the functionality of Microcontroller and its applications to solve real world engineering |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 6 | 10 | 1 | - | - | - | 17 |
| CO2 | - | 13 | 12 | - | - | - | 25 |
| CO3 | 1 | - | 7 | - | - | 4 | 12 |
| CO4 | 8 | 13 | 1 | - | 3 | - | 25 |
| CO5 | 15 | 8 | - | - | - | - | 23 |
| CO6 | 4 | 8 | 1 | - | - | 9 | 22 |
|  | | | | | | | **124** |



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| **Course Code** | **21EC2015** | **Duration** | **3hrs** |
| **Course Name** | **WEB TECHNOLOGY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | State the HTML element to add a link. | | CO1 | R | 1 |
| 2. | Define the use of<body> tag in HTML web page. | | CO1 | R | 1 |
| 3. | State the CSS Selector that selects the HTML element by  **\*** symbol. | | CO2 | R | 1 |
| 4. | Write the name of the tag which is used to embed CSS in html page. | | CO2 | R | 1 |
| 5. | What is a cookie? | | CO3 | R | 1 |
| 6. | Interpret the importance of DOM | | CO3 | U | 1 |
| 7. | Write the syntax for writing JSP code. | | CO4 | A | 1 |
| 8. | Recall SAX in XML. | | CO4 | R | 1 |
| 9. | Define Event oriented parsing | | CO4 | R | 1 |
| 10. | Write the use of JAX-RPC. | | CO6 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Describe the HTML code to display the following content in a webpage.  a. Breakfast   * Dosa   b. Afternoon   * Biryani | | CO1 | U | 3 |
| 12. | Write html code for the following design   |  |  | | --- | --- | | **Name** | **Department** | | XXX | ECE | | YYY | ECM | | | CO1 | A | 3 |
| 13. | Implement CSS code to change the background and text color of a DIV element while user keeps the mouse over it. | | CO2 | U | 3 |
| 14. | Interpret JSP expression tag with example. | | CO4 | U | 3 |
| 15. | Illustrate the need of XML namespace. | | CO4 | A | 3 |
| 16. | Explain how does SOAP works. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Demonstrate a HTML registration form as given below with all fields that are mandatory and include necessary attributes. Explain all the form elements with its syntax. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Explain the various CSS Selectors with suitable programs. | CO2 | U | 6 |
|  | b. | Explain the purpose of onclick event with its example program. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Explain Servlet Life cycle with its architecture diagram and list out all servlet methods with its syntax. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Explain the various document object model methods used to access the HTML elements in JavaScript with its example program. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Explain all JSP implicit objects in detail. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Describe the process of performing DOM based XML processing. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Explain the working of AJAX in detail with its architecture diagram. | CO5 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain WSDL in detail and list out the difference between WSDL and SOAP. | CO6 | An | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Design simple web pages using markup languages like HTML and XHTML. |
| CO2 | Create dynamic web pages using DHTML and java script that is easy to navigate and use. |
| CO3 | Program server side web pages that have to process request from client side web pages. |
| CO4 | Represent web data using XML and develop web pages using JSP. |
| CO5 | Understand various web services |
| CO6 | Comprehend how these web services interact. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | 3 | 15 | - | - | - | 20 |
| CO2 | 2 | 9 | 6 | - | - | - | 17 |
| CO3 | 1 | 13 | 12 | - | - | - | 26 |
| CO4 | 2 | 15 | 16 | - | - | - | 33 |
| CO5 | - | - | - | 12 | - | - | 12 |
| CO6 | - | - | 4 | 12 | - | - | 16 |
|  | | | | | | | **124** |



|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **21EC2016** | **Duration** | **3hrs** |
| **Course Name** | **INTERNET OF THINGS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define IoT and how it works? | | CO1 | R | 1 |
| 2. | Write the benefits of IoT. | | CO1 | R | 1 |
| 3. | Summarize Connectivity. | | CO2 | U | 1 |
| 4. | List the requirements of RFID protocols in IoT. | | CO2 | R | 1 |
| 5. | What is the role of the cloud in smart grid architecture? | | CO3 | R | 1 |
| 6. | List out various IoT Platforms. | | CO3 | U | 1 |
| 7. | Give the advantages of cloud computing. | | CO4 | U | 1 |
| 8. | What is the most important concern of cloud computing? | | CO4 | R | 1 |
| 9. | What is IoT Analytics? | | CO5 | R | 1 |
| 10. | What is the purpose of actuators in IoT? | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | List the layers of IoT architecture. | | CO1 | R | 3 |
| 12. | Write short notes on Messaging Protocols. | | CO2 | An | 3 |
| 13. | Differentiate Arduino and Raspberry Pi. | | CO3 | U | 3 |
| 14. | Point out the different data types used in cloud computing. | | CO4 | R | 3 |
| 15. | What are Risk Analysis Structures? | | CO5 | An | 3 |
| 16. | Define brownfield in IoT. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain Data transfer referred with OSI Model. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Describe the IoT protocol Architecture. | CO2 | R | 12 |
|  |  |  |  |  |  |
| 19. | a. | Write in detail about the types of boards. | CO3 | R | 6 |
|  | b. | Write detailed notes on the GPS Module with neat diagrams. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Discuss IoT App development using Google Cloud with a neat diagram. | CO3 | C | 12 |
|  |  |  |  |  |  |
| 21. | a. | Explain the concepts involved in Mbed Programming. | CO4 | R | 6 |
|  | b | Discuss Raspberry Pi and its components details. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Illustrate the Network Analytics in detail. | CO5 | U | 6 |
|  | b. | Write short notes on Edge Streaming Analytics in detail. | CO5 | R | 6 |
|  |  |  |  |  |  |
| 23. | a. | Write detailed notes on the Internet of Vehicles (IoV). | CO6 | R | 12 |
|  |  |  |  |  |  |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the IoT Layering concepts in detail. | CO2 | An | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Understand the basics of IoT, networks, and communication. |
| CO2 | Realize the importance of sensors and understand the sensor mechanism. |
| CO3 | Possess the required knowledge and expertise in IoT architecture, layering concepts, and analysis of various protocols in IoT. |
| CO4 | Understand the various networks and development platforms in IoT |
| CO5 | Develop knowledge to overcome the challenges in IoT application platforms. |
| CO6 | Familiarize the various IoT applications |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 5 | 12 |  |  |  |  | 17 |
| CO2 | 13 | 1 |  | 15 |  |  | 29 |
| CO3 | 7 | 4 | 6 |  |  | 12 | 29 |
| CO4 | 10 | 7 |  |  |  |  | 17 |
| CO5 | 7 | 6 |  | 3 |  |  | 16 |
| CO6 | 15 | 1 |  |  |  |  | 16 |
|  | | | | | | | **124** |



|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **21EC2027** | **Duration** | **3hrs** |
| **Course Name** | **LINUX PROGRAMMING** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Identify the directory in which every single file and directory starts. | | CO1 | U | 1 |
| 2. | Define shell. | | CO1 | R | 1 |
| 3. | State the purpose of CD command. | | CO2 | R | 1 |
| 4. | Construct a command for giving execution privilege for a file f1.txt | | CO2 | A | 1 |
| 5. | List any two operations that can be performed on a file in command mode. | | CO3 | R | 1 |
| 6. | Identify command used to prepare a file to print with footers, headers, and the formatted text. | | CO4 | R | 1 |
| 7. | Predict the output for **“uniq-d linux.txt”.** | | CO4 | A | 1 |
| 8. | Quote the command for executing shell script. | | CO5 | R | 1 |
| 9. | Summarize **“eval Command”.** | | CO5 | U | 1 |
| 10. | Define Signal in linux programming. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Enumerate three features of Linux programming. | | CO1 | R | 3 |
| 12. | Compare and contrast touch and cat command used in file system. | | CO2 | U | 3 |
| 13. | Recite the four commands to save and quit from the Vi Editor. | | CO3 | R | 3 |
| 14. | Choose the appropriate commands to perform the following tasks,  (i) Change case  (ii) Remove new lines | | CO4 | A | 3 |
| 15. | Discuss && and II Logical operators with example. | | CO5 | U | 3 |
| 16. | Show different types of I/O system calls with an example for each. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | List and brief about the components of Linux system. | CO1 | R | 6 |
|  | b. | Illustrate with block diagram about the architecture of Linux in detail. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18 | a. | Explain in detail about:   1. Process management 2. killing process with signals | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Brief note on the commands given below with two attributes and examples for each:   1. Zip 2. Gzip 3. Gunzip 4. Tar | CO2 | R | 8 |
|  | b. | Construct command for the following operations:   1. Display specified month and year using calendar command 2. Display current date’s month in number format using date command 3. Display Manual page 4. To Perform calculation | CO2 | A | 4 |
|  |  |  |  |  |  |
| 20. | a. | Construct code in VI Editor to append the content of file to another file by using Cut, Copy, Paste commands with an example. | CO3 | A | 6 |
|  | b. | Illustrate the commands used in vi editor to perform the following operations:  (i) To find a word.  (ii) Replace a word in a file.  (ii) Replace a word with an interval. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | Apply GREP command to perform the following:  (i) Search for a particular word in a file and display the number of occurrences.  (ii) Display only the matched pattern.  (iii) Invert the pattern match. | CO4 | A | 6 |
|  | b. | Determine SED commands for the given tasks :  File Content:  1 “unix is great os. unix is open source. unix is a free operating system.unix is easy to learn.unix is a multiuser os.  2 Learn unix.  3 unix is a powerful”  Tasks:  (a) Replace “unix” with “linux” for all occurrences.  (b) Print the replaced lines.  (c) Delete last two lines by using range command.  (d) Parentheses first character of each word. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | Summarize UNIQ command with four attributes and an example for each. | CO4 | U | 8 |
|  | b. | Define filters and write short notes on the following with an example.   1. Cat 2. Tac 3. Sort 4. Translation | CO4 | R | 4 |
|  |  |  |  |  |  |
| 23. | a. | Simulate the following operations by using Read Command:   1. Read multiple variables from user without echo command   Variable names are : name1, name2, name3   1. Read Password from user and store it in variable   Variable name : Pswd   1. Read array without echo and display ‘0’ , ‘4’ indexed array values   Variable name : arr   1. Limit the length of the input by 4 2. Read using timed input and the time specified is 3 seconds | CO5 | A | 10 |
|  | b. | Name two features of shell programming | CO5 | R | 2 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain in detail about unmask command and demonstrate how to modify file permissions during creation. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Documentation will demonstrate good organization and readability |
| CO2 | File processing projects will require data organization, problem solving and research. |
| CO3 | Scripts and programs will demonstrate simple effective user interfaces. |
| CO4 | Scripts and programs will demonstrate effective use of structured programming. |
| CO5 | Scripts and programs will be accompanied by printed output demonstrating completion of a test plan. |
| CO6 | Testing will demonstrate both black and glass box testing strategies |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 10 | 1 | 6 | - | - | - | 17 |
| CO2 | 9 | 7 | 13 | - | - | - | 29 |
| CO3 | 4 | 6 | 6 | - | - | - | 16 |
| CO4 | 5 | 8 | 16 | - | - | - | 29 |
| CO5 | 3 | 4 | 10 | - | - | - | 17 |
| CO6 | 1 | 3 | 12 | - | - | - | 16 |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **21EC2028** | **Duration** | **3hrs** |
| **Course Name** | **DATA ANALYTICS AND DATA VISUALIZATION** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define Data Science. | | CO1 | R | 1 |
| 2. | Compare primary and secondary data collection techniques. | | CO1 | U | 1 |
| 3. | Determine the output of the following code snippet:  set={5,7,9,11,13}  print(set[3]) | | CO2 | A | 1 |
| 4. | Name a python library to handle multidimensional array. | | CO2 | R | 1 |
| 5. | List any two open data sources. | | CO3 | R | 1 |
| 6. | Explain environmental data science. | | CO3 | U | 1 |
| 7. | Indicate the importance of function in Python. | | CO4 | U | 1 |
| 8. | Write the output of the following Python code.  dict = {"james":10, "davis":15}  dict["james"] | | CO4 | A | 1 |
| 9. | Define data visualization. | | CO5 | R | 1 |
| 10. | Define a dashboard. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Calculate the sensitivity and specificity of the machine learning classifier whose TP=464, TN=672, FP=161, FN=41. | | CO1 | A | 3 |
| 12. | List the advantages of R programming. | | CO2 | R | 3 |
| 13. | Compare quantitative data and qualitative data. | | CO3 | U | 3 |
| 14. | Explain Python user-defined function with syntax. | | CO4 | U | 3 |
| 15. | Write any three big data visualization tools. | | CO5 | A | 3 |
| 16. | List the characteristics of a dashboard. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Summarize the pipeline of data science process with necessary examples. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Classify the operators in python and explain all the operators with an example. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. | a. | Describe k-means clustering algorithm in detail with necessary illustrations. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 20. | a. | Explain the role of data science in the growth of E-Commerce. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Write a python code for the following operations by considering two tuples tup1 = (2,4,5,7,8,1,2,4,6,4), tup2 = (11,3,1,8,3,7,21,6,5,13).   1. Concatenate and print the above two tuples. 2. Repeat the elements of tuple ‘tup1’ four times. 3. Calculate the number of occurrences of an element ‘2’ in the tuple ‘tup1’. 4. Find the minimum value of the tuple ‘tup2’. 5. Arrange the elements of ‘tup2’ in descending order. 6. Find the number of elements present in ‘tup2’. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Explain the function parameters with python code. | CO4 | A | 6 |
|  | b. | Develop a python code for designing a simple calculator. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Explain visual encodings with the appropriate examples, and make use of Bertin’s visual variables. | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the steps to be followed for designing dashboards for usability. | CO6 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Design and create data visualizations. |
| CO2 | Conduct exploratory data analysis using visualization. |
| CO3 | Use knowledge of perception and cognition to evaluate visualization design alternatives. |
| CO4 | Design and evaluate color palettes for visualization based on principles of perception. |
| CO5 | Identify opportunities for application of data visualization theory and principles. |
| CO6 | Critique existing visualizations based on design information dashboard. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 25 | 3 | - | - | - | 29 |
| CO2 | 4 | 12 | 1 | - | - | - | 17 |
| CO3 | 1 | 4 | 12 | - | - | - | 17 |
| CO4 | - | 4 | 25 | - | - | - | 29 |
| CO5 | 1 | - | 15 | - | - | - | 16 |
| CO6 | 4 | 12 | - | - | - | - | 16 |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **21EC2029** | **Duration** | **3hrs** |
| **Course Name** | **HIGH PERFORMANCE COMPUTING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Name the mechanism to ensure data reliability through redundancy and protection in storage unit. | | CO1 | R | 1 |
| 2. | Indicate the performance metric that indicates the raw computational power of a supercomputer. | | CO1 | U | 1 |
| 3. | Identify the unit of the computing node that fetches instructions from memory, decodes and manages the execution of operations. | | CO2 | R | 1 |
| 4. | State the architecture used in vector processors. | | CO2 | R | 1 |
| 5. | Select a programming model used to create multithreaded applications for shared memory systems. | | CO3 | R | 1 |
| 6. | Predict the network in which the nodes are connected with global and local interconnect. | | CO3 | A | 1 |
| 7. | Which model analyses the complexity in parallel execution of an algorithm? | | CO4 | R | 1 |
| 8. | Name the scheduling mechanism in which high priority task using the CPU time over a low priority task. | | CO4 | R | 1 |
| 9. | Identify the OS structure in which the interfacing single large kernel manages all system services and functionalities. | | CO5 | R | 1 |
| 10. | Indicate the term for the process of preparing and cleaning data for analysis in Big Data projects. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Define High Performance Computing and give some applications. | | CO1 | R | 3 |
| 12. | Discuss briefly on distributed memory parallel architecture. | | CO2 | U | 3 |
| 13. | Paraphrase the key characteristics of shared memory computer. | | CO3 | U | 3 |
| 14. | State the term OS jitter. Why is it a concern in a high-performance computing system? | | CO4 | R | 3 |
| 15. | Differentiate between a process from a thread. | | CO5 | An | 3 |
| 16. | Summarize on the three primary characteristics of Big Data often referred as the 3 Vs. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Describe the key components and their functions in the anatomy of a supercomputer. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Illustrate the different forms of parallel computing and give its characteristics. | CO2 | An | 6 |
|  | b. | Explain Flynn’s classification in the context of modern parallel computing systems. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Explain the hybrid memory computer model used in parallel computing. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 20. | a. | Explain the random-access machine model (RAM) for analyzing the performance of serial algorithms. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Discuss the Fork-Join algorithm and describe how they facilitate the execution of tasks in parallel. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. | a. | Describe any six services provided by operating system in detail. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Consider the following set of processes with the length of the CPU burst time given in milliseconds.   |  |  |  | | --- | --- | --- | | **Process** | **Burst Time** | **Priority** | | P1 | 6 | 1 | | P2 | 2 | 4 | | P3 | 8 | 2 | | P4 | 3 | 5 | | P5 | 4 | 3 |  1. Draw the Gantt chart for the following scheduling algorithms First Come First Served, Shortest Job First, Priority and Round robin with a time slice of 2 ms. 2. Also calculate the average waiting time and average turn-around time for each algorithm | CO4 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain Big Data lifecycle and discuss the key activities, challenges and best practices associated with each stage. | CO6 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **COURSE OUTCOMES** | | | | | | | | |
| CO1 | Understand the architecture of computing technology | | | | | | | | |
| CO2 | Recognize the various parallel HPC architecture families | | | | | | | | |
| CO3 | Demonstrate the architectural features of parallel computers | | | | | | | | |
| CO4 | Analyse and assess the performance of HPC applications | | | | | | | | |
| CO5 | Define the emerging trends in computing technology | | | | | | | | |
| CO6 | Interpret the impact of HPC for big data processing | | | | | | | | |
| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | | | |
| **CO / P** | | | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | | | 4 | 13 |  |  |  |  | 17 |
| CO2 | | | 2 | 9 |  | 6 |  |  | 17 |
| CO3 | | | 1 | 3 | 1 | 12 |  |  | 17 |
| CO4 | | | 5 |  | 24 |  |  |  | 29 |
| CO5 | | | 1 | 24 |  | 3 |  |  | 28 |
| CO6 | | |  | 16 |  |  |  |  | 16 |
|  | | | | | | | | | **124** |



|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **21EC2032** | **Duration** | **3hrs** |
| **Course Name** | **COMPUTER VISION** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define smoothing in a spatial domain image enhancement technique. | | CO1 | R | 1 |
| 2. | List the morphological operations in binary image processing. | | CO1 | R | 1 |
| 3. | State the formula to compute the chessboard distance. | | CO2 | R | 1 |
| 4. | Define shape from shading. | | CO2 | R | 1 |
| 5. | Calculate the length for the given boundary. | | CO3 | A | 1 |
| 6. | Define area of a region. | | CO3 | R | 1 |
| 7. | Recall the formula for classification accuracy | | CO4 | R | 1 |
| 8. | Indicate the applications of Hough Transform. | | CO4 | U | 1 |
| 9. | Enumerate the term “motion estimation”. | | CO5 | R | 1 |
| 10. | Identify the projection that show more than one side of an object. | | CO5 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Enumerate the importance of thresholding. | | CO1 | R | 3 |
| 12. | Illustrate Thinning operation in image processing. | | CO2 | U | 3 |
| 13. | Predict boundary descriptors for the given boundary. | | CO3 | U | 3 |
| 14. | Summarize the line detection process using RANSAC. | | CO4 | U | 3 |
| 15. | Paraphrase photometric stereo process. | | CO5 | U | 3 |
| 16. | Discuss the lane detection process in In-vehicle vision system. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain spatial filters in detail with necessary equations and diagrams. | CO1 | U | 6 |
|  | b. | Employ morphological operations on any binary image.  With the structuring element as follows. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | Discuss the relationship between pixels. | CO2 | U | 4 |
|  | b. | An image set is shown below. Let V be the set of gray level values used to define the connectivity in the image. Compute D4, D8 and Dm distances between pixels P and Q for V = (0,1). | CO2 | A | 8 |
|  |  |  |  |  |  |
| 19. | a. | Develop the chain code for the given boundary of an object | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Apply Hough Transform and examine whether the points (1,2), (2,  3) and C (3, 4) are collinear. Also find the equation of the line on which these points lie. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Describe the different projection schemes in 3D vision in detail. | CO5 | U | 8 |
|  | b. | Summarize the problems faced in 3D recognition model. | CO5 | U | 4 |
|  |  |  |  |  |  |
| 22. | a. | Explain the fundamental steps in facial detection and recognition system in detail. | CO1 | U | 8 |
|  | b. | Summarize the feature extraction method for categorizing textures. | CO1 | U | 4 |
|  |  |  |  |  |  |
| 23. | a. | Explain the boundary, region and Fourier descriptors in detail. | CO3 | U | 12 |
|  |  |  |  |  |  |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Discuss the methods to locate pedestrian in lane detection system | CO6 | U | 8 |
|  | b. | Summarize the importance of Chamfer Matching in image processing | CO6 | U | 4 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Implement fundamental image processing techniques required for computer vision. |
| CO2 | Perform shape analysis and to Implement boundary tracking techniques. |
| CO3 | Apply chain codes and other region descriptors. |
| CO4 | Apply Hough Transform for line, circle, and ellipse detections. |
| CO5 | Apply 3D vision techniques and Implement motion related techniques. |
| CO6 | Develop applications using computer vision techniques. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 5 | 18 | 6 | - | - | - | 29 |
| CO2 | 2 | 7 | 8 | - | - | - | 17 |
| CO3 | 1 | 15 | 13 | - | - | - | 29 |
| CO4 | 1 | 4 | 12 | - | - | - | 17 |
| CO5 | 2 | 15 | - | - | - | - | 17 |
| CO6 | - | 15 | - | - | - | - | 15 |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **22EC1001** | **Duration** | **3hrs** |
| **Course Name** | **PHYSICAL ELECTRONICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define the term “pitch”. | | CO1 | R | 1 |
| 2. | Consider two speakers are connected in parallel with the impedances of Z1= 2 Ω and Z2= 2 Ω. Find the equivalent impedance Z in ohms. | | CO1 | E | 1 |
| 3. | Give examples for low-pitched sound. | | CO2 | U | 1 |
| 4. | Write the units for Loudness. | | CO2 | U | 1 |
| 5. | List the methods of Ultrasonics production. | | CO3 | R | 1 |
| 6. | Write the advantages of solar cells. | | CO3 | A | 1 |
| 7. | Predict the maximum open circuit voltage of a solar cell. | | CO4 | E | 1 |
| 8. | Label the parts of wind turbine with a neat diagram. | | CO4 | R | 1 |
| 9. | List any two properties of superconductor. | | CO5 | R | 1 |
| 10. | Write the drawbacks of fuel cell. | | CO6 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Estimate the intensity of sound in decibels, if I/IO=4.5 | | CO1 | E | 3 |
| 12. | Calculate the reverberation time (T), if the volume of room is 1000 m3 and absorption co-efficient to be 99 sabin. | | CO2 | A | 3 |
| 13. | What is “Inverse Piezoelectric effect”? | | CO3 | R | 3 |
| 14. | Define cavitation in ultrasonic cleaning. | | CO4 | R | 3 |
| 15. | Reproduce the block diagram of tidal energy harvester. | | CO5 | R | 3 |
| 16. | List the applications of LASER. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the factors affecting acoustics of sound and its remedies. | CO1 | A | 8 |
|  | b. | Discuss briefly about the magnetostriction effect. | CO1 | U | 4 |
| 18. | a. | Construct the cross-schematic diagram of speaker and explain its working principle. | CO2 | A | 7 |
|  | b. | Write the properties of ultrasonic waves. | CO2 | A | 5 |
| 19. |  | Explain the working principle of wind-diesel hybrid system with a neat diagram. | CO3 | U | 12 |
| 20. |  | Classify and correlate the non-destructive testing using ultrasonics. | CO4 | U | 12 |
| 21. | a. | Explain the mechanism, classification and applications of fuel cell. | CO5 | An | 6 |
|  | b. | Explain the principles and properties of superconductivity. | CO5 | A | 6 |
| 22. |  | Express the equation for energy density ρ(r) using Einstein’s Co-efficient. | CO5 | C | 12 |
| 23. | a. | Paraphrase the working principle of CO2 laser with neat sketch. | CO6 | U | 6 |
|  | b | Explain the arrangement and working of G.P Thomson experiment. | CO6 | An | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Describe the basic components and working principle of scanning electron microscope. | CO6 | R | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the concept of lasers and apply laser action in electronic |
| CO2 | Discern the laws governing acoustics and implement the same in creating better environment for workers in electronics and communication industries. |
| CO3 | Apply non-destructive testing techniques in the field of electronics industry. |
| CO4 | Create efficient electronics industrial applications by applying the principles of superconducting materials. |
| CO5 | Infer the knowledge of Renewable energy sources and devices. |
| CO6 | Apply the basic concepts of quantum mechanics in devices such as Single Electron Transistor. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 4 | 8 |  | 4 |  | 17 |
| CO2 | 0 | 2 | 15 |  |  |  | 17 |
| CO3 | 4 | 12 | 1 |  |  |  | 17 |
| CO4 | 4 | 12 | 6 |  | 1 |  | 22 |
| CO5 | 3 | 8 | 12 |  |  |  | 23 |
| CO6 | 15 | 6 | 1 | 6 |  |  | 28 |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **22EC1004** | **Duration** | **3hrs** |
| **Course Name** | **FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | A bulb has a power of 500W. Compute the energy dissipated by it in 2 minutes. | | CO1 | A | 1 |
| 2. | Identify the efficiency of thermal power plants. | | CO1 | U | 1 |
| 3. | List the applications of stepper motors. | | CO2 | R | 1 |
| 4. | Identify the motor used in electric trains. | | CO2 | U | 1 |
| 5. | Name the semiconductor material used for making yellow and green LEDs. | | CO3 | R | 1 |
| 6. | Identify the working principle behind relays. | | CO3 | U | 1 |
| 7. | Interpret the logic circuit that can remember a previous output. | | CO4 | A | 1 |
| 8. | Identify the function of ALU. | | CO4 | U | 1 |
| 9. | Name the sensor used for altitude and pressure measurement in aircraft. | | CO5 | R | 1 |
| 10. | Identify a key technology used in 4G communication. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Determine the cost of the electricity needed to operate a refrigerator of 750W for a day if the rate charged for electricity is Rupees 6/ kWh. | | CO1 | A | 3 |
| 12. | Discuss the major parts of a rotor in a DC generator. | | CO2 | U | 3 |
| 13. | Determine the color bands on the following resistors having a 5% tolerance.  i) 22 kΩ ii) 150 kΩ | | CO3 | A | 3 |
| 14. | Compare sequential and combinational circuits. | | CO4 | An | 3 |
| 15. | Sketch blocks of a measurement system. | | CO5 | A | 3 |
| 16. | Compare and contrast 4G and 5G mobile technologies. | | CO6 | An | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the working principle of an induction-type energy meter with a neat diagram. | CO1 | U | 10 |
|  | b. | List any two advantages of a three-phase supply. | CO1 | R | 2 |
|  |  |  |  |  |  |
| 18. | a. | Explain with illustrations, the construction and working of DC motors. | CO2 | U | 10 |
|  | b. | List a few applications of DC motors. | CO2 | R | 2 |
|  |  |  |  |  |  |
| 19. | a. | Explain the construction and operation of the PN junction diode using the suitable circuit diagram. | CO3 | U | 10 |
|  | b. | Sketch the IV characteristics of the PN junction diode. | CO3 | R | 2 |
|  |  |  |  |  |  |
| 20. | a. | Illustrate the workings of a Full Adder with truth tables and logical circuit diagrams. | CO4 | An | 10 |
|  | b. | Articulate the Boolean expressions of half adder. | CO4 | A | 2 |
|  |  |  |  |  |  |
| 21. | a. | Appraise on the imaging techniques involved in Ultrasound scanners using a block diagram. | CO5 | An | 10 |
|  | b. | List the different types of sensors. | CO5 | R | 2 |
|  |  |  |  |  |  |
| 22. | a. | Differentiate active and passive electronic components in detail. | CO3 | An | 10 |
|  | b. | List a few examples of active components. | CO3 | R | 2 |
|  |  |  |  |  |  |
| 23. | a. | With illustration,describe the working of a thermal power plant. | CO1 | U | 10 |
|  | b. | Differentiate between Conventional and Non-Conventional Energy Sources. | CO1 | An | 2 |
| COMPULSORY QUESTION | | | | | |
| 24. | a. | Explain briefly the various blocks of satellite communication with relevant diagrams. | CO6 | An | 10 |
|  | b. | Discuss different types of satellites. | CO6 | U | 2 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Recognize the importance and judicious use of energy systems in everyday life. |
| CO2 | Identify the types of electrical machines used for various applications. |
| CO3 | Understand and apply the concept of electronics to design simple circuits. |
| CO4 | Understand and relate various digital circuits. |
| CO5 | Understand the various sensing and instrumentation applications. |
| CO6 | Identify the various generations of wireless communication. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | 21 | 4 | 2 | - | - | 29 |
| CO2 | 3 | 14 | - | - | - | - | 17 |
| CO3 | 5 | 11 | 3 | 10 | - | - | 29 |
| CO4 | - | 1 | 3 | 13 | - | - | 17 |
| CO5 | 3 | - | 3 | 10 | - | - | 16 |
| CO6 | - | 3 | - | 13 | - | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **22EC2001** | **Duration** | **3hrs** |
| **Course Name** | **INTRODUCTION TO BIG DATA** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | List the advantages and disadvantages of Big Data. | | CO1 | R | 1 |
| 2. | List the significance of the term “velocity” associated with Big Data. | | CO1 | R | 1 |
| 3. | Name the characteristics of real-time systems in Big Data. | | CO2 | R | 1 |
| 4. | Name any two language detection methods in NLP. | | CO2 | R | 1 |
| 5. | Distinguish between “event processing” and “complex event processing”. | | CO3 | An | 1 |
| 6. | Summarize the two types of navigational database models in DBMS. | | CO3 | U | 1 |
| 7. | List the desired resource allocation properties in resource management. | | CO4 | R | 1 |
| 8. | Outline the technical concepts of MapReduce. | | CO4 | U | 1 |
| 9. | List any two security models available in Big Data. | | CO5 | R | 1 |
| 10. | Summarize the need for sentiment analysis in practical applications. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Explain Volume, Veracity and Value in Big Data. | | CO1 | U | 3 |
| 12. | Illustrate the different components available in Hadoop. | | CO2 | U | 3 |
| 13. | Summarize the ACID properties in relational data models. | | CO3 | U | 3 |
| 14. | Distinguish between “rule-based approaches” and “lexicon-based approaches” in sentiment analysis. | | CO4 | An | 3 |
| 15. | Compare device-based sensing and device-free sensing in Big Data. | | CO5 | U | 3 |
| 16. | Explain the role of Big Data in grid applications. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the ideology of any 6Vs necessary for any data to be called as “Big Data”. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Summarize the different concepts and methods for Named Entity Recognition in NLP. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. | a. | Illustrate the different methods for anomaly detection in practical applications. | CO3 | U | 6 |
|  | b. | Compare the different types of Recommender Systems with examples. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Distinguish between column, graph and document based stores in NoSQL data models. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 21. | a. | Summarize the technical concepts and fairness policies of single resource management in the cloud. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 22. | a. | Explain the concepts of splitter and interleaver in Local Resource Shaper. | CO5 | U | 6 |
|  | b. | Illustrate the technical concepts of any two Big Data processing systems and platforms. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 23. | a. | Outline the technical concepts of the models in secured platforms over encrypted Big Data. | CO5 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the role of Big Data in mining Thai public opinions. | CO6 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Understand the basic concepts of big data and its methods. |
| CO2 | Analyze the real-time big data for social media applications. |
| CO3 | Analyze data by its big data infrastructures and platforms. |
| CO4 | Perform analytics on local resource consumption shaping and system optimization. |
| CO5 | Understand the applications in big data security and privacy. |
| CO6 | Comprehend the real data models and its applications. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | 15 | 0 | 0 | 0 | 0 | 17 |
| CO2 | 2 | 15 | 0 | 0 | 0 | 0 | 17 |
| CO3 | 0 | 16 | 0 | 13 | 0 | 0 | 29 |
| CO4 | 1 | 13 | 0 | 3 | 0 | 0 | 17 |
| CO5 | 1 | 27 | 0 | 0 | 0 | 0 | 28 |
| CO6 | 0 | 16 | 0 | 0 | 0 | 0 | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **22EC2002** | **Duration** | **3hrs** |
| **Course Name** | **SOCIAL MEDIA ANALYTICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | List the differences between “deep analysis” and “ad-hoc analysis” in social media. | | CO1 | R | 1 |
| 2. | Distinguish between “velocity of data” and “domain of analysis” in social media. | | CO1 | U | 1 |
| 3. | Enumerate the different types of network models in social media analytics. | | CO2 | R | 1 |
| 4. | List the differences between weakly connected graph and strongly connected graph. | | CO2 | R | 1 |
| 5. | Enumerate the different types of data used for information retrieval. | | CO3 | R | 1 |
| 6. | “Multi-word queries are more accurate than the single word queries”. Justify this statement. | | CO3 | E | 1 |
| 7. | Enumerate the different applications of natural language processing. | | CO4 | R | 1 |
| 8. | Describe the types of learning methods used for sentiment classification. | | CO4 | U | 1 |
| 9. | Differentiate the technical concepts of linkedin and Google+. | | CO5 | U | 1 |
| 10. | List the applications of recommendation systems in social media. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Distinguish between internal social media and external social media with examples. | | CO1 | U | 3 |
| 12. | Describe the different types of connectivity in social graphs. | | CO2 | U | 3 |
| 13. | Distinguish between search engines and meta-search engines in social media. | | CO3 | U | 3 |
| 14. | Explain the technical concept of aspect-based sentiment analysis. | | CO4 | U | 3 |
| 15. | Describe the technical concepts of facebook with necessary diagrams. | | CO5 | U | 3 |
| 16. | Explain the technical concepts of homophily in social data graphs. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the machine capacity and the depth of analysis for different domains of social media data. | CO1 | U | 6 |
|  | b. | Describe the merits and demerits of different social media platforms. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | “Different types of graphs are necessary for different social media applications”. Justify this statement with detailed explanation and mathematical equations. | CO2 | E | 12 |
|  |  |  |  |  |  |
| 19. | a. | Distinguish between breadth-first crawlers and preferential crawlers. | CO4 | An | 4 |
|  | b. | Describe the various web spamming methodologies used in social media analytics. | CO4 | U | 8 |
|  |  |  |  |  |  |
| 20. | a. | Explain the different types of opinions in sentiment analysis. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | “Github is considered as an interest graph instead of social graph”. Justify this statement with mathematical equations. | CO3 | E | 6 |
|  | b. | Describe the characteristic features of Google+ with examples. Include graphical illustrations and mathematical equations wherever necessary. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Summarize the properties of real-world networks with necessary mathematical equations and graphical illustrations. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Explain the technical concepts of classical recommendation algorithms in social media analytics. | CO6 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the process of information retrieval with neat block diagram. Include mathematical equations wherever necessary. | CO3 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | COURSE OUTCOMES |
| CO1 | Understand the concept of social media analytics and its significance. |
| CO2 | Apply web analytics to the realistic data sets. |
| CO3 | Analyze social network data to identify important social actors, subgroups and network properties in social media sites. |
| CO4 | Illustrate solutions to the emerging problems with social media. |
| CO5 | Design new solutions to opinion extraction, sentiment classification problems. |
| CO6 | Summarize the issues in social recommendation systems. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 16 | - | - | - | - | 17 |
| CO2 | 2 | 15 | - | - | 12 | - | 29 |
| CO3 | 1 | 21 | - | - | 7 | - | 29 |
| CO4 | 1 | 12 | - | 4 | - | - | 17 |
| CO5 | - | 16 | - | - | - | - | 16 |
| CO6 | 1 | 15 | - | - | - | - | 16 |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **22EC2005** | **Duration** | **3hrs** |
| **Course Name** | **PATTERN RECOGNITION TECHNIQUES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | List the different machine learning model in pattern recognition. | | CO1 | R | 1 |
| 2. | Identify the different classification methods for PR. | | CO1 | A | 1 |
| 3. | List the steps for sequential forward floating selection. | | CO2 | R | 1 |
| 4. | List the classification methods with the performance measures. | | CO3 | R | 1 |
| 5. | Recall the information gained by selecting attribute Ai to branch or to partition the data and give its expression. | | CO3 | R | 1 |
| 6. | Define binary classification. | | CO4 | R | 1 |
| 7. | Outline the issues with unsupervised learning. | | CO4 | U | 1 |
| 8. | How syntactic analysis is done via parsing? | | CO5 | R | 1 |
| 9. | What is neural network? | | CO5 | R | 1 |
| 10. | List the applications of neural network models. | | CO6 | An | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Define dimensionality reduction with an example. | | CO1 | R | 3 |
| 12. | Infer the bottleneck of sequential backward selection. | | CO2 | R | 3 |
| 13. | Find the value of entropy for the data set D has 20% positive and 80% negative. | | CO3 | R | 3 |
| 14. | What are the problems associated with clustering? | | CO4 | R | 3 |
| 15. | Interpret Kuhn – tucker condition for optimization in SVM. | | CO5 | E | 3 |
| 16. | List two main algorithms used to combine multiple classifiers to produce a better classifier. | | CO6 | An | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Interpret the selection of texture features for classifying Synthetic Aperture Radar images. | CO1 | U | 3 |
|  | b. | Explain about different phases in pattern recognition systems. Brief about the activities for designing the pattern recognition systems. | CO2 | U | 9 |
|  |  |  |  |  |  |
| 18. | a. | List the taxonomy of feature selection algorithms. | CO2 | R | 2 |
|  | b. | Explain the different types of feature selection and feature extraction with an example. | CO2 | U | 10 |
|  |  |  |  |  |  |
| 19. | a. | Explain the following terms,   1. Precision and recall ii. F1 value iii. ROC curve   Sensitivity and specificity | CO4 | U | 6 |
|  | b. | Evaluate ‘k=6 (6NN)’ for three different organization such as,  Government (A) = 10  Science (B) = 12  Arts (C) = 8  Create a new point with the condition of using k-nearest neighbor classification (kNN) with the algorithm. | CO4 | E | 6 |
|  |  |  |  |  |  |
| 20. | a. | Develop a continuous attribute by splitting into two intervals at each node in continuous space and avoid over fitting in classification. | CO4 | A | 4 |
|  | b. | Explain about the decision tree algorithm and how to choose an attribute to partition data with an example. | CO2 | U | 8 |
|  |  |  |  |  |  |
| 21. | a. | Explain in brief about unsupervised learning and data clustering with an example. | CO4 | U | 9 |
|  | b. | List the main advantages of model-based clustering. | CO4 | An | 3 |
|  |  |  |  |  |  |
| 22. | a. | Examine syntactic pattern recognition of realistic problems with an example. | CO5 | An | 6 |
|  | b. | Explain the following,   1. Syntactic recognition via parsing 2. Syntactic recognition via graphical approaches | CO5 | U | 6 |
|  |  |  |  |  |  |
| 23. | a. | Classify the different types of neural networks and how significantly used for training process. | CO5 | An | 8 |
|  | b. | Infer the term long short term memory network. | CO6 | U | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain in brief about support vector machine algorithm and compute the margin based on separable cases. | CO6 | U | 6 |
|  | b. | Estimate the optimization problem used in SVM algorithm. | CO6 | C | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Understand the basic pattern recognition techniques. |
| CO2 | Implement simple pattern classifiers, classifier combinations, and structural pattern recognizers. |
| CO3 | Realize the learning and clustering concepts |
| CO4 | Explain and compare a variety of pattern classification and structural pattern recognition |
| CO5 | Identify and solve engineering problems. |
| CO6 | Apply pattern recognition techniques to real-world problems such as document analysis and recognition |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 4 | 3 | 1 | - | - | - | 8 |
| CO2 | 6 | 27 | - | - | - | - | 33 |
| CO3 | 5 | - | - | - | - | - | 5 |
| CO4 | 4 | 16 | 4 | 3 | 6 | - | 33 |
| CO5 | 2 | 6 | - | 14 | 3 | - | 25 |
| CO6 | - | 10 | - | 4 | - | - | 20 |
|  | | | | | | | **124** |



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| **Course Code** | **22EC2006** | **Duration** | **3hrs** |
| **Course Name** | **DEEP LEARNING** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | List the two major applications of unsupervised learning methods. | | CO1 | R | 1 |
| 2. | Distinguish between classification and regression in machine learning. | | CO1 | U | 1 |
| 3. | Enumerate the different parameters used in deep neural networks. | | CO2 | R | 1 |
| 4. | List the differences between sigmoidal and tanh activation function. | | CO2 | R | 1 |
| 5. | Enumerate the various types of pooling methods in convolutional neural networks. | | CO3 | R | 1 |
| 6. | “The size of the filter should not be higher than the size of the input image in convolutional neural network”. Justify this statement. | | CO3 | E | 1 |
| 7. | Enumerate the different types of unsupervised deep neural networks. | | CO4 | R | 1 |
| 8. | Describe the types of generative AI methods. | | CO4 | U | 1 |
| 9. | Differentiate single class and multi-class classification methods. | | CO5 | U | 1 |
| 10. | List the applications of recurrent neural networks. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Distinguish between supervised and unsupervised learning algorithms. | | CO1 | U | 3 |
| 12. | Describe the different types of loss functions with mathematical equations. | | CO2 | U | 3 |
| 13. | Distinguish between fully connected layer and convolutional layer in convolutional neural networks. | | CO3 | U | 3 |
| 14. | Explain the technical concept of deep belief network with neat architecture. | | CO4 | U | 3 |
| 15. | Describe the procedure for fixing the number of neurons in the input and the output layer of deep neural networks. | | CO5 | U | 3 |
| 16. | Explain the application of deep neural networks in speech recognition with a block diagram. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Distinguish between machine learning and deep learning methods. | CO1 | U | 6 |
|  | b. | Describe the technical concepts of unsupervised learning methodologies along with their merits and demerits. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | “Selection of the optimizers for the training process is based on accuracy and convergence”. Justify this statement with detailed explanation and mathematical equations. | CO2 | E | 12 |
|  |  |  |  |  |  |
| 19. | a. | Distinguish between denoising and variational autoencoders. | CO4 | An | 4 |
|  | b. | Describe the operation of generative adversarial networks with block diagram. | CO4 | U | 8 |
|  |  |  |  |  |  |
| 20. | a. | Explain the step-by-step process of building a deep neural model for practical applications. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | “L1/L2 regularization methods are used for avoiding overfitting/underfitting problems in deep neural networks”. Justify this statement with mathematical equations. | CO3 | E | 6 |
|  | b. | Describe Alexnet and Resnet with necessary architectures and mathematical equations. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Summarize the different types of hyperparameters with necessary diagrams and mathematical equations. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Explain the application of deep neural networks in sentiment analysis with necessary diagrams. | CO6 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the architecture and the training process of convolutional neural networks with neat diagrams and mathematical equations. | CO3 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | 1. Understand basics of machine learning and deep learning. |
| CO2 | 1. Gain an understanding on fundamentals of deep networks. |
| CO3 | 1. Identify and implement suitable deep learning architectures to solve real-time problems. |
| CO4 | 1. Develop an understanding on Convolutional Neural Network and its application. |
| CO5 | 1. Outline the basic concepts in tuning deep networks. |
| CO6 | Explore the deep learning applications. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 16 | - | - | - | - | 17 |
| CO2 | 2 | 15 | - | - | 12 | - | 29 |
| CO3 | 1 | 21 | - | - | 7 | - | 29 |
| CO4 | 1 | 12 | - | 4 | - | - | 17 |
| CO5 | - | 16 | - | - | - | - | 16 |
| CO6 | 1 | 15 | - | - | - | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **22EC2007** | **Duration** | **3hrs** |
| **Course Name** | **NATURAL LANGUAGE PROCESSING.** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define Natural Language Processing with an example. | | CO1 | R | 1 |
| 2. | Discuss the term tokenization. | | CO1 | U | 1 |
| 3. | Describe the smart process in creating large vocabulary of speech with an example. | | CO2 | U | 1 |
| 4. | Explain the objective of speech enhancement with real time application. | | CO2 | U | 1 |
| 5. | Discuss the Probabilistic Context- Free Grammar (PCFG) with the help of four parameters. | | CO3 | U | 1 |
| 6. | Describe the term consistency in syntax parsing with an example. | | CO3 | U | 1 |
| 7. | Explain semantic analysis with the process of linguistic inputs and meaning of representation. | | CO4 | U | 1 |
| 8. | Describe word sense ambiguation in choosing the right sense word with an example. | | CO4 | U | 1 |
| 9. | Explain the turn taking rule with an example. | | CO5 | U | 1 |
| 10. | Illustrate named entity recognition with an example. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | List the important challenges faced by Natural Language Processing. | | CO1 | R | 3 |
| 12. | Sketch and explain the block diagram of vocal system with speech production in detail. | | CO2 | A | 3 |
| 13. | Differentiate between right and left linear grammar with an example each. | | CO3 | U | 3 |
| 14. | Explain the canonical form in assigning multiple meaning for a single sentence with an example. | | CO4 | U | 3 |
| 15. | Differentiate between Brown Corpus and British National Corpus. | | CO5 | U | 3 |
| 16. | Recall the concepts of evaluation in performance of ranked system for Precision and Fallout. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Define strings. And discuss the regular expressions patterns with examples. | CO1 | R | 6 |
|  | b. | Explain the different Parts of Speech Tagging with related examples. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Illustrate on various concepts faced in Automatic Speech Recognition with an example. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. | a. | Describe about feature unification operator and its structure with examples. | CO3 | R | 6 |
|  | b. | Explain in detail about Chomsky hierarchy a computational linguistic model in complexity. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Discuss Computational semantics with a parse tree example. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Describe the coherence resolution in computational resources with examples. | CO5 | R | 6 |
|  | b. | Explain the port stemmer with examples for information retrieval and to improve the performance of information. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Explain the words and transducers in morphological parsing with examples in detail. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Describe the syntax tree for an example “book that flight” using Top down parsing. | CO2 | R | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Discuss the system of Information extraction with real time applications in detail. | CO6 | U | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Build a tag for the given text with basic Language features. |
| CO2 | Design an innovative application using NLP components. |
| CO3 | Understand the rule-based system to tackle morphology/syntax of a language. |
| CO4 | Apply the tag set for statistical processing of real-time applications. |
| CO5 | Comprehend the use of different statistical approaches for different types of NLP applications. |
| CO6 | Understand the applications of the NLP techniques. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 10 | 19 | - | - | - | - | 29 |
| CO2 | 12 | 14 | 3 | - | - | - | 29 |
| CO3 | 6 | 11 | - | - | - | - | 17 |
| CO4 | - | 17 | - | - | - | - | 17 |
| CO5 | 6 | 10 | - | - | - | - | 16 |
| CO6 | 3 | 13 | - | - | - | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **22EC2012** | **Duration** | **3hrs** |
| **Course Name** | **ELECTROMAGNETIC FIELDS AND WAVES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Find the vector function A ⃗ = 3y4z2 ax + 4x3z2 ay + 3x2y2az is solenoidal. | | CO1 | R | 1 |
| 2. | Express the equation of the differential volume element in terms of spherical co-ordinate system. | | CO2 | C | 1 |
| 3. | Discuss the concept of electric flux. | | CO2 | U | 1 |
| 4. | Write the relationship between electric field and potential. | | CO3 | A | 1 |
| 5. | Interpret the condition of the magnetic torque. | | CO4 | A | 1 |
| 6. | Differentiate between HFSS and CADFEKO. | | CO4 | U | 1 |
| 7. | List out the relative permeability value of paramagnetic material. | | CO5 | R | 1 |
| 8. | Define Poynting vector. | | CO5 | R | 1 |
| 9. | Express Maxwell’s equation from Ampere’s law. | | CO6 | C | 1 |
| 10. | Write the wave equations in conducting medium. | | CO6 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Find the divergence of function *V = xy ax + 2yz ay + 3zx az* at point  (-1, -1, 2). | | CO1 | R | 3 |
| 12. | Differentiate Poisson’s equation and Laplace’s equation. | | CO2 | U | 3 |
| 13. | Evaluate energy density of magnetic field. | | CO3 | E | 3 |
| 14. | Illustrate the Faraday’s Law. | | CO4 | U | 3 |
| 15. | Classify the different kinds of inductance. | | CO5 | U | 3 |
| 16. | Examine the concept of uniform plane wave. | | CO6 | E | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Describe the conditions for two vectors A and B to be parallel and perpendicular. | CO1 | R | 2 |
|  | b. | Evaluate the divergence theorem with a neat sketch.  = | CO1 | An | 10 |
|  |  |  |  |  |  |
| 18. | a. | Show that the following conditions,   1. is a conservative vector field. | CO2 | U | 9 |
|  | b. | State stoke’s theorem. | CO2 | R | 3 |
|  |  |  |  |  |  |
| 19. | a. | State and prove the Gauss’s law with a neat sketch. | CO3 | R | 8 |
|  | b. | Discuss the following charge distribution with an expression,   1. Linear charge density 2. Surface charge density 3. Volume charge density | CO3 | U | 4 |
|  |  |  |  |  |  |
| 20. | a. | Explain that the boundary condition between two dielectric media,   1. Et1 = Et2 ii) = | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Determine the inductance of long wire in cylinder with a neat sketch. | CO4 | A | 8 |
|  | b. | Discuss about the electromagnetic induction. | CO4 | U | 4 |
|  |  |  |  |  |  |
| 22. | a. | Define Maxwell’s equation. Derive any two equations with justification. | CO5 | R | 8 |
|  | b. | Infer the standing wave equation when electromagnetic wave incident normally on a perfect conductor. | CO5 | U | 4 |
|  |  |  |  |  |  |
| 23. | a. | Express the condition for the power flow per unit area, P = E X H. | CO5 | C | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Describe the wave propagation in good dielectric and good conductor. | CO6 | R | 4 |
|  | b. | Explain the different types of polarization with a neat sketch. | CO6 | U | 8 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** | | | | | | | | |
| CO1 | Demonstrate an ability to apply the co-ordinate systems and are familiar with the different vector operators. | | | | | | | | |
| CO2 | Gained the knowledge on the concepts of electric fields. | | | | | | | | |
| CO3 | Design the magnetic flux density from the Biot-Savart’s law and the Ampere’s circuital law. | | | | | | | | |
| CO4 | Determined the electromagnetic induction with EM tools. | | | | | | | | |
| CO5 | Acquire the different methods of EMF generation and Maxwell’s equations. | | | | | | | | |
| CO6 | Illustration of electromagnetic waves in different mediums. | | | | | | | | |
| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | | | |
| **CO / P** | | | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | | | 6 | - | - | 10 | - | - | 16 |
| CO2 | | | 3 | 13 | - | - | - | 1 | 17 |
| CO3 | | | 8 | 4 | 1 | - | 3 | - | 16 |
| CO4 | | | - | 20 | 9 | - | - | - | 29 |
| CO5 | | | 10 | 7 | - | - | - | 12 | 29 |
| CO6 | | | 4 | 8 | 1 | - | 3 | 1 | 17 |
|  | | | | | | | | | **124** |



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| **Course Code** | **22EC2013** | **Duration** | **3hrs** |
| **Course Name** | **DIGITAL SYSTEM DESIGN** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Identify the radix of the decimal number system. | | CO1 | R | 1 |
| 2. | Estimate the 2’s complement of (0011)2. | | CO1 | U | 1 |
| 3. | Determine the difference and borrow output of A-B when A=0 and B=1. | | CO2 | A | 1 |
| 4. | Determine the number of full adders required to add two 4-bit numbers using serial adder. | | CO2 | A | 1 |
| 5. | Identify the name of the single bit storage device that is edge triggered. | | CO3 | U | 1 |
| 6. | Determine the number of clock pulses required to read a 4-bit data in shift register using SIPO. | | CO3 | A | 1 |
| 7. | Name the type of counter in which the first flipflop is triggered by an external clock pulse and the output triggers the next flipflop. | | CO4 | R | 1 |
| 8. | Identify the type of state diagram in which the output depends only upon the present state. | | CO4 | U | 1 |
| 9. | Identify the type of logic family which has high speed of operation. | | CO5 | U | 1 |
| 10. | Name any one type of Nonvolatile memory. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Determine the Boolean expression and truth table for the logic diagram shown in Figure 1.    **Figure 1** | | CO1 | A | 3 |
| 12. | Design a 1 to 2 demultiplexer. | | CO2 | A | 3 |
| 13. | Define hazard and list the different types of hazards. | | CO3 | R | 3 |
| 14. | Differentiate Ring counter from Johnson counter. | | CO4 | U | 3 |
| 15. | Design NOR gate using CMOS logic Family. | | CO5 | A | 3 |
| 16. | List the different types of PLDs and mention the architectural difference between them. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Simplify the following using Boolean algebra. | CO1 | A | 6 |
|  | b. | Convert (128)10 into corresponding binary, octal and hexadecimal number system. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Construct a 4x3 binary multiplier and explain its operation. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Design a 3-bit binary ripple up counter. | CO3 | A | 6 |
|  | b. | Define pulse width, cycle, setup time and hold time using neat timing waveform. | CO3 | R | 6 |
|  |  |  |  |  |  |
| 20. | a. | Design a sequential circuit for the state diagram shown in Figure 2 using T flip-flop.  E:\official\LMS\moore.png  **Figure 2** | CO3 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Classify Digital Integrated circuits based on their integration levels and circuit technology. Explain them. | CO5 | U | 6 |
|  | b. | Design a 3 input NAND gate using totem pole output TTL logic Family. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | Design a full subtractor circuit. | CO2 | A | 6 |
|  | b. | Implement the Function using only NAND gates. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Design a Parallel in Serial out shift register and explain its operation with a neat timing diagram. | CO3 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the write and read operation of memory unit with neat memory cycle timing waveform. | CO6 | U | 6 |
|  | b. | Implement the function Y = A+ AB + ABC using PLA architecture. | CO6 | A | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** | | | | | | | |
| CO1 | Illustrate the basic postulates of Boolean algebra, operation of logic gates and Verilog data types. | | | | | | | |
| CO2 | Design and distinguish various combinational logic circuits | | | | | | | |
| CO3 | Design and compare various sequential logic circuits. | | | | | | | |
| CO4 | Design different types of synchronous counters. | | | | | | | |
| CO5 | Illustrate different logic families. | | | | | | | |
| CO6 | Classify memory devices and identify methods for implementation of logic circuits. | | | | | | | |
| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | | |
| **CO / P** | | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | | 1 | 7 | 15 |  |  |  | 23 |
| CO2 | |  |  | 23 |  |  |  | 23 |
| CO3 | | 9 | 1 | 31 |  |  |  | 41 |
| CO4 | | 1 | 4 |  |  |  |  | 5 |
| CO5 | |  | 7 | 9 |  |  |  | 16 |
| CO6 | | 4 | 6 | 6 |  |  |  | 16 |
|  | | | | | | | | **124** |



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| **Course Code** | **22EC2015** | **Duration** | **3hrs** |
| **Course Name** | **COMMUNICATION THEORY AND SYSTEMS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | What is the basic purpose of an electronic communication system? | | CO1 | R | 1 |
| 2. | What is the function of a modem? | | CO2 | R | 1 |
| 3. | Draw the frequency spectrum of amplitude modulation. | | CO3 | A | 1 |
| 4. | List two advantages of VSB. | | CO3 | U | 1 |
| 5. | State modulation index of frequency modulation. | | CO3 | R | 1 |
| 6. | What is meant by indirect FM generation? | | CO3 | U | 1 |
| 7. | Write the equation for the transmitted power for an AM system. | | CO4 | A | 1 |
| 8. | Mention the standard Intermediate frequency value of the AM receiver. | | CO4 | U | 1 |
| 9. | Expand AFC. | | CO4 | R | 1 |
| 10. | Define the noise figure of a network. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Explain the following terms in connection with communication systems.  (i) Simplex system. (ii) Half duplex system. | | CO1 | U | 3 |
| 12. | Compare AM with DSB-SC and SSB-SC AM. | | CO3 | An | 3 |
| 13. | List three comparisons between AM and FM. | | CO3 | An | 3 |
| 14. | Write short notes on image frequency rejection. | | CO4 | U | 3 |
| 15. | What do you mean by automatic gain control? | | CO4 | U | 3 |
| 16. | What is white noise? Mention its characteristics. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | List out the advantages and disadvantages of wireless communication. | CO2 | An | 8 |
|  | b. | Define modulation. What is the need for modulation? | CO2 | U | 4 |
|  |  |  |  |  |  |
| 18. | a. | A modulating signal of is amplitude modulated over a carrier signal of . Derive expressions for the modulation index, LSB, and USB frequencies. | CO5 | E | 6 |
|  | b. | Write short notes on degrees of amplitude modulation with neat waveforms. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Construct a ring modulator circuit and summarize the concept of AM generation using it. | CO3 | C | 6 |
|  | b. | Explain the detection of AM signals using the Square law detector. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | How is the narrow band FM converted into wideband FM? | CO3 | A | 4 |
|  | b. | Justify that the varactor diode can be used for frequency modulation. | CO3 | E | 8 |
|  |  |  |  |  |  |
| 21. | a. | Distinguish between high-level and low-level modulation. | CO4 | An | 4 |
|  | b. | Draw a neat block diagram of an AM transmitter and explain each block. | CO4 | U | 8 |
|  |  |  |  |  |  |
| 22. | a. | Describe the working of the typical directly modulated FM transmitter with the help of a neat diagram. | CO4 | U | 8 |
|  | b. | Why is frequency allocation essential in communication systems? | CO4 | U | 4 |
|  |  |  |  |  |  |
| 23. | a. | Calculate the figure of merit of the DSB-SC receiver system. | CO6 | A | 8 |
|  | b. | How do you represent narrow-band noise? | CO6 | U | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Derive an expression for the AM wave and draw its spectrum. | CO5 | An | 8 |
|  | b. | In an AM transmitter, the carrier power is 10 kW and the modulation index is 0.5. Calculate the total RF power delivered. | CO5 | A | 4 |

**CO** – COURSE OUTCOME

**BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Apply engineering mathematical concepts in various communication techniques. |
| CO2 | Identify the required system for a better communication technique. |
| CO3 | Analyze and interpret data considering the limitations of various modulation techniques. |
| CO4 | Employ appropriate modulators and demodulators for transmitters and receivers |
| CO5 | Predict and mathematically design an appropriate modulation technique. |
| CO6 | Assess the adverse effect of noise on signals. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 3 | - | - | - | - | 4 |
| CO2 | 1 | 4 | - | 8 | - | - | 13 |
| CO3 | 1 | 8 | 5 | 6 | 8 | 6 | 34 |
| CO4 | 1 | 27 | 1 | 4 | - | - | 33 |
| CO5 | - | 6 | 4 | 8 | 6 | - | 24 |
| CO6 | 4 | 4 | 8 | - | - | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **22EC2020** | **Duration** | **3hrs** |
| **Course Name** | **FPGA BASED SYSTEM DESIGN** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Identify the type of IC design flow in which the logic synthesis design step is present. | | CO1 | R | 1 |
| 2. | Indicate the logical design steps in IC design flow. | | CO1 | U | 1 |
| 3. | Determine the output for F = a >> 3 in Verilog HDL if a = 4’b1001. | | CO2 | A | 1 |
| 4. | Indicate the syntax for logical OR in Verilog HDL. | | CO2 | U | 1 |
| 5. | Indicate the formula to calculate maximum frequency of a clock signal. | | CO3 | U | 1 |
| 6. | Define hold time. | | CO3 | R | 1 |
| 7. | Indicate a method to improve speed in FPGA Architecture. | | CO4 | U | 1 |
| 8. | Indicate whether the statement” An improper reset strategy can create an unnecessarily large design and inhibit certain area optimizations” is true or false. | | CO4 | U | 1 |
| 9. | Identify the parameters on which dynamic power consumption depends upon. | | CO5 | U | 1 |
| 10. | Mention one application of Embedded system in the area of telecommunication. | | CO6 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Differentiate logical design from physical design in IC design flow. | | CO1 | U | 3 |
| 12. | Develop a Verilog code for 2 to 4 decoder using case statement. | | CO2 | A | 3 |
| 13. | Explain rolling up the pipeline in FPGA area architecting. | | CO4 | U | 3 |
| 14. | Explain how to manage clock skew in FPGA power architecting. | | CO5 | U | 3 |
| 15. | Sketch the block diagram of generic embedded system architecture and differentiate system bus from peripheral bus. | | CO6 | A | 3 |
| 16. | Fig 1  Estimate the delay from path A to path C in Fig 1. | | CO3 | An | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the CLB and I/O block architecture of Xilinx 2000 series FPGA. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Illustrate the significance of initial block, always block, blocking and non-blocking assignments in Verilog. | CO2 | A | 6 |
|  | b. | Design a 4-bit binary parallel adder using gate level modeling. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | https://lh6.googleusercontent.com/qwaNBEY4VOoSqSlZ-FL-m_nBvU7sq598Um98Ic58w8VyPSZIa0zJUnVzimNwOF-kuElwxaxhYc-1MG99Ier6EaDtjIs12sUvf-MW15d2h1HcQqTXPD8fFgHqs602I1HtfmkPTdgiDC7oyYxym0o7NJZ4QA=s2048  https://lh4.googleusercontent.com/G12546xdWXL6Zrr5i-7haazNYVGX7EZ0pxaPrK-mhXROzgMtuitOAAL6A_lHkZJkWPgmYP0CPS31oX_xYCWH51b4wRUqM3a7-23cOkeNPOM--B06150-HK3Fwjfk2PTcf8kXZCWbHynys4ZgSjUzMqdOqg=s2048  Estimate the performance of implementation of the above code in terms of throughput, latency, timing and explain method to obtain high throughput. | CO3 | An | 6 |
|  | b. | Analyze the impact of register balancing in the timing performance improvement of a design with necessary examples. | CO3 | An | 6 |
|  |  |  |  |  |  |
| 20. | a. | Explain the impact of reset on area with necessary examples. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Describe the impact of input control on architecting power in FPGA. | CO5 | U | 6 |
|  | b. | Describe the impact of dual edge triggered flip-flop on architecting power in FPGA. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | Design a T flip-flop using behavioral modeling in Verilog HDL and write the testbench for the same. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | Illustrate the I/O block architecture of Xilinx 3000 series FPGA. | CO1 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain about Vivado HLS tool. | CO6 | U | 6 |
|  | b. | Explain hardware/software co-design in Zynq. | CO6 | U | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Understand FPGA design flow and architectures. |
| CO2 | Program using Verilog HDL |
| CO3 | Architect speed and timing issues in FPGA |
| CO4 | Analyze area usage in FPGA |
| CO5 | Optimize power in FPGA |
| CO6 | Design embedded systems using FPGA |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 16 | 12 |  |  |  | 29 |
| CO2 |  | 1 | 28 |  |  |  | 29 |
| CO3 | 1 | 1 |  | 15 |  |  | 17 |
| CO4 |  | 5 | 12 |  |  |  | 17 |
| CO5 |  | 4 | 12 |  |  |  | 16 |
| CO6 |  | 12 | 4 |  |  |  | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **22EC2023** | **Duration** | **3hrs** |
| **Course Name** | **IoT SECURITY AND TRUST** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Differentiate between encryption and decryption. | | CO1 | U | 1 |
| 2. | State the primary application of RSA encryption algorithm. | | CO1 | R | 1 |
| 3. | List the cybersecurity requirements for IIoT. | | CO2 | R | 1 |
| 4. | Write the expansion for the acronym CERT. | | CO2 | A | 1 |
| 5. | Define a software bug. | | CO3 | R | 1 |
| 6. | Define vulnerability in the context of IoT security. | | CO3 | R | 1 |
| 7. | Write the appropriate definition for trust management. | | CO4 | A | 1 |
| 8. | Define IdM. | | CO4 | R | 1 |
| 9. | State the principle of light-weight cryptography. | | CO5 | R | 1 |
| 10. | State the necessity for IT Act 2000. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Differentiate between symmetric and asymmetric encryption algorithms. | | CO1 | U | 3 |
| 12. | Write the significance of Crypto-processors in security. | | CO2 | A | 3 |
| 13. | List the threat modeling methods | | CO3 | R | 3 |
| 14. | Explain the principle of Policy-Based Trust Systems. | | CO4 | A | 3 |
| 15. | Illustrate an access control matrix and explain in detail. | | CO5 | U | 3 |
| 16. | List the various types of hacker attacks. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Articulate Elliptic Curve Cryptography in detail with necessary diagrams. | CO1 | A | 6 |
|  | b. | Discuss the properties of Monoid in an algebraic system with appropriate definitions. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Interpret the ISA/IEC 62443 framework architecture with a neat sketch and explain in detail. | CO2 | A | 6 |
|  | b. | Illustrate the functional blocks of ISA/IEC 62443 with neat diagrams and explain in detail. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Explain Identity and Access Management in detail and their models with necessary diagrams. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 20. | a. | Interpret the concepts of web of trust with necessary diagrams in detail. | CO4 | A | 6 |
|  | b. | Discuss the Trust Management Principles, Terminologies and components with diagrams. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | Explain Light-weight cryptography, its need, methods, design and performance in detail. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. | a. | Discuss the objectives, procedures and methodologies of Network forensics in network security. | CO6 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Explain the various types and modes of hacker attacks in detail. | CO6 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Illustrate the various mechanisms of Cloud IdM in detail with diagrams. | CO6 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Design and implement cryptography algorithms using C programs |
| CO2 | Solve network security problems in various networks |
| CO3 | Build security systems using elementary blocks |
| CO4 | Build Trustable cloud based IoT systems |
| CO5 | Solve IoT security problems using light weight cryptography |
| CO6 | Appreciate the need for cyber security laws and methods. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 10 | 6 |  |  |  | 17 |
| CO2 | 1 | 6 | 10 |  |  |  | 17 |
| CO3 | 5 |  |  | 12 |  |  | 17 |
| CO4 | 1 | 6 | 10 |  |  |  | 17 |
| CO5 | 1 | 3 |  | 12 |  |  | 16 |
| CO6 | 4 | 24 |  | 12 |  |  | 40 |
|  | | | | | | | **124** |



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| **Course Code** | **22EC2024** | **Duration** | **3hrs** |
| **Course Name** | **COGNITIVE IOT** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | State the need for cognitive IoT. | | CO1 | R | 1 |
| 2. | Describe the significance of the process ‘Ideate’ in product development. | | CO1 | U | 1 |
| 3. | List the applications of DNN. | | CO2 | R | 1 |
| 4. | Name an artificial neuron architecture. | | CO2 | R | 1 |
| 5. | Identify the cloud service model used as host. | | CO3 | U | 1 |
| 6. | Define edge computing. | | CO3 | R | 1 |
| 7. | Name the processing unit that is referred as accelerator. | | CO4 | R | 1 |
| 8. | State the need for parallel computing. | | CO4 | R | 1 |
| 9. | List any two cloud protocols. | | CO5 | R | 1 |
| 10. | Define data mining. | | CO5 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | List the advantages of cognitive IoT. | | CO1 | R | 3 |
| 12. | Describe data analytics. | | CO2 | U | 3 |
| 13. | Compare private cloud with public cloud. | | CO3 | U | 3 |
| 14. | Define heterogeneous computing. | | CO4 | R | 3 |
| 15. | Describe the term ‘variety’ in Big Data. | | CO5 | U | 3 |
| 16. | Interpret the emerging trends in IoT security threats. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Discuss the technologies involved in cognitive computing. | CO1 | U | 6 |
|  | b. | Compare cognitive computing with other computing techniques. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Explain the process involved in cognitive cycle. | CO2 | A | 6 |
|  | b. | Illustrate the process of data analytics for IoT ANN classification. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Interpret the features of cloudlets and its significance. | CO3 | A | 6 |
|  | b. | Describe the concept of content delivery network with a suitable example. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Illustrate the need for CNN training in GPU. | CO4 | A | 6 |
|  | b. | Sketch the GPU architecture of NVIDIA GeForce 6. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Explain the significance of edge devices in IoT communication. | CO5 | A | 6 |
|  | b. | Interpret the characteristics of Big Data. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | Describe the types of IoT data analytics and the process involved in its life cycle. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Infer the advantages and disadvantages of private, public and hybrid cloud. | CO3 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Interpret the different types of security attacks. | CO6 | A | 8 |
|  | b. | Describe authentication and data integrity awareness. | CO6 | U | 4 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Integrate the aspects of human cognitive processes in the system design |
| CO2 | Comprehend the underlying cognitive process can have many abstractions of a cognitive cycle such as ‘sense’, ‘understand’, ‘design’ and ‘act’ |
| CO3 | Detect any failures of system components and re-configure itself which provides a graceful degradation through self-healing |
| CO4 | Accomplish knowledge about the application, system architecture, resources, system state and behaviour |
| CO5 | Incorporate recent advancements in the Machine Learning including Deep Learning in IoT |
| CO6 | Analyze security issues in IoT applications |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 4 | 13 | - | - | - | - | 17 |
| CO2 | 2 | 15 | 12 | - | - | - | 29 |
| CO3 | 1 | 10 | 6 | 12 | - | - | 29 |
| CO4 | 5 | - | 12 | - | - | - | 17 |
| CO5 | 2 | 3 | 12 | - | - | - | 17 |
| CO6 | - | 4 | 11 | - | - | - | 15 |
|  | | | | | | | **124** |



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| **Course Code** | **22EC2026** | **Duration** | **3hrs** |
| **Course Name** | **IoT DATA ANALYTICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Identify the need for data preparation in data analytics. | | CO1 | R | 1 |
| 2. | Infer the importance of regression technique. | | CO1 | U | 1 |
| 3. | List any two longitudinal functional groups in IoT functional model. | | CO2 | R | 1 |
| 4. | Illustrate the symbol of aggregation relationship in domain model. | | CO2 | U | 1 |
| 5. | Describe the features of BLE. | | CO3 | R | 1 |
| 6. | Define affinity diagram. | | CO3 | R | 1 |
| 7. | In a street lighting system, the vertical platform objective is not only to collect the data from the lights but also be able to dim them and turn them on and off. Judge the statement. | | CO4 | A | 1 |
| 8. | Define affinity diagram. | | CO4 | R | 1 |
| 9. | Judge the statement. Data mining technique is used to transform the raw data in a useful and efficient format. | | CO5 | A | 1 |
| 10. | Describe Intrusion detection. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Classify the types of data for IoT analytics. | | CO1 | U | 3 |
| 12. | Distinguish between web socket and REST API. | | CO2 | U | 3 |
| 13. | Sketch the stages in data life cycle. | | CO2 | A | 3 |
| 14. | List down the steps in planning the use case for IoT. | | CO3 | R | 3 |
| 15. | Differentiate between supervised and non-supervised learning. | | CO5 | U | 3 |
| 16. | Describe predictive analytics in internet of things | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the following with an example.   1. Structured data 2. Semi-structured data 3. Unstructured data | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | |  | | --- | | Discuss any four communication models in internet of things with neat block diagram. | | CO1 | U | 12 |
|  |  |  |  |  |  |
| 19. | a. | Explain any five requirements of IoT edge platforms in detail | CO3 | U | 6 |
|  | b. | Discuss Boehm’s Spiral model for software development in detail. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Develop an IoT methodology framework for agriculture example with example. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Explain any one problem in decision tree learning. | CO5 | An | 6 |
|  | b. | Explain the basic decision tree learning algorithm. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Explain any four types of clustering methods available in machine learning with relevant example. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Explain the main characteristics of exploratory data analysis with relevant visualization plots. | CO6 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Discuss anomaly detection for predictive maintainenace using a crafted dataset for industrial automation. | CO6 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Identify the various models applied for IoT solutions |
| CO2 | Simulate the real world scenarios with the IoT models |
| CO3 | Assess different business requirements of Internet of Things. |
| CO4 | Understand the principles of value engineering and analysis |
| CO5 | Gain knowledge on the data analytics of IoT |
| CO6 | Deploy data analytics solution to IoT based systems |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 28 | - | - | - | - | 29 |
| CO2 | 1 | 4 | 15 | - | - | - | 20 |
| CO3 | 5 | 6 | - | - | - | - | 11 |
| CO4 | 1 | 6 | 1 | - | - | - | 8 |
| CO5 | - | 21 | 1 | 6 | - | - | 28 |
| CO6 | 4 | 12 | - | 12 | - | - | 28 |
|  | | | | | | | **124** |



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| **Course Code** | **22EC2027** | **Duration** | **3hrs** |
| **Course Name** | **BRAIN COMPUTER INTERFACE** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Classify the lobes of a human brain. | | CO1 | U | 1 |
| 2. | Define BCI systems. | | CO1 | R | 1 |
| 3. | Articulate the Action potential process. | | CO2 | A | 1 |
| 4. | Identify the chemical which is responsible for carrying the information from one neuron to the other. | | CO2 | U | 1 |
| 5. | Illustrate Autoregressive (AR) Modelling in time domain signal analysis. | | CO3 | An | 1 |
| 6. | Express Baye’s rule mathematically. | | CO3 | U | 1 |
| 7. | Define reinforcement learning. | | CO4 | R | 1 |
| 8. | Write the mathematical expression for accuracy. | | CO4 | R | 1 |
| 9. | List any two applications of BCI system. | | CO5 | R | 1 |
| 10. | Identify the layers of BCILAB toolbox. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Summarize invasive methodology of brain signal acquisition with an example. | | CO1 | U | 3 |
| 12. | Classify the categories of AEP. | | CO2 | U | 3 |
| 13. | State the significance of Cooley- Tukey algorithm. | | CO3 | R | 3 |
| 14. | List the steps to solve a Machine Learning problem. | | CO4 | R | 3 |
| 15. | Differentiate between invasive and non-invasive BCI systems. | | CO5 | U | 3 |
| 16. | Illustrate the significance of plug-in’s in BCILAB toolbox. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Appraise on the 10/20% of electrode placement standards, montages and the electrodes for EEG signal acquisition with necessary diagrams. | CO1 | An | 6 |
|  | b. | Illustrate the BCI block schematic with a neat diagram and explain in detail. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Describe the recording techniques, electrodes requirements and the response curves of Auditory Evoked Potential with necessary diagrams. | CO2 | U | 6 |
|  | b. | Explain Auditory Evoked Potential and its classifications in detail. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Explain the steps involved in spike sorting in detail with necessary diagrams. | CO3 | U | 6 |
|  | b. | Illustrate fractal dimension technique of EEG signal processing with mathematical analysis. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Discuss the significance of Hjorth Parameters for time-varying signal analysis with mathematical expressions. | CO3 | U | 6 |
|  | b. | Explain Spatial filtering techniques for brain signal processing in detail with diagrams. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Explain Binary classification and its evaluation methodology in detail. | CO4 | An | 6 |
|  | b. | Explain Ensemble classifier and its generation methods in detail. | CO4 | An | 6 |
|  |  |  |  |  |  |
| 22. | a. | Analyze the ROC methodology to compare the relative performance among competing models. | CO4 | An | 6 |
|  | b. | Explain the Perceptron architecture, training and learning algorithm in detail with diagrams. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 23. | a. | Design a BCI system for decoding and tracking the hand position with necessary diagrams. | CO5 | C | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Analyze the ethics of Brain Computer Interfacing involving Medical, Health and Safety Issues. | CO6 | An | 6 |
|  | b. | Illustrate the architecture of BCILAB toolbox and explain in detail. | CO6 | A | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Comprehend the components of BCI system |
| CO2 | Apply concepts to assess the brain activation |
| CO3 | Select appropriate feature extraction methods |
| CO4 | Use machine learning algorithms for BCI. |
| CO5 | Explore the applications of BCI |
| CO6 | Execute BCI using BCILAB toolbox |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 10 |  | 6 |  |  | 17 |
| CO2 |  | 16 | 1 |  |  |  | 17 |
| CO3 | 3 | 19 | 6 | 1 |  |  | 29 |
| CO4 | 5 | 6 |  | 18 |  |  | 29 |
| CO5 | 1 | 3 |  |  |  | 12 | 16 |
| CO6 | 1 | 3 | 6 | 6 |  |  | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **22EC3004** | **Duration** | **3hrs** |
| **Course Name** | **GRAPH THEORY AND APPLICATIONS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Analyze the following graph and find the following.     1. Deg(v1), Deg(V3), 2. List the parallel edges, 3. List the edges in Series, 4. Fuse v5 and v6 vertices and draw the graph after fusion | CO1 | An | 6 |
|  | b. | For the following graphs G and G1  Develop    G2= G⊕ G1  G3=G ⋂ G1  G4=G⋃ G1  G5=G1-e4  G6=G1-d  G7=G-vi  G7=G⋂G | CO1 | A | 10 |
|  |  |  |  |  |  |
| 2. | a. | Explain any four graph theory application for solving problems. | CO3 | A | 16 |
|  |  |  |  |  |  |
| 3. | a. | Explain the following  i) Hamiltonian circuits (ii) Euler Graph (iii) Complete graph | CO1 | U | 6 |
|  | b. | A connected graph has 7 vertices and 14 edges calculate the number of spanning tree branches and the number of chords. | CO4 | A | 4 |
|  | c. | Analyze the following tree and find the eccentricity of vertices, centre and radius | CO4 | An | 6 |
|  |  |  |  |  |  |
| 4. | a. | Construct the dual graph for the following graph | CO2 | A | 6 |
|  | b. | Show that a connected planar graph with n vertices and e edges has  e − n + 2 regions. | CO2 | U | 10 |
|  |  |  |  |  |  |
| 5. | a. | Show that a simple graph (i.e., a graph without parallel edges or self-loops) with n vertices and k components can have at most  (n − k)(n − k + l)/2 edges. | CO1 | U | 16 |
|  |  |  |  |  |  |
| 6. | a. | Explain the following layout operations using the corner stitch data structure  i) Point Finding (ii) Neighbor Finding (iii) Area Search  iv) Enumerate all Tiles (v) Block Creation (iv) Block Deletion | CO6 | A | 16 |
|  |  |  |  |  |  |
| 7. | a. | Apply Dijkstra's Algorithm for the following graph and find the shortest path between vertex v1 and other vertices. | CO5 | A | 16 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. | a. | Develop the neighborhood graph for the following rectangle | CO6 | A | 5 |
|  | b. | List the several classes of graph and explain the relationship between them. | CO6 | R | 8 |
|  | c. | Explain Line sweep method. | CO5 | A | 7 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the basic structure of graphs. |
| CO2 | Understand the concept of planar and dual graph |
| CO3 | Relate graph theory concepts in solving problems |
| CO4 | Understand the data structure concepts. |
| CO5 | Apply the appropriate algorithms to for Physical design |
| CO6 | Apply an analytical approach for Physical design |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 22 | 10 | 6 | - | - | 38 |
| CO2 | - | 10 | 6 | - | - | - | 16 |
| CO3 | - | - | - | 16 | - | - | 16 |
| CO4 | - | - | 4 | 6 | - | - | 10 |
| CO5 | - | - | 23 | - | - | - | 23 |
| CO6 | 8 | - | 21 | - | - | - | 29 |
|  | | | | | | | **132** |



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| **Course Code** | **MACHINE LEARNING FOR COMMUNICATION SYSTEMS** | **Duration** | **3hrs** |
| **Course Name** | **22EC3008** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Describe each mixture models mentioned below with any one-use case,   1. Mixture of gaussian (b) MLE and EM | CO1 | R | 20 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Discuss the fundamental differences between multi-class and multi-label classification techniques. | CO2 | U | 10 |
|  | b. | Explain the key principles and applications of Classification and Regression Trees (CART). | CO2 | A | 10 |
|  |  |  |  |  |  |
| 3. | a. | Compare and contrast the working principles of Naïve Bayes, and K-Nearest Neighbors algorithms with necessary empirical conditions. | CO2 | E | 10 |
|  | b. | List out the key differences and explain Multiple Linear Regression and Logistic Regression with an example. | CO2 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Explain K-means clustering and hierarchical clustering in terms of their algorithmic approaches, strengths, and weaknesses. | CO3 | An | 10 |
|  | b. | Evaluate how Principal Component Analysis (PCA) and Self-Organizing Maps (SOM) differ in their approaches to dimensionality reduction and clustering. | CO3 | An | 10 |
|  |  |  |  |  |  |
| 5. | a. | Explain the structure of transmission epochs and the learning algorithms used for channel allocation. | CO4 | An | 10 |
|  | b. | Discuss some key considerations and challenges in the development and implementation of online learning algorithms for opportunistic spectrum access. | CO4 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Interpret how the k-Nearest Neighbors (k-NN) algorithm assists in Adaptive Modulation and Coding (AMC). | CO5 | A | 10 |
|  | b. | Examine how Assisted Adaptive Modulation and Coding (AMC) differ from AMC using Support Vector Machines (SVM). | CO5 | A | 10 |
|  |  |  |  |  |  |
| 7. | a. | Summarize the key metrics and methods used to perform the performance analysis of k-NN-Assisted Adaptive Modulation and Coding (AMC) systems compared to Reinforcement Learning (RL) Assisted AMC systems. | CO5 | E | 20 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Evaluate the principles and methods used in neural network-based channel equalization with any one-use case. | CO6 | E | 10 |
|  | b. | Evaluate the benefits and enhancements that Multilayer Perceptron-based equalizers bring to communication systems. | CO6 | An | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Compare functional link artificial neural network (ANN) based equalizers and radial basis function (RBF) based equalizers, and what are the advantages and disadvantages of each in the context of channel equalization? | CO6 | A | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the techniques, mathematical concepts of machine learning. |
| CO2 | Apply various supervised learning methods to appropriate problems. |
| CO3 | Create probabilistic and unsupervised learning models for handling unknown pattern. |
| CO4 | Design machine learning algorithms for spectrum access and sharing. |
| CO5 | Apply machine learning algorithms for modulation and coding. |
| CO6 | Identify machine learning algorithms for channel equalization and signal detection. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 20 |  |  |  |  |  | 20 |
| CO2 |  | 20 | 10 |  | 10 |  | 40 |
| CO3 |  |  |  | 20 |  |  | 20 |
| CO4 |  | 10 |  | 10 |  |  | 20 |
| CO5 |  |  | 20 |  | 20 |  | 40 |
| CO6 |  |  | 20 | 10 | 10 |  | 40 |
|  | | | | | | | **180** |



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| **Course Code** | **22EC3009** | **Duration** | **3hrs** |
| **Course Name** | **5G COMMUNICATION AND BEYOND** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Compare the various features of 1G to 5G technologies in detail with necessary applications. | CO1 | An | 12 |
|  | b. | Explain the design requirements of green and soft 5G Networks. | CO1 | U | 8 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Explain how device to device communication enables fifth generation (5G) wireless network communication from short-range wireless to vehicle-to- vehicle. | CO2 | An | 20 |
|  |  |  |  |  |  |
| 3. | a. | With neat sketch, explain the 3GPP 3D MIMO Channel Model and its observation on channel measurements. | CO3 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Determine an approximate analytical expression for the uplink achievable rate of a massive multi- input multi-output (MIMO) | CO3 | A | 20 |
|  |  |  |  |  |  |
| 5. | a. | Explain the transceiver architecture of orthogonal frequency division multiplexing in 5G system. | CO4 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Explain the multi-carrier modulation techniques filter bank multicarrier (FBMC) and universal filtered multi-carrier (UFMC) with necessary equations. | CO4 | A | 20 |
|  |  |  |  |  |  |
| 7. | a. | Explain EM based channel estimation technique for OFDM system. | CO6 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Explain a visible light communication system model for 6G requirements. | CO5 | An | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Consider a single-cell downlink scenario where there is a single base station (BS), and users , with , and all terminals are equipped with a single antenna. The BS always sends data to all users simultaneously, subject to the constraint of total power *P*. It is assumed that the wireless links experience independent and identically distributed (i.i.d.) block Rayleigh fading and additive white Gaussian noise (AWGN). The channels are sorted as which indicates that user always holds the ith weakest instantaneous channel. Devise a multiple access technique that operates in the same band, at the same time but is distinguished by the power level. Also determine the achievable data rate of ith user. | CO4 | An | 12 |
|  | b. | Compare the achievable data rate of User 1 and User 2 in NOMA and OMA with necessary equations. | CO4 | An | 8 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Understand the trends, goals and vision of next generation wireless communication systems. |
| CO2 | Apply the basic understandings of key technologies to solve the existing problems of the 5G communications. |
| CO3 | Identify the state-of-the-art problems and apply the basic knowledge of massive MIMO for finding out the solutions. |
| CO4 | Analyse the performance of various physical layer technologies like mm-wave and multiple access techniques from physical layer perspective. |
| CO5 | Familiarise with 6G key enabling technologies like millimeter-wave communications, terahertz communications, and visible light communications. |
| CO6 | Acquire basic knowledge on 5G based machine learning applications. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 8 | - | 12 | - | - | 20 |
| CO2 | - | - | - | 20 | - | - | 20 |
| CO3 | - | - | 40 | - | - | - | 40 |
| CO4 | - | 20 | 20 | 20 | - | - | 60 |
| CO5 | - | - | - | 20 | - | - | 20 |
| CO6 | - | - | 20 | - | - | - | 20 |
|  | | | | | | | **180** |



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| **Course Code** | **22EC3010** | **Duration** | **3hrs** |
| **Course Name** | **MACHINE LEARNING FOR ENGINEERS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Explain the concept of a margin in SVM and discuss the way of finding an optimal hyperplane for separating two classes. Also bring out its advantages and limitations. | CO1 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | State the need for machine learning. | CO1 | R | 5 |
|  | b. | Illustrate the different types of learning with suitable examples – supervised, unsupervised and reinforcement. | CO1 | U | 15 |
|  |  |  |  |  |  |
| 3. | a. | Describe the different types of activation functions used in artificial neural networks with their mathematical functions, illustration, significance and their limitations. | CO2 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Define the architecture and functioning of a Adaptive Resonance Theory. | CO3 | R | 10 |
|  | b. | Explain the fundamental principles of a Hopfield Neural Network, including its structure and neuron activation rules. | CO3 | An | 10 |
|  |  |  |  |  |  |
| 5. | a. | Explain the forward pass and backward pass in back propagation neural network. How do they work together to update the neural network’s weights? | CO4 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Compare the differences between GRUs and LSTMs. Also give suggestions on what situations should we choose GRU over LSTM and vice versa? | CO4 | An | 20 |
|  |  |  |  |  |  |
| 7. | a. | Define a pretrained deep learning architecture and how does it differ from training a deep learning model from scratch. | CO5 | U | 5 |
|  | b. | Describe the architectural features of Inception and ResNet architecture. | CO5 | U | 15 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Describe the primary elements of a Generative Adversarial Network and explain training process, where the generator and discriminator compete against each other. | CO5 | U | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Explain machine learning models for medical image analysis and diagnosis. Explain the benefits of deep learning in capturing complex patterns in medical data. | CO6 | U | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Outline the basic principles of machine learning techniques |
| CO2 | Understand the technical operation of artificial neural networks |
| CO3 | Describe the various neural network architectures and algorithms |
| CO4 | Understand the basic concepts of deep convolutional methods |
| CO5 | Analyze various deep learning architectures and algorithms |
| CO6 | Explore the various engineering applications using ML techniques |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 5 | 15 |  | 20 |  |  | 40 |
| CO2 |  | 20 |  |  |  |  | 20 |
| CO3 | 10 |  |  | 10 |  |  | 20 |
| CO4 |  |  |  | 40 |  |  | 40 |
| CO5 |  | 40 |  |  |  |  | 40 |
| CO6 |  | 20 |  |  |  |  | 20 |
|  | | | | | | | **180** |



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| **Course Code** | **23EC1001** | **Duration** | **3hrs** |
| **Course Name** | **COMPUTATIONAL THINKING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Identify the logical reasoning technique in the given statement. “All dogs that I have seen are brown in colour. So, all dogs must be brown” | | CO1 | U | 1 |
| 2. | Name the problem solving method that helps to find more useful solutions by providing a clear and inspiring aim. | | CO1 | A | 1 |
| 3. | Interpret the word ‘pseudo’ and ‘code’. | | CO2 | U | 1 |
| 4. | Identify the algorithm control structure that executes one or more instructions repeatedly. | | CO2 | U | 1 |
| 5. | Define Objective Tree. | | CO3 | R | 1 |
| 6. | Identify the category of control structure in the given algorithm.  IF length(password)<8  PRINT (“Your Password is not valid!”) | | CO2 | U | 1 |
| 7. | Write any one type of linked list. | | CO4 | A | 1 |
| 8. | Define Recursion. | | CO5 | R | 1 |
| 9. | Identify the given flowchart symbol. | | CO2 | U | 1 |
| 10. | Justify the need for brute force algorithm. | | CO6 | E | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Categorize the types of logical reasoning. | | CO1 | An | 3 |
| 12. | List the various properties of an algorithm. | | CO2 | R | 3 |
| 13. | Differentiate between Sequence, Selection and Repetition. | | CO3 | U | 3 |
| 14. | Define array and state the advantage and disadvantage of array list. | | CO4 | R | 3 |
| 15. | Illustrate the concept of use case diagrams with an example. | | CO2 | An | 3 |
| 16. | Explain Huffman codes with an example. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the deductive and inductive logical reasoning methods employed for problem solving. | CO1 | A | 8 |
|  | b. | Develop an algorithm to determine if a student has passed the exam or not. | CO1 | C | 4 |
|  |  |  |  |  |  |
| 18. | a. | Construct an algorithm and sketch a flowchart to check the working condition of a lamp. | CO1 | C | 8 |
|  | b. | Compare Algorithm with Program. | CO2 | E | 4 |
|  |  |  |  |  |  |
| 19. | a. | Explain the Control and Data abstraction with simple class diagram. | CO2 | U | 8 |
|  | b. | Write the characteristics of a good program. | CO2 | A | 4 |
|  |  |  |  |  |  |
| 20. | a. | Define Control flow statement and describe the different types of selection statements with suitable example. | CO3 | R | 12 |
|  |  |  |  |  |  |
| 21. | a. | Explain the Problem Tree analysis tool that establish the ‘cause and effect’ relationship with suitable example and differentiate Problem Tree with Objective Tree. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 22. | a. | Illustrate the concept of accessing, deleting and inserting linked list elements with suitable example. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 23. | a. | Sketch the graph given as G=(V,E), where V={A,B,C,D,E} and E={(A,D), (B,E), (C,E), (D,A), (A, B), (E,A)} and interpret the graph as a model of airline routing. | CO5 | A | 6 |
|  | b. | Compare Searching with Sorting and explain the different types of sorting with example. | CO5 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Discuss the elements of greedy strategy and summarize the sequence of steps to design greedy algorithms. | CO6 | U | 8 |
|  | b. | Illustrate the fractional knapsack problem with an example. | CO6 | An | 4 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** | | | | | | | | |
| CO1 | Exhibit basic knowledge to understand, define and solve problems. | | | | | | | | |
| CO2 | Design and implement algorithm(s) for a given problem. | | | | | | | | |
| CO3 | Choose the appropriate algorithm for handling the database. | | | | | | | | |
| CO4 | Identify the suitable data structure for implementation in diverse applications. | | | | | | | | |
| CO5 | Solve problems using appropriate problem solving methods. | | | | | | | | |
| CO6 | Design algorithms using brute force and greedy approach. | | | | | | | | |
| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | | | |
| **CO / P** | | | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | | |  | 1 | 9 | 3 |  | 12 | 25 |
| CO2 | | | 3 | 12 | 4 | 3 | 4 |  | 26 |
| CO3 | | | 13 | 15 |  |  |  |  | 28 |
| CO4 | | | 3 |  | 1 | 12 |  |  | 16 |
| CO5 | | | 1 | 6 | 6 |  |  |  | 13 |
| CO6 | | |  | 11 |  | 4 | 1 |  | 16 |
|  | | | | | | | | | **124** |



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| **Course Code** | **23EC1002** | **Duration** | **3hrs** |
| **Course Name** | **PROGRAMMING FOR PROBLEM SOLVING WITH C** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | What is the role of format specifiers in C programming? | | CO1 | R | 1 |
| 2. | Distinguish between variable and constant. | | CO2 | R | 1 |
| 3. | Identify the output of this C code.  #include <stdio.h>  int main()  {  int n = 1, m = -1;  if (n > 0)  if (m > 0)  printf("True");  else  printf("False");  return 0;  } | | CO3 | R | 1 |
| 4. | Analyze the bugs and correct them.  #\include <stdio.h>  {  int a, b;  a=100;  b=16;  c=90;  printf(“A is”, a, b,c);  } | | CO3 | An | 1 |
| 5. | Interpret the output of C Program.  #include <stdio.h>  int main()  {  int a[] = {11,21,13,14};  int b[4] = {54,16,7,80};  printf("%d,%d", a[1], b[1]);  } | | CO3 | A | 1 |
| 6. | Explain in brief about ‘&’ and ‘\*’ operators. | | CO5 | U | 1 |
| 7. | Write the syntax for ‘structure’ in C. | | CO4 | A | 1 |
| 8. | Describe about ‘Function Definition’. | | CO4 | U | 1 |
| 9. | List out the applications of pointer in C. | | CO3 | U | 1 |
| 10. | Explain how to open a file for both reading and writing in C when working with files. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Describe the role of a loop in C programming, and how do "for" and "while" loops differ? | | CO1 | R | 3 |
| 12. | Write a program in C to find greatest among three integers. | | CO2 | A | 3 |
| 13. | Write a C program to compare two strings. | | CO3 | A | 3 |
| 14. | Distinguish Arrays and Structure. | | CO4 | U | 3 |
| 15. | Explain the concept of pointers within the context of the C programming language. | | CO5 | U | 3 |
| 16. | State the purpose of file handling in C programming, and why is it important? | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the ‘Program development cycle’. | CO1 | U | 8 |
|  | b. | Construct a C program that computes the result of the expression '10 + 800 / 10 - 4 \* 10' by considering operator precedence and associativity. Also, perform a manual calculation of the expression. | CO3 | A | 4 |
|  |  |  |  |  |  |
| 18. | a. | Write a C Program to print the following pattern using ‘Nested Loops’.    \*  \* \*  \* \* \*  \* \* \* \*  \* \* \* \* \* | CO4 | A | 6 |
|  | b. | Write a ‘C’ code for building an arithmetic calculator to perform Addition, Subtraction, Multiplication and Division using Switch-case statement. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Construct a C program to perform Matrix Addition. | CO3 | A | 8 |
|  | b. | Write a C program to concatenate two strings by adopting the library functions. | CO3 | A | 4 |
|  |  |  |  |  |  |
| 20. | a. | Write a C program to create a login application. Initialize two strings user[] = ‘admin’ and passwd[]= ‘kits’. Allow the user to enter the username (case insensitive) and password. Then compare the entered user credentials with stored to print “Login Successful” or “Invalid username or Password”. | CO6 | A | 8 |
|  | b. | Differentiate between one-dimensional (1D) and two-dimensional (2D) arrays. | CO3 | U | 4 |
|  |  |  |  |  |  |
| 21. | a. | Construct a C program to accept records of 5 different States using Array of Structures. The Structure should contain the name of the State, number of engineering colleges, medical colleges, management colleges, and universities in the State. Calculate the total number of colleges and display. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Write a program to count the number of characters and words in a file. | CO2 | A | 6 |
|  | b. | Write a program to copy the contents of a file to another file. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Construct a program in C that utilizes file operations to establish an employee database. | CO6 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Construct a C program that employs ‘Structures’ to establish a student database for an organization. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Describe the basics of computer and software development process. |
| CO2 | Implement algorithms in C to solve a range of computational problems |
| CO3 | Apply systematic approaches to locate and resolve issues related to logic, syntax, runtime, and memory management. |
| CO4 | Develop proficient skills in creating structured C programs emphasizing modularity and code reusability. |
| CO5 | Apply algorithms in programming to effectively manage memory. |
| CO6 | Design efficiently in real-world software development projects. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 4 | 8 |  |  |  |  | 12 |
| CO2 | 1 | 12 | 3 |  |  |  | 16 |
| CO3 | 1 | 5 | 26 |  |  |  | 33 |
| CO4 |  | 4 | 19 |  |  |  | 23 |
| CO5 |  | 4 |  |  |  |  | 4 |
| CO6 | 3 | 1 | 32 |  |  |  | 36 |
|  | | | | | | | **124** |



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| **Course Code** | **23EC2015** | **Duration** | **3hrs** |
| **Course Name** | **BASIC ELECTRONICS FOR AEROSPACE ENGINEERS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Sketch the symbol for fixed and variable inductor. | | CO1 | A | 1 |
| 2. | List the characteristics of ideal transformer. | | CO1 | R | 1 |
| 3. | Write the advantages of brushless DC motor. | | CO2 | A | 1 |
| 4. | State Faraday’s law of electromagnetic induction. | | CO2 | R | 1 |
| 5. | Define Zener diode. | | CO3 | R | 1 |
| 6. | Identify the majority and minority carriers in N type semiconductor. | | CO3 | R | 1 |
| 7. | Sketch the symbol and truth table of NAND gate. | | CO4 | A | 1 |
| 8. | Give examples of combinational logic circuits. | | CO4 | U | 1 |
| 9. | Identify the temperature sensor used in aircrafts. | | CO5 | R | 1 |
| 10. | Predict the speed (Data Rate) of 4G Technology. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Determine the value of resistance for the given color band.  a) Red, Green, Black, Gold  b) Brown, Black, Orange | | CO1 | A | 3 |
| 12. | Explain the working principle of Electric Generator. | | CO2 | A | 3 |
| 13. | Sketch the circuit of zener diode voltage regulator. | | CO3 | A | 3 |
| 14. | Compare combinational circuit with sequential circuit. | | CO4 | U | 3 |
| 15. | List the sensors used in space crafts. | | CO5 | U | 3 |
| 16. | Differentiate 3G,4G and 5G in Mobile computing. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the types of Fixed Resistors with its specifications. | CO1 | U | 8 |
|  | b. | List the factors that affect the inductance of the coil. | CO1 | R | 4 |
|  |  |  |  |  |  |
| 18. | a. | Sketch the constructional diagram of a DC Motor and explain its working principle. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Describe the working of Digital Storage Oscilloscope with neat block diagram. | CO3 | U | 7 |
|  | b. | Sketch and explain the input and output characteristics of a BJT. | CO3 | A | 5 |
|  |  |  |  |  |  |
| 20. |  | Construct and explain the block diagram of Digital Multimeter. Also identify its ports and symbols. | CO3 | C | 12 |
|  |  |  |  |  |  |
| 21. |  | Design a half subtractor and full subtractor circuit using logic gates. Also verify its truth table. | CO4 | C | 12 |
|  |  |  |  |  |  |
| 22. |  | Sketch the design flow to interface Arduino controller with temperature sensor and explain it in detail. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Discuss the construction and working of pressure sensors used in aircraft systems. | CO5 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Explain the satellite system used for global mobile communication. | CO6 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Apply laws of natural science in the use of electronic components in everyday life. |
| CO2 | Identify the types of electrical machines, variables, and parameters for various applications. |
| CO3 | Identify, assemble and evaluate simple electronic circuits. |
| CO4 | Recognize the need of various digital circuits as key to good problem definition. |
| CO5 | Articulate the various sensing and instrumentation applications. |
| CO6 | Identify the various wireless communication systems. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 5 | 8 | 4 | - | - | - | 17 |
| CO2 | 1 | - | 16 | - | - | - | 17 |
| CO3 | 2 | 7 | 8 | - | - | 12 | 29 |
| CO4 | - | 4 | 13 | - | - | 12 | 29 |
| CO5 | 1 | 15 | - | - | - | - | 16 |
| CO6 | 3 | 13 | - | - | - | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **20EC2014** | **Duration** | **3hrs** |
| **Course Name** | **BASIC ELECTRONICS FOR AEROSPACE ENGINEERS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Draw the symbol for fixed and variable Inductor | | CO1 | R | 1 |
| 2. | What was the key invention of Russel Ohl in the year of 1939? | | CO1 | R | 1 |
| 3. | List down the applications of a Generator. | | CO2 | R | 1 |
| 4. | Name some examples for passive electronic components. | | CO2 | U | 1 |
| 5. | What is the use of brush in DC Generator? | | CO3 | R | 1 |
| 6. | What are the main classifications of semiconductor devices based on its type? | | CO3 | R | 1 |
| 7. | Write down different types of Arduinos? | | CO4 | U | 1 |
| 8. | What are called as universal gates? why they are called so? | | CO4 | R | 1 |
| 9. | What all are the key uses of a sensor. | | CO5 | U | 1 |
| 10. | The speed (Data Rate) of 4G Technology is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Figure out the main classification blocks of Passive Elements and explain the same with some examples. | | CO1 | U | 3 |
| 12. | Draw and explain the VI characteristics of a diode under forward bias condition. | | CO2 | C | 3 |
| 13. | Draw the equivalent circuit diagram of DC Series motor with necessary equations. | | CO3 | R | 3 |
| 14. | Draw and explain the working of full wave rectifier. | | CO4 | U | 3 |
| 15. | Elaborate on the fundamental pressure sensing mechanisms used in the aircraft instrument system. | | CO5 | An | 3 |
| 16. | Sketch the basic block diagram of the communication system. | | CO6 | C | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | |
| 17. | a. | Determine the maximum and minimum value of a resistor with the following color code in ohms. Make a color code table by including all necessary colors.  a) Blue, Violet, Brown and Silver  b) Black, white, Black and Gold | C01 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Find the total resistance, voltage, and current in parallel resistor circuit with three resistors. That are each measured as R1= 96Ω, R2 = 122 Ω and R3 = 48 Ω, respectively. The Current between the resistors is measured as I1=2A, I2=8A and I3=6A, Draw the circuit neatly. | C01 | E | 8 |
|  | b. | Differentiate different types of capacitors. | C01 | U | 4 |
|  |  |  |  |  |  |
| 19. | a. | A 8 pole DC series generator, wave connected with 122 slots each slots contain 60 conductors and running at 1700 rpm supplies a load of 20.5 Ω resistance at the terminal voltage of 230V. The armature resistance is 0.25 Ω and the field resistance is 230Ω . find the armature current, the induced EMF and the flux per pole. | C02 | E | 12 |
|  |  |  |  |  |  |
| 20. | a. | Elaborate CB, CC configurations of a transistors. | C03 | An | 6 |
|  | b. | Explain avalanche breakdown and Zener breakdown. | C03 | An | 6 |
|  |  |  |  |  |  |
| 21. | a. | Using a detailed constructional diagram, explain how a DC generator works and how it is built. | C02 | A | 8 |
|  | b. | Draw and explain the parts of a DC 3 Point Starter. | C02 | C | 4 |
|  |  |  |  |  |  |
| 22. | a. | Explain the various blocks of a microcontroller. | C04 | U | 6 |
|  | b. | Compare and contrast combinational and sequential circuit. | C04 | R | 6 |
|  |  |  |  |  |  |
| 23. | a. | Describe the operation of the bourdon tube with a neat diagram. Write the advantages and limitations of bourdon tube pressure gauge. | C05 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Compare 2G,3G and 4G technologies. | CO6 | R | 6 |
|  | b. | With a neat diagram, describe the satellite system for global mobile communication. | CO6 | U | 6 |

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|  | **COURSE OUTCOMES** |
| CO1 | Recognize importance and judicious use of electronic components in everyday life |
| CO2 | Identify the types of electrical machines used for various applications. |
| CO3 | Understand and apply the concept of electronics to design simple circuits. |
| CO4 | Understand and relate various digital circuits |
| CO5 | Understand the various sensing and instrumentation applications. |
| CO6 | Identify the various generations of wireless communications. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 5 | 4 | 12 |  | 8 |  | 29 |
| CO2 | 1 | 1 |  | 8 | 12 | 7 | 29 |
| CO3 | 7 | 10 |  |  |  |  | 17 |
| CO4 | 7 | 10 |  |  |  |  | 17 |
| CO5 |  | 1 |  | 15 |  |  | 16 |
| CO6 | 7 | 6 |  |  |  | 3 | 16 |
|  | | | | | | |  |