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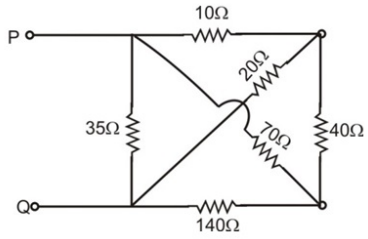
End Semester Examinations - Nov-Dec 2015 Exams

14EE1001 Basic Electrical Engineering

Set A **Time : 3 hrs** **Total Marks: 100**

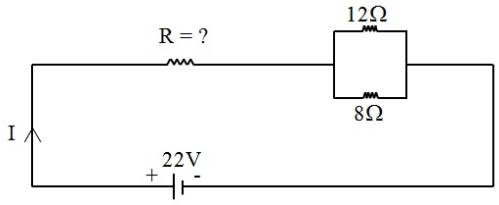
1. a. Describe the concepts of series and parallel circuit. Also list out the disadvantages of series circuit and advantages of parallel circuit. (10 marks)

   b. Determine the effective resistance between P and Q using star – delta conversion. (10 marks)

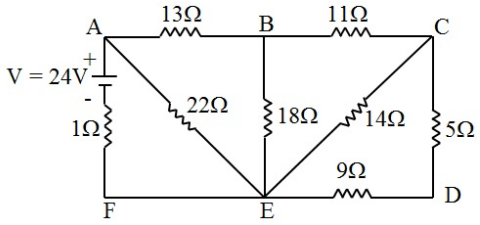


OR

2. a) A resistance R is connected in series with parallel circuit comprising of two resistors 12 ohms and 8 ohms respectively. The total power dissipated in the circuit is 70 W when the supplied voltage is 22 volts. Calculate the value of R. (8)



b) An electrical network is arranged as shown in figure. (12)
   a. Find the current in branch AF
   b. The power absorbed in branch BE
   c. Potential difference across CD



3. a) Make a detailed comparison of magnetic and electric circuits. (10)
   b) Write down the Laws of electromagnetic induction and explain with illustration. (10)

OR

4. a. Define Self induced emf, Mutually induced emf, Statically induced emf and Dynamically induced emf. (10)

   b. Prove that the coupling co-efficient between two magnetic circuits is:

$$k = \frac{M}{\sqrt{(L_1 L_2)}}$$ (10)

5. a. With a neat sketch, explain the operation of a hydro power station. (14)

   b. Explain the Three phase emf generation with phasor diagram. (6)

OR

6. a. Derive the RMS value and average value of a sinusoidal alternating current quantity. (14)

   b. Compare overhead and underground system. (6)

7. a. Explain the principle, construction, working and application of a DC motor. (12)

   b. Derive the emf equation of a DC generator. (8)

OR

8. a. Explain the principle, construction, working and application of an alternator. (14)

   b. Write down the production of Rotating Magnetic Field in an Induction motor . (6)

9. a. Explain the working of Induction type energy meters with diagram. (12)

   b. With a neat circuit diagram, explain fluorescent lamp wiring. (8)

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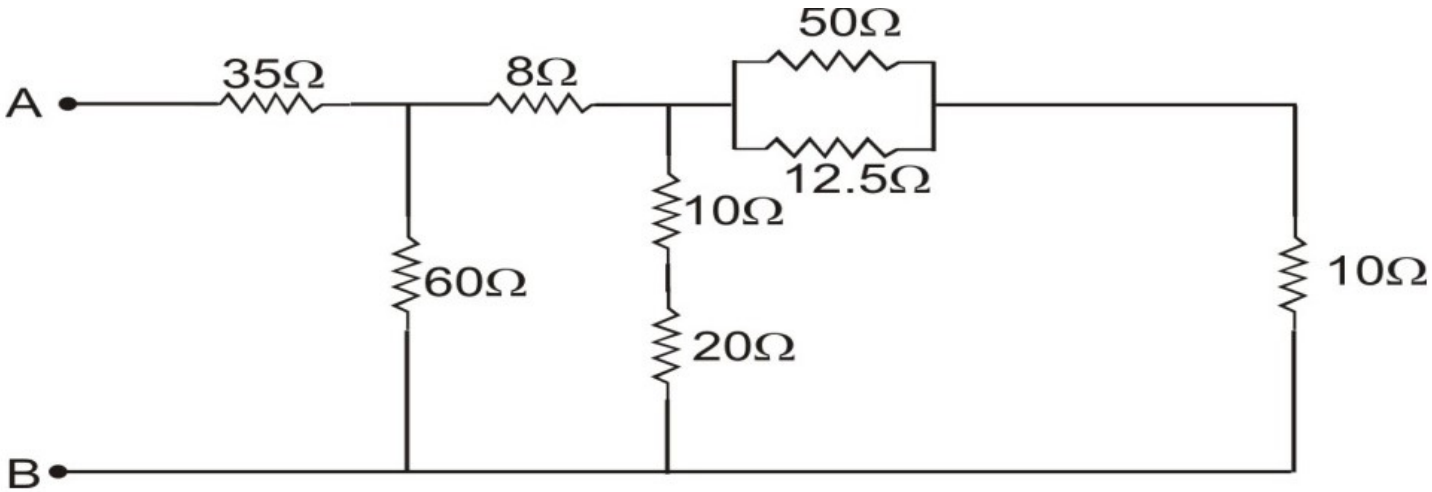
End Semester Examinations - Nov-Dec 2015 Exams

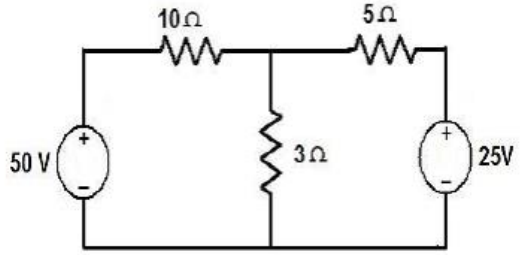
14EE2001 Electric Circuits and Networks

Set **Time : 3 hrs**
A **Total Marks: 100**

1. a. Determine the equivalent resistance between terminals A and B in the Figure. (10)

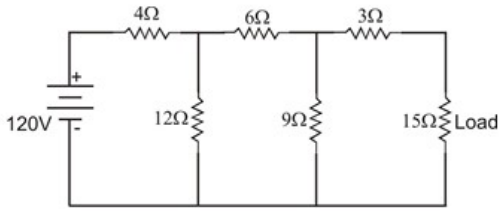


b. Find the power delivered by the batteries of figure below. (10)

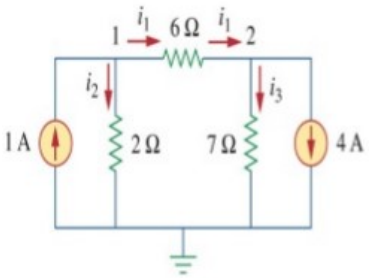


OR

2. a. Find the load current using mesh analysis. (10)

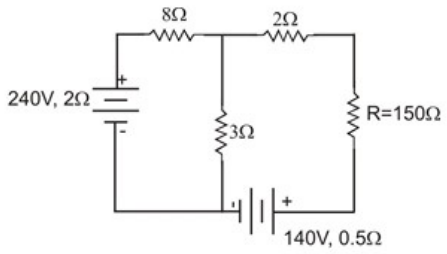


b. Find the node voltages at 1 & 2. (10)



3. a. State and explain Thevenins theorem. (10)

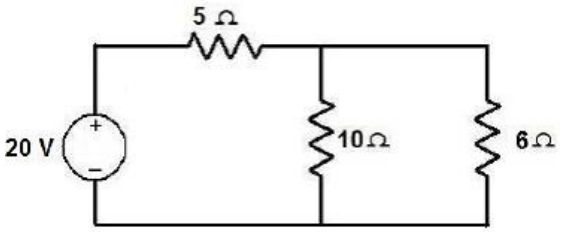
b. Find the current in the 150 Ω load resistor of the circuit shown in figure using the principle of superposition. (10)



OR

4. a. State and explain maximum power transfer theorem for variable Pure resistive load.(10)

b. Using Norton's theorem, find current through 6 ohm resistance shown in figure. (10)



5. a. The impedances each of 10 + j5 ohm are connected in delta to a 3 phase, 400 V supply. Determine the current in each phase and in each line. Calculate also the total power drawn from the supply and the power factor of the load. (10)

b. Derive an expression to find the output current, voltage and amplification factor of a single tuned coupled circuit. (10)

OR

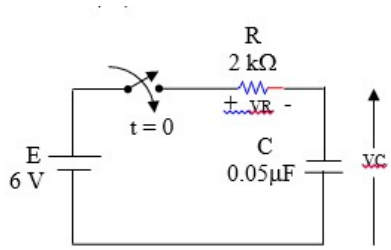
6. a. With a neat circuit and phasor diagram explain the three phase power measurement by two wattmeter method and also derive the expression for Power Factor. (10)

b. Explain dot rule for coupled coils. (5)

c. Two inductively coupled coils have self inductance L_1 = 50 mH and L_2 = 200 mH. If the Co-efficient of coupling is 0.5, find the value of mutual inductance between the coils. (5)

7. a. The switch in the RC circuit shown in Fig. was closed at t = 0. There was no charge initially stored on the capacitor. Find

a. v_R, the voltage across the resistor at t = 60 ms.
b. The time at which v_R is 2 V. (10)



b. Derive the transient response of an RL circuit when it is switched to a unit step voltage source at time t=0. Assume that the initial current through the inductor is zero. (10)

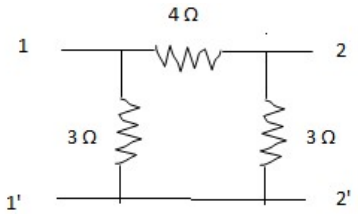
OR

8. a. Derive the transient response of an RL circuit when it is switched to a sinusoidal voltage source at time t=0. Assume that the initial current through the inductor is zero. (10)

b. A Series RLC circuits has R=50 ohm, L= 0.2H, and C = 50 microfarad. Constant voltage of 100V is impressed upon the circuit at t=0. Find the expression for the transient current assuming initially relaxed

conditions. (10)

9. a. Determine the open circuit impedance parameters of the π network given below.(10)



b. Design a constant K low pass filter having a cut off frequency of 2 KHz to operate with a terminated load resistance of 500 ohm. (10)

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End Semester Examinations - Nov-Dec 2015 Exams

14EE2004 Electromagnetic Fields

Set B **Time : 3 hrs**
Total Marks: 100

1. a)State the condition of helmholtz theorem and explain the same.(8)

   b)Locate the following points in the corresponding coordinate system ***P*** (2,-4,2) ***Q*** (3,45º,6) ***R*** (1.5,120º,30º).(8)

   c)State the condition of a solenoid.(4)

OR

2. a)Locate the point $(3,45^0,30^0)$ in spherical coordinate system.(5)

   b)A point is given as (2,1,3) convert these into spherical coordinate systems.(10)

   c)Write the differential elements of a cylindrical coordinate system.(5)

3. a. State and explain columbs law in detail. (8)

   b. Three point charges of $3*10^3$ μ μC are placed at 3 corners of a square. The side of a square is 0.2m.Find electric field intensity at vacant corners.(12)

OR

4. a)Calculate the electric flux density at P(2,-3,6) produced by a point charge 55 mC at Q (-2,3,-6). (10)

   b)An electric dipole is located symmetrically at y axis with a distance 1 cm with a charge of ±3 nC. Find the electric potential at P(2,1.5,3). (10)

5. A capacitor with air as the dielectric medium has a plate area of $1cm^2$ with a plate separation of 0.1mm.Find the displacement current and displacement current density for an applied voltage of 100 sin $(3.14 * 10^6)t$. (20)

OR

6. State and prove Biot Savarts Law and prove Ampers Circuital law with an illustration.(20)

7. From the fundamental laws, derive Maxwell's equations in point form and integral form.(20)

OR

8. Using the concept of dynamic induced emf , derive the (i)emf induced in a moving conductor (ii)emf induced in a rotating disc (iii)emf induced in a rotating drum.(4+8+8)

9. Derive the electromagnetic wave parameter for a good conductor and mention its applications. (20)

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End Semester Examinations - Nov-Dec 2015 Exams

14EE2005 DC Machines and Transformers

Set B **Time : 3 hrs** **Total Marks: 100**

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1. A. Explain the Principle of operation of a DC machine. (10)

   B. Define armature reaction. What are the effects of armature reaction? Name the various methods of decreasing the effects of armature reaction. (10)

OR

2. Classify the d.c generator based on the methods of excitation. Derive the emf equation of each type with relevant circuit diagram. (20)

3. A. The Open circuit characteristic of a DC shunt generator driven at 600rpm is as follows.

Field Current (A)	0.5	1	2	3	4	5
Generated EMF (Volts)	75	225	330	390	410	425

   Find (a) the emf to which the generator will excite when the field circuit resistance is 100Ω. (b) the additional resistance required in the field circuit to reduce the emf to 350V. (c) critical value of the shunt field resistance at 600rpm (d) the critical speed when the field circuit resistance is 100Ω. (e) the lowest possible speed at which an open circuit voltage of 300V can be obtained with the field circuit resistance of 100Ω. Neglect brush contact drop. (15)

   B. Under what circumstances does a DC shunt generator fails to build up? (5)

OR

4. A. A 250kW, 500V, long shunt compound generator develops 480V, on no-load when running at 1000rpm. The speed of the machine falls to 975 rpm on full load and the terminal voltage rises to 500V. If the increase in flux from no load to full load is 15%, calculate the value of the armature resistance. The series and shunt field resistances are 0.02Ω and 100Ω respectively. Assume a voltage drop of 1V/brush. (10)

   B. Explain the load characteristics of a DC Shunt generator. (10)

5. A. A 220V DC shunt motor runs at 1000rpm while taking a current of 25A. The resistance of the armature is 0.2Ω and that of shunt field circuit is 110Ω. Calculate the speed when the load is increased so that the motor takes a current of 50A. During this increase in load, armature reaction weakens the field by 2%. The voltage drop per brush is 1V. Determine the torque developed in both cases. (14)

   B. Derive the torque equation of a DC motor. (6)

OR

6. A. Write in detail about the load characteristics of a Shunt, Series and Compound Motor. (12)

   B. Explain the working of a three point starter in a DC motor. (08)

7. A. Explain the equivalent circuit of a transformer. (08)

   B. A 20kVA, 440V/220V, single phase transformer has resistances of 0.9Ω and 0.022Ω. The values of the reactances are 0.15Ω and 0.037Ω. Calculate for the transformer (i) total resistance referred to the primary (ii) the total resistance referred to the secondary (iii) total reactance referred to the primary (iv) total reactance referred to the secondary (v) full load copper loss. Draw the equivalent circuit for the above details. (12)

OR

8. A 220V/440V, single phase transformer has the following test results:

   OC Test: 220V, 1.5A, W on LV side

   SC Test: 20V, 6A, 80W on HV side

   Calculate the (a) equivalent circuit of the transformer referred to LV side and HV side. (b) full load efficiency at 0.8pf (c) voltage regulation at 0.8 pf (lagging & leading) conditions. (20)

9. Draw the diagram of connection for the back-to-back test on two similar single phase transformers and explain how the efficiency and equivalent circuit parameters of these transformers can be determined. (20)

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End Semester Examinations - Nov-Dec 2015 Exams

14EE2007 Induction and Synchronous Machines

Set A **Time : 3 hrs** **Total Marks: 100**

1. **A.** Draw the equivalent circuit of a three phase induction motor. (08)

   B. A 440V, three phase, 50Hz, 4 pole, Y-connected induction motor has a full load speed of 1425rpm. The rotor has an impedance of (0.4+j4)Ω and rotor/stator turn ratio of 0.8. Calculate (i) full load torque (ii) rotor current and full load rotor cu loss (iii) power output if windage and friction losses amount to 500W (iv) maximum torque and the speed at which it occurs (v) starting current (vi) starting torque. (12)

OR

2. Draw the circle diagram from no load and short circuit test of a three phase, 14.92kW, 400V, 6 pole induction motor from the following test results. No-load: 400V, 11A, p.f = 0.2, Short circuit: 100V, 25A, p.f = 0.4, Rotor cu loss at standstill is half the total cu loss. From the diagram, find (a) Line current (b) slip (c) Mechanical output power (d) efficiency (e) power factor at full load (f) maximum torque. (20)

3. Using double revolving field theory, explain why a single phase induction motor is not self starting. Draw the torque slip curve of a single phase induction motor. (20)

OR

4. Find the mechanical power output at a slip of 0.05 of the 180W, 4 pole, 110V, 50Hz, single phase induction motor whose constants are as follows: R_1 = 1.86Ω, X_1 = 2.56Ω, R_2' = 3.56Ω, X_2' = 2.56Ω, X_m = 53.5Ω, core loss = 35W, friction and windage losses = 13.5W. (20)

5. A. A 50 kVA, 415 V, 50 Hz, star-connected alternator has an effective resistance of 0.2 Ω per phase. A field current of 8 A causes an emf of 415 V on open-circuit and a current of 185 A on short-circuit. Calculate (i) the synchronous impedance (ii) the synchronous reactance and (iii) the full-load voltage regulation at 0.8 *pf* lagging. (10)

   B. With neat circuit, explain how to predetermine regulation of three phase alternator by Rothert's MMF method. (10)

OR

6. A. Discuss the methods of synchronizing an alternator with an infinite bus bar. (10)

   B. Derive an expression for the synchronizing power of an alternator and deduce an equation for the synchronizing torque. (10)

7. Derive an expression for power developed as a function of load angle for a salient pole generator, neglecting resistance. Obtain the condition for maximum power. (20)

OR

8. A three phase, star connected, 11kV, 12 pole, 50Hz, salient pole synchronous motor has reactance of X_d = 5Ω and X_q = 3Ω. At certain load, the motor draws 20MW at unity pf. Compute (i) the excitation voltage (ii) power developed (iii) synchronizing power and corresponding torque (iv) maximum power developed and the corresponding load angle. Neglect the resistance of the winding. (20)

9. A. Discuss briefly why synchronous motors are inherently not self starting. Explain the different methods for starting of synchronous motors. (12)

   B. A six pole, three phase, star connected synchronous motor has synchronous impedance of (0.5+j8.0)Ω per phase.When operating on 2.2kV, 50Hz bus bars, its field current is such that the emf induced is 1.8kV.Calculate the maximum torque that can be developed at this excitation condition, current and power factor.
   (08)

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End Semester Examinations - Nov-Dec 2015 Exams

14EE2010 Power Electronics

Set B

Time : 3 hrs
Total Marks: 100

1. a) Draw and elucidate the reverse recovery characteristics of a power diode. (10)

   b) Compare Power MOSFET and Power BJT. (5)

   c) Outline the V-I Characteristics of TRIAC with a neat diagram. (5)

OR

2. a) Mention the major features, drawbacks and applications of IGBT. (8)

   b) Explain the Static and switching characteristics of Power MOSFET. (12)

3. a) A single phase fully controlled full bridge converter is supplied by 230V, 50Hz. It is connected with R-L Load. (13)

      i) Determine the average and rms output voltage if the firing angle is 60°.

      ii) Calculate the firing angle for which the average output voltage of the converter is 200V.

   b) Sketch the circuit diagram of three phase half wave controlled converter. (7)

OR

4. a) Explain the operation of a single phase semi converter bridge with neat diagram and waveforms.(15)

   b) Compare single phase full and semi controlled converters. (5)

5. a) List out the applications of AC Voltage Controller and Cycloconverter. (8)

   b) Analyze the working of single phase to single phase step down cycloconverter with circuit diagram and waveform. (12)

OR

6. a) Recommend a DC to DC Converter which can operate in all the four quadrants.(15)

   b) A type – A chopper has V_{dc} = 100 V, R = 10 Ohms. If the duty cycle is 0.4, calculate average voltage V_{avg}, rms voltage V_{rms}, average current I_{avg} and rms output power P_o (5)

7. Describe the operation of three phase inverter in 180° mode conduction with necessary circuit diagram, waveforms. Derive the expression for the RMS value of phase voltage and line voltage.

OR

8. a) What is PWM? Also mention its advantages and disadvantages. (6)

   b) Explain about the working of single phase series inverter. (14)

9. a) Discuss the working of UPS with neat circuit diagram. (10)

   b) With circuit diagram and waveforms explain the operation of phase controlled rectifier fed DC Motor Drive. (10)

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End Semester Examinations - Nov-Dec 2015 Exams

14EE2013 Transmission and Distribution

Set B

Time : 3 hrs
Total Marks: 100

1. A). Derive the expression for capacitance of a single phase over head line. (10)

B). The three conductors of a 3 phase wire are arranged at the corners of a right angled isosceles triangle. If each equal side of this triangle is 2m, find line – to – neutral capacitance per km. Take the diameter of each conductor as 1.24 cm. The conductors are transposed at equal intervals. (10)

OR

2. A) Show how regulation and transmission efficiency are determined for medium lines using a End Condenser Method. (10)

B) A 3-phase, 50Hz transmission line 100 km long delivers 20 MW at 0.9 pf lagging and at 110 kV. The resistance and reactance of the line per phase per km are 0.2 ohm and 0.4 ohm respectively, while capacitance admittance is 2.5×10^{-6} siemen / km/ ph.

a. Calculate the current voltage at the sending end.

b. Efficiency of transmission. Use nominal T method. (10)

3. A.) Discuss any two methods to increase the value of string efficiency with suitable sketches. (10)

B.)Explain suspension type insulators. Give reasons for unequal potential distribution over a string of suspension insulators. Show that in a string of suspension insulators, the disc nearest to the conductor has the highest voltage across it. (!0)

OR

4. A.) Write down the expression for maximum sag in overhead transmission line. Discuss the effects of wind and ice covering on the sag of an overhead line conductor. (10)

B). Two towers of heights 30m and 90m respectively support a transmission line conductor at water crossing. The horizontal distance between the towers is 500m. If the tension in the conductor is 1600kg, find the minimum clearance of the conductor and the clearance of the conductor mid-way between the supports. Weight of the conductor is 1.5kg/m. Bases of the towers can be considered to be at the water level. (10)

5. A).A 33 kV, 50 Hz, 3 phase underground cable, 4 km long uses three single core cables. Each of the conductor has a diameter of 2.5 cm and the radial thickness of insulation is 0.5 cm. Determine (a) capacitance of the cable / phase (b) charging current / phase (c) total charging KVAR. The relative permittivity of insulation is 3.(10)

B). With a neat cross sectional diagram, explain the construction of underground cables.(10)

OR

6.

A). Prove that g_{max}/g_{min} in a single core cable is equal to D/d where D is the internal sheath diameter and d is the core diameter. (10)

B). A single core cable of conductor diameter 2 cm and lead sheath of diameter 5.3 cm is to be used on a 66 KV, 3 phase system. Two intersheaths of diameters 3.1 cm and 4.2 cm are introduced between the core and the lead sheath. If the maximum stress in the layers is the same, find the voltages on the

intersheaths. (10)

7.

A). A 2-wire d.c distributor AB is fed from both ends .At feeding point A the voltage is maintained as at 230V and at B 235 V .The total length of the distributor is 200meters

and loads are tapped off as under:

25 A at 50 meters from A; 50 A at 75 meters from A;

30 A at 100 meters from A; 40 A at 150 meters from A;

The resistance per kilometer of one conductor is 0.3 Ω .Calculate:

(i)Current in various sections of the distributor.

(ii)Minimum voltage and the point at which it occurs.(10)

B.Explain briefly two methods of solving A.C. distribution problems .(10)

OR

8. Describe briefly the different types of ac and dc distribution? (20)

9.

A). Draw and explain the structure of AC transmission system with its voltage levels.(10)

B). Derive an expression for two phase two wire system. (10)

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End Semester Examinations - Nov-Dec 2015 Exams

14EE3001 Power Semiconductor Devices

Set B **Time : 3 hrs**
Total Marks: 100

1. a) Sketch the Two Transistor Model of a SCR. (7 Marks)

   b) Brief our latching and holding current of a Thyristor. (5 Marks)

   c) List out the major features of IGBT. (8 Marks)

OR

2. a) Compare Power BJT and Power MOSFET. (8 Marks)

   b) Sketch a basic Power Electronic circuit. (5 Marks)

   c) Discuss the development of Power Semiconductor Devices. (7 Marks)

3. a) Construct the storage charge Q_{RR} and the peak reverse current I_{RR} of a Power Diode, if the reverse recovery time of a diode is $t_{rr} = 5\mu s$ and the rate of fall of the diode current is di/dt = 20A/μs. (5 Marks)

   b) Demonstrate the working of Power Diode in the reverse recovery mode in detail. (15 Marks)

OR

4. Explain the static V-I and switching characteristics of Thyristor with neat diagrams and waveforms.

5. a) Describe the working principle, static & switching characteristics of Power MOSFET with necessary diagrams and waveforms. (13 Marks)

   b) List out the major features of IGBT. (7 Marks)

OR

6. Assess the steady state and switching characteristics of Power BJT with neat diagrams and waveforms.

7. a) TRIAC can be operated in four modes – Justify the statement with neat diagrams and explanation. (10 Marks)

   b) Propose a R-C based circuit to manage the turning on and off of TRIAC for an AC Voltage Controller. (10 Marks)

OR

8. a) Construct and discuss a firing circuit to control two SCR's using UJT with neat sketch. (7 Marks)

   b) Evaluate the performance of IGBT in the switching mode with neat diagram and waveforms. (13 Marks)

9. Appraise the working principle and characteristics of GTO with neat diagrams and waveforms.

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End Semester Examinations - Nov-Dec 2015 Exams

14EE3002 Power Converter Analysis – I

Set B

Time : 3 hrs
Total Marks: 100

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1. A single phase half controlled converter supplies an inductive load. Assuming that the output current is virtually constant, and is equal to 4A, determine the following performance measures, if the supply voltage is 230V and if the firing angle is maintained at 60°. (a) Average output voltage (b) Supply RMS current (c) Supply fundamental RMS current (d) Fundamental power factor (e) Supply power factor (f) Supply harmonic factor (g) Voltage ripple factor. (20)

OR

2. Derive the expressions for the following performance parameters of a single phase fully controlled converter. (i) Input displacement factor (ii) Input power factor (iii) DC voltage ratio (iv) Current distortion factor (v) harmonic factor (vi) voltage ripple factor (vii) Active power input (viii) Reactive power input. (20)

3. (a) For a three phase half wave SCR converter delivering continuous output current, derive expressions for the average output voltage for firing angle of (a) $0° < \alpha < 30°$ (b) $30° < \alpha < 150°$. (12)

   (b Draw the following waveforms: line voltage, output voltage, load current, source current, thyristor current and thyristor voltage. (08)

OR

4. (a) Discuss about the effects of source inductance on the performance of a three phase full converter. Draw the relavent waveforms. (14)

   (b) Compare a three phase semiconverter with three phase full converter. (06)

5. Explain the working of a class A chopper. Derive the expression for minimum and maximum current for a class A chopper. (20)

OR

6. (a) The input voltage to a buck boost converter is E_{dc} = 10V. The duty cycle α = 0.3 and the switching frequency is 25kHz. The inductance L = 150µH and the filter capacitance C = 220µF. The average load current I_o = 1.2A. Determine: (a) Average output voltage (b) peak to peak output voltage ripple (c) peak to peak current of inductor (d) peak current of the device. (14)

   (b) Discuss about the control strategies used for chopper. (06)

7. (a) A single phase full wave ac voltage controller feeds a load of R = 20Ω with an input voltage of 230V, 50Hz. Firing angle for both the thyristors is 45°. Calculate (i) rms value of output voltage (ii) load power and input power factor (iii) average and rms current of thyristors. (10)

   (b) Construct a AC voltage controller which can control the voltage continuously from 0 to 2 times the applied voltage and explain its operation. (10)

OR

8. What is a matrix converter? Discuss how three phase to three phase frequency conversion occurs in the converter. Mention the advantages and disadvantages of the converter. (20)

9. Explain the operation for a half wave mode of ZVS resonant buck converter with associated waveforms. List the advantages and limitation of ZVS converters. (20)

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End Semester Examinations - Nov-Dec 2015 Exams

14EE3003 Power Converter Analysis – II

Set B

Time : 3 hrs
Total Marks: 100

1. a) Outline the Sinusoidal pulse width modulation techniques used for controlling inverter output voltage. (10)

   b) Explain the principle of operation of single phase full bridge inverter with neat waveforms. (10)

OR

2. Justify that in 120º conduction mode, three phase bridge inverter underutilizes the devices. Also Compare the operation with 180º conduction mode.

3. a. Construct a current source inverter for force-commutation operation and also derive its average voltage equation for R load. (15)

   b. Compare voltage source inverter and current source inverter. (5)

OR

4. a) Sketch the current and voltage waveforms for a single phase current source inverter which uses Ideal Switches. (15)

   b) A single phase auto-sequential commutated CSI is fed from 220V dc source. The load is R = 10Ω. Thyristors have turn-off time of 20 µs and inverter output frequency is 50Hz. Take a factor of safety of 2. Determine suitable value of source inductance assuming a maximum current change of 0.5A in one cycle. Neglect all losses. Find also the values of commutating capacitors. (5)

5. a) Prepare a comparison chart for the component requirements per leg of the three types of multilevel Inverter. (5)

   b) Analyze the Power circuit of 5 level multilevel inverter which does not have any balancing capacitors and clamping diodes. (15)

OR

6. Portray the principle of operation and features of Flying -capacitor Multilevel Inverter with neat diagrams and waveforms.

7. a) Analyze the operation of series resonant inverters with Unidirectional switches. (12)

   b) A series resonant inverter has L = 50µH, C= 6µF and R = 2Ω. The DC input voltage V_s = 220V and frequency of the output voltage f_o = 7kHz. The turn-off time is t_q = 10µs. Determine a resonant frequency f_r, the available turn off time t_{off} and maximum permissible frequency f_{max}, the peak to peat capacitor voltage, the peak load current, sketch the instantaneous load current, capacitor voltage, the rms load current, the output power, the average supply current. (8)

OR

8. a) Describe the various modes of operation in series resonant inverter with bidirectional switches. (15)

   b) Discuss about resonant DC link inverter. (5)

9. a) Illustrate the application of Inverters with one example. (10)

   b) Predict the requirements for a good inverter (10)

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End Semester Examinations - Nov-Dec 2015 Exams

14EE3007 Generalized Theory of Electrical Machines

Set A **Time : 3 hrs**
Total Marks: 100

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1. a) Generalize the voltage equations for Kron's Primitive machine in matrix form. And identify the observations are made from the impedance matrix of this machine? (14)

   b) Originate an expression of transformer voltage and speed voltage in the armature of an electrical machine. (6)

OR

2. Formulate an expression for the electrical torque of the Kron's Primitive machine. Show that no torque is produced by interaction between the flux and current on the same axis.

3. A three phase Induction motor has the following per phase parameters referred to stator:

   Stator resistance ---- 0.30 W

   Rotor resistance ---- 0.45 W

   Stator and Rotor leakage reactance ---- 2.1 W each

   Magnetizing reactance ---- 30.00 W

   Calculate the parameters of an equivalent 2-phase Induction motor if it's per phase turns are:

   i. same as that of the 3-phase Induction motor.

   ii. 3/2 times that of the 3-phase Induction motor.

   iii. √3/2 times of the 3-phase Induction motor

OR

4. a) In order to ensure power invariance in transforming one set of variables to another, show that the transpose of the transformation matrix should be equal to its inverse. (10)

   b) Demonstrate the term 'Linear transformation' as used in electrical machines? Illustrate your answer with suitable examples. (10)

5. The separately excited d.c. generator running at 4500 / π rpm, has the following parameters: r_f= 80 Ω; L_f = 40 H; r_a = 0.1 Ω; L_a = 0.3 mH; Motional Inductance M_d = 0.8 H; (or generated e.m.f constant $K_g = M_d \omega_r$ = 120 volts / field amp)

   a. The field is unexcited and the armature is open. Find the armature voltage as a function of time and sketch it, if a constant voltage of 160 volts is suddenly impressed across the field terminals.

   b. Dramatize the rise of armature current in part (a), if the armature terminals are initially short circuited.
   c. Armature voltage has attained steady value in part (a). Now the armature is suddenly connected to a load of resistance 1.1 Ω in the series with an inductance of 1.7 mH. Conclude (i) armature current and (ii) the armature terminal voltage as functions of time.
   d. In part (c), calculate the electrical torque as a function of time. Obtain the mean value of torque also.
   e. In part (c), after the armature current has become steady state, an additional resistance of 0.4 Ω is inserted in the load circuit. Predict the armature current, after this change.

OR

6. Paraphrase the principle of regenerative braking and counter current braking of d.c.motors.

7. Develop the three phase induction machine stator and rotor voltage, flux linkages, torque equations in terms of arbitrary *qdo* reference frame.

OR

8. a) Investigate the Stator transient inductance of three phase induction machine in detail. (14)

   b) Draw the relationship between abc and arbitrary qdo reference frame of Induction Machine. (6)

9. a) Explain in detail about the steady state operation of Synchronous Machine. (10)

   b) Develop the sub-transient Inductance of Synchronous Machine. (10)

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End Semester Examinations - Nov-Dec 2015 Exams

14EE3011 Photovoltaic Systems

Set A

Time : 3 hrs
Total Marks: 100

1. a) . Draw the equivalent circuit of an ideal solar cell and derive its Fill Factor. (15)

   b) . Derive the PV Module current equation by considering the series resistance of a solar cell. (5)

OR

2. a) Briefly write about the geometric and atmospheric effects of sunlight with Suitable sketches. (10)

   b) Estimate the monthly average daily global solar radiation on the horizontal surface at Nagpur(21.06 N,79.03 E) during the month of May

   if the average sunshine hours per day is 10.2. Assume values for a=0.27 and b=0.50. (10)

3. a). Draw the circuit diagram of the three phase inverter circuit. Also draw its necessary waveforms and explain the operation of the circuit. (10)

   b). Discuss open circuit voltage and short circuit current parameter of PV cell. (10)

OR

4. a). With the help of neat sketches , explain the various types of energy storage methods. List out its merits and demerits. (15)

   b). Derive an equation for a hot spot problem in a photovoltaic modules and safe operating area. (5)

5. a). With the help of a neat diagram explain the principle of working of Lead acid batteries State its advantages and limitations of this cell. (10)

   b) . Briefly explain about the factors affecting the battery performance. (10)

OR

6. Design a solar PV System wherein the total load consists of CFL,TV, fan, refrigerator and a computer . The system should allow the use of loads in non-sunshine hours. The operating hours and power rating of these loads are given in the table below.

S.NO	LOAD	WATTS	H/DAY	NUMBER
1	CFL	18	6	3
2	FAN	70	4	2
3	TV(27")	250	8	1
4	REFRIGERATOR	150	2	1
5	COMPUTER	250	1	1

7. a). With the help of neat diagrams explain about the power conditioning circuits used in PV system and derive an expression for voltage gain for the types of DC-DC Converters.(10)

b). Describe about the interfacing of PV modules to load and battery modeling. (10)

OR

8. a) Discuss about the mismatches in series and parallel connection of solar photovoltaic modules. (10)

b) .Design a PV water pumping system, which is required to draw 20,000 litres of water every day from a depth of 20mt. Assume the necessary values for the same. (10)

9. a). With the help of an example explain about the PV array sizing procedure and battery sizing procedure in a standalone photovoltaic system and draw the graph between C_A vs C_S. (10)

b). Draw the schematic diagram of a grid connected photovoltaic systems and discuss about its technical considerations.(10)

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End Semester Examinations - Nov-Dec 2015 Exams

14EE3012 Power Electronic Circuits

Set B

Time : 3 hrs
Total Marks: 100

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1. a. What is a thyristor? Give constructional details side-gate thyristor. Explain and sketch its schematic diagram, static I-V characteristics. (15 marks)

   b. Draw the two transistor model of SCR and derive an expression for anode current. (5 marks)

OR

2. a. Explain switching characteristics of an IGBT. How does latch-up occur in an IGBT? (10 marks)

   b. Discuss briefly the concept of power electronics and various types of power electronic converters. (5 marks)

   c. Define and show latching and holding currents as applicable to an SCR in its I-V characteristics. (5 marks)

3. a. Describe the working of a single phase full converter in the inverter mode with RLE load. Illustrate your answer with waveforms for source voltage, load voltage and current, source current, current through and voltage across one SCR. Assume continuous conduction. (15 marks)

   b. A 3-phase full converter charges a battery from a three-phase supply of 230V, 50Hz. The battery emf is 200V and its internal resistance is 0.5W. On account of inductance connected in series with the battery, charging current is constant at 20A. Compute the firing angle delay and the supply power factor. (5 marks)

OR

4. a. Describe the effect of source inductance on the performance of a single phase full converter with relevant waveforms. Indicate the sequence of conduction of various thyristor. (5 marks)

   b. A single-phase half-wave converter is operated from 230V, 50Hz source and the load resistance is R=12W. For a firing angle delay of 30^{o}, determine rectification efficiency, form factor, voltage ripple factor, transformer utilization factor and PIV of thyristor. (10 marks)

   c. With neat diagrams, explain the operation of Ideal dual converter. (5 marks)

5. a. Explain the operation of different modes of voltage-commutated chopper with neat diagrams. Sketch its voltage and current waveforms with respect to time. (15 marks)

   b. A step up chopper has input voltage of220V and output voltage of 660V.if the conducting time of thyristor-chopper is 100μs, Compute the pulse width of the load. (5 marks)

OR

6. a. Describe the working of four quadrant chopper with relevant circuit diagrams and its operation in all the four quadrants. (10 marks)

   b. Discuss the main types of dc choppers. Enumerate the applications of dc choppers. Explain TRC control strategy followed for varying duty cycle α. (10 marks)

7. a. What are resonant converters? With neat circuit diagrams and waveforms, explain ZCS resonant converter. (15 marks)

   b. Give the advantages and limitations of ZCS resonant converters. (5 marks)

OR

8. a. What are resonant converters? With neat circuit diagrams and waveforms, explain ZCS resonant converter. (15 marks)

b. Give the advantages and limitations of ZCS resonant converters. (5 marks)

9. a. For a single-phase voltage controller, connected to a resistive load, analyse the output voltage waveform into various harmonics using fourier series and find the expressions for the amplitude of fundamental voltage component and its phase. (12 marks)

b. A single-phase full-wave ac voltage controller feeds a load of R=20W with an input voltage of 230V, 50 Hz. Firing angle of thyristor is 45^{o}. Determine (i) rms value of output voltage, (ii) power delivered to load and input power factor and (iii) average input current. (8 marks)

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End Semester Examinations - Nov-Dec 2015 Exams

14EE3013 Energy Engineering

Set A

Time : 3 hrs
Total Marks: 100

1. A. Investigate on the various ways to conserve energy with an outline of the energy flow diagram.(8 Marks)

   B.Summarize on the formation of fossil fuels and compare their difference from renewable resources.(7 Marks)

   C.Analyze on the fossil fuels based on the reserves and potential of generation in India.(5 Marks)

OR

2. A. Group the energy sources as conventional and non conventional sources. (5 Marks)

   B.Evaluate on the consumption and production of crude oil in the world with the statistical data.(15 Marks)

3. A. Calculate the efficiency of a liquid flat plate collector and draw the thermal resistance network showing the losses in the collector.(15 Marks)

   B. Criticize on the effect of any five parameters on the performance of the flat plate collector.(5 Marks)

OR

4. A. Plan the various ways of extracting energy from biomass and outline their technologies in detail.(13 Marks)

   B. Analyze on the hot rock resources and present the useful energy generated from the same.(7 Marks)

5. A. State two similarities between fuel cell and internal combustion engine.(2 Marks)

   B. Illustrate the intrinsic differences between a fuel cell and a battery.(5 Marks)

   C. Explain the construction and operation of the various types of fuel cells with their applications.(13 Marks)

OR

6. A.Summarize on the emission regulations and problems of the Kyoto protocol .(10 Marks)

   B. Plan the various ways of preventing secondary pollution and analyze the source problem of these pollutions.(10 Marks)

7. A. Summarize on the pollution due to thermal and nuclear power generation and their control measures.(10 Marks)

   B. Plan and suggest the various relevant ways of preventing global warming in the world.(5 Marks)

   C. Analyze on the evolution of Smart grids and present the smart energy resources .(5 Marks)

OR

8. A. Propose the control methods to prevent pollution due to hydro power generation and analyze on the productive ways to conserve energy.(15 Marks)

   B.Plan the various ways of handling and disposal of the radioactive waste.(5 Marks)

9. A. Evaluate on the functional domain selection in a cyber security for wireless networks.(8 Marks)

   B.Draw the main components of the SCADA system in distribution management systems.(5 Marks)

   C.Summarize on the transmission system of smart grids with relevant diagrams .(7 Marks)

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14EE3021 Flexible AC Transmission Systems

Set B **Time : 3 hrs**
Total Marks: 100

1. a) Discuss the concept of power flow in an AC system with neat diagrams (7)

   b) Name the benefits of FACTS Controllers (5)

   c) How do you classify the FACTS controllers? (8)

OR

2. a) Functional control scheme for the TSC-TCR type static var generator (10)

   b) With a neat sketch explain the principle of operation of basic Thyristor Switched Capacitor and draw its characteristics (10)

3. Write the objectives of shunt compensation and discuss its role in improving (20)

   (a) Transient stability

   (b) Voltage stability

   (c) Power oscillation damping.

OR

4. a) Draw V-I Characteristic of SVC and STATCOM (6)

   b) Write the objectives of Series compensation (4)

   c) Explain the working and characteristics of GCSC (10)

5. a) Illustrate the overall IPFC control structure (8)

   b) With the help of a block diagram explain the basic UPFC control scheme. Discuss on the functional control modes of UPFC (12)

OR

6. a) Derive the expression for $X_{TCSC}(\alpha)$ in terms of X_L and X_c and explain its impedance –delay angle characteristics (10)

   b) Explain the operation of Thyristor -switching series capacitor (10)

7. a) Select a suitable FACTS Device which will improving both the transient torque and system stability forms of SSR problems (10)

   b) Explain TCBR Operation for Damping the Low-Frequency transients and Dynamic instability (10)

OR

8. a) Illustrate the Overall UPFC Control structure (10)

   b) Explain the Real and Reactive power flow control of UPFC (10)

9. a) Draw the single line diagram of Kayenta ASC and Explain its importance in the transmission line (10)

   b) Explain the SSR performance, harmonics and power system stability of Slatt TCSC (10)

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14EE3024 Distributed Generation

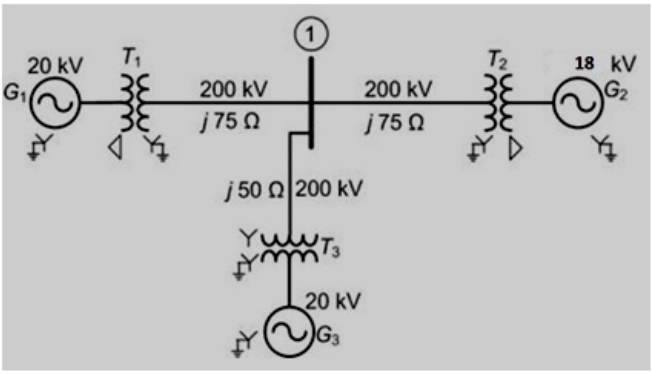
Set A

Time : 3 hrs
Total Marks: 100

1. a) Compare traditional grid with microgrid. (5)

b) Define distributed generation. Summarize the various misconceptions on the definition of DG. (5)

c) For the given system draw the per-unit reactance diagram with G_3 ratings as base. (10)



Equipment Data

G_1	200 MVA, 20kV, X_d=15%
G_2	300 MVA, 18kV, X_d=20%
G_3	300 MVA, 20kV, X_d=20%
T_1	300 MVA, 220/22 kV, X=10%
T_2	3×1f Transformers each rated 100 MVA, 130/25 kV, X=10%
T_3	300 MVA, 220/22 kV, X=10%

OR

2. a) Identify the various components represented by the symbols and write the functions of each component. (10)

S.No	Symbol
1	
2	
3	
4	
5.	

b) Draw the functional schematic of distributed energy sources (DES) interconnection system. Describe the various components of the system. (10)

3. a) Describe different types of micro turbines. List their applications. (10)

b) Derive the expression for power from a wind turbine rotor. Write the inferences from this expression. (5)

c) List the advantages and disadvantages of vertical axis wind turbines. (5)

OR

4. a) Compare the five key technologies deployed in Combined Heat Power Systems. (5)

b) Classify hydropower plants according to their power capacity. List their applications. (5)

c) Illustrate any two types of concentrating solar power plants.(10)

5. Develop different control loops required to interface IC engines to the grid through power electronics interface. Take the grid operating requirements into consideration. Justify the need for each control loop. (20)

OR

6. a) Outline the concept behind the MPPT of WECS. Construct two schemes to track the MPP in a WECS which do not use wind speed measurement. (10)

b) Categorize the modern wind turbine technology according to the power electronics interface. Describe each category. (10)

7. a) A PWM inverter-based DG is connected to a typical distribution system. The inverter is controlled by phase-lock loop (PLL) control based on d-q referenced frame. Predict the problems that will affect the inverter due to unbalanced grid and propose suitable techniques to mitigate the problems. (10)

b) Examine the effect of capacitor switching on the distribution system with different case studies. Draw important conclusions. (10)

OR

8. a) "A grid-tied DG is required by law to have a grid tie inverter with an anti-islanding function". Justify. (5)

b) Classify anti-islanding schemes. Analyze any three techniques. (15)

9. a) Develop local control strategies for AC microgrids. Modify the basic droop control to be suitable for DG systems. (10)

b) List out the responsibilities of microgrid controllers. Describe the centralized and decentralized control techniques applied to microgrids. (10)

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End Semester Examinations - Nov-Dec 2015 Exams

14EE3025 Communications And Control In Smart Grid

Set B **Time : 3 hrs**
Total Marks: 100

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1. 1. a. List out the Benefits and draw backs of the smart Grid concept in power system network (10)

b. Define demand response and brief about its significance (10)

OR

2. Write short notes on smart grid communication requirements in smart Grid (20)

3. Illustrate how Smart Meters can be play an important role to make a system Smart (20)

OR

4. Write Short notes on smart grid communication standards , challenges and protocols (20)

5. Interpret the function of Phasor Measurement Unit (PMU) (20)

OR

6. Construct the Wide area monitoring system (WAMS) to measure the various power system parameters and list out its role in smart grid communication.

7. a. What are the wireless network solutions are available for smart grid communication and explain about it. (10)

b. Write short notes on pricing and energy consumption scheduling (10)

OR

8. Illustrate the basic block diagram of SCADA. Demonstrate the challenges to secure the current automation systems such as SCADA systems with examples. Brief about threats to SCADA systems. (20)

9. a. Review the mitigation techniques used in cyber security system? (8)

b. Analyze different layers in secure communication networks and specify various security requirements to establish such network in smart grid communication. (12)

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14EE3026 Electrical Transients in Power Systems

Set A **Time : 3 hrs**
Total Marks: 100

1. [a] Derive the expressions for first order transients of a RL series circuit excited by an AC sinusoidal source [10]

   [b] Obtain the wave forms for

   (1) Short circuit of a passive RL circuit on ac source, switch closed at zero crossing of the voltage wave.

   (2) Short circuit of a passive RL circuit on ac source, switch closed at the crest of the voltage wave [10]

   [OR]

   OR

2. [a] Derive the expressions for second order transients of a RLC series circuit excited by DC source [10]

   [b] Classify the Transients based on Time, Frequency and Frequency Ranges [10]

3. Discuss in detail the transient phenomena based on the system configuration, the source type, line length, and terminations.

   For a line open at the far end, three types of transients on switching [20]

   [OR]

   OR

4. Brief with diagrammatic representation for the following [20]

   (a) Power system configuration for EMTP simulation of transients on energizing a line.

   (b) Three-phase simultaneous closure.(c) Synchronous closing. (d) Resistance closing

5. [a] List out the over voltages produced by the following operations may be called temporary over voltages [10]

   [b] Mention some mechanisms of generating these transients called temporary over voltages and switching over voltages. [10]

   [OR]

   OR

6. [a] Where they cause transient enclosure voltages (TEV) and travelling waves that propagate along Overhead transmission lines

   when Internally generated transients propagate throughout GIS to reach external connections and bushings [10]

   [b] Describe the effect of lumped capacitance at entrance to GIS when a capacitance, for example, a CVT is installed

   at the entrance of a GIS, under fault conditions [10]

7. Discuss in detail about the Reactances of a synchronous Generator [20]

   [OR]

OR

8. Obtain an envelope of decaying AC component of the short circuit current wave of a synchronous generator

during sub transient, transient, and steady-state periods after a terminal fault. [20]

9. [a] Prepare the modelling guidelines for transformer given by CIGRE and draw the Equivalent circuit of two winding transformer with simplifications [10]

[b] Enumerate the transient voltages impact on Transformers [10]

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14EE3040 Simulation of Power Electronic Systems

Set A **Time : 3 hrs**
Total Marks: 100

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1. A. Classify different methods of data reading and handling operations in MATLAB (14)

   B. Explain the file formats available in MATLAB (06)

OR

2. A. With an example, explain about the control structures available in MATLAB for programming (14)

   B. Solve the following and obtain the results of X_1, X_2 and X3. (6)

When a=6; b=10; c=-2;
X_1 = abs(c)>3 & c<(b-a) & b+a > 3
X_2 = (b==10) | (a< 4)
X_3 = a.*5 >= b.*3 & c < a

3. Exhibit how MATLAB/Simulink FFT tool is used to perform harmonic analysis. Explain with an example. (20)

OR

4. Develop a 5 level MLI using MATLAB/Simulink. Provide the timing diagram for the same along with the Pulse generator block properties. (20)

5. Create a PSIM schematic for performing the speed control of a DC Motor below the rated speed. The input supply available is 220V 1phase 50Hz AC. (20)

OR

6. Compare the methods of gating pulse generation of MATLAB/Simulink, PSIM and PSpice (20)

7. Using SIMCOUPLER develop a DC drive model for controlling the DC motor module available in PSIM. Th ratings of the machine are R_a=0.9 R_f =140ohm, N=1800, V=220. Control circuit to be created in MATLAB/Simulink. (20)

OR

8. Create a MATLAB/Simulink model for a single phase full wave rectifier. Let the firing angle be 40°. Plot the voltage across the RL load (210 ohm, 35mH), Voltage across the thyristor. Input supply be 1phase, 60Hz, 230V. Provide the block parameters also. (20)

9. Using PSPICE, Give the procedure for developing a three phase PWM inverter. Plot the output Voltage characteristics (20)

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14EE3052 PV System Design And Installation

Set B

Time : 3 hrs
Total Marks: 100

1. Discuss the steps sequence to be followed while installing photovoltaic systems. (20)

OR

2. a) With support of load estimation worksheet, find the total AC load, average AC load, total DC load and average DC load. (8)

Individual loads	Quantity	Power rating (W)	Daily usage (hours)
Ceiling Fan	4	60	14
Air Conditioner	1	1000	8
Clothes Washer	1	1450	1.5
Heater	1	1500	1
Iron	1	1200	0.5
Mixer	1	120	0.25
TV	2	300	3
Cell Phone	4	24	1
CFL	4	40	5
DC submersible pump	1	50	1
Refrigerator	1	475 for 13 hrs	-
Computer	1	100	1

B) Outline the factors that affecting the solar module performance with neat graphs. (12)

3. A) Describe the Photovoltaic System Components and also bring out the differences between stand-alone, Hybrid and Grid-tied Photovoltaic Systems. (10)

B) Design a 48V system with sixteen 12V, 5A PV modules and the battery capacity of 6VDC, 360Ah. Additionally, find total Volts, total Amps of solar panel and total Amp-Hours of battery. (10)

OR

4. With detailed description, bring down any four variables to be considered while specifying and installing battery storage system for a stand-alone photovoltaic system. (20)

5. a) Using the sample PV system below, calculate the wire sizes needed for the various portions of stand-alone PV systems. Determine the wire size in various circuits on the DC side of a PV system that powers both DC and AC loads. Assume, single wire run between PV to controller and controller to battery. (Data Sheets may be allowed). (16)

DC system voltage	24 volts
Ten 100-watts modules	Each 12 Volt nominal, Short circuit current Isc of each is 7.2 amps, and maximum power current Imp of each is 6.2 amps.
Eight batteries	Each 6 Volt and 350 Ah
One Charge controller	24 Volts, rated for 60 amps
One 2500 watt Inverter	Input DC=24 volts, Output AC=230V
Total connected DC load	500 Watts at 24 hours
Voltage drop requirement between the PV and battery bank is 2% and the distance is 48 feet.	
Voltage drop requirement between the battery and DC load is 2% and the distance is 12 feet.	
Voltage drop requirement between the battery bank and inverter is 2% and the distance is 7 feet.	

b) List down the differences between equipment grounding and system grounding . (4)

OR

6. Discuss various mounting system types of photovoltaic systems with neat diagrams. (20)

7. a) List down the materials and tools required while going to maintenance trip. (8)

b) Explain any four troubleshooting information for common issues in PV power system, their cause and remedythe following in detail. (12)

OR

8. With neat schematic diagram and sizing worksheet, design a stand-alone PV System for the following loads (home) with help of system specifications. All loads work with 230V AC supply. (20)

Electric Load Information			
Individual loads	Quantity	Power rating (W)	Daily usage (hours)
VCR	1	40	3
Gas clothes dryer	1	300	1
Clothes Washer	1	1450	0.5
Laptop	1	40	8
Microwave	1	1400	0.083
TV	1	130	4
CFL	15	15	4
Refrigerator	1	127	9

System Specifications	
DC System voltage	48 volts
Days of autonomy	4 days
Battery DOD	50%
Battery Capacity	350Ah, 6V
PV Module Power	85 Watts
PV Module Voltage	12 Volt nominal
PV Peak Amps	5.02A
PV Short Circuit Amps	5.34A
PV array mounting is unadjustable and will be set at tilt angle=latitude, year round and there is no backup generator.	
Controller Voltage rating	48 Volt nominal
Maximum Pass-through Amperage	40A
Inverter efficiency	90%
Inverter Continuous Power Output	4000W
Inverter Voltage	48 Volt nominal
Surge Capacity	95 Amps AC

9. a) Discuss the first aid procedures while working with Photovoltaic System. (10)

b) Discuss the electrical while installing or working with Photovoltaic System. (10)

Wishing you All the Best

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End Semester Examinations - Nov-Dec 2015 Exams

14EE3053 Materials For Solar Power

Set B

Time : 3 hrs
Total Marks: 100

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1. Give the detaild study about the Electrical conductivity of solar cell(20)

OR

2. a) Explain Recombination of carriers in semiconductors 10
b) Brief the Screen-Printed Cell Fabrication with a neat Diagram.(5)
c) Formulate the Absorption coefficient with a neat diagram. 5

3. Explain the Technology for Si Extraction along the detailed procedure (20)

OR

4. Explain the physical and optical properties of solar cell(20)

5. a).Give the Ideal coating characteristics solar cell detaily.(10)
b). give the types and applications of various solar cell. (10)

OR

6. Give the probability analysis of Recombination process in semicoductor base solar cells.(20)

7. Explain the Physics of Solar Cells eaboratly(20)

OR

8. A) Explain the fabrication process for InP solar cell .(10)
B) Write the material properties of GaAs with crystal structure diagram. (5)
C) Give the advantages and disadvantages of GaAs. (5)

9. A) Explain the process flow of commercial Si cell technology. (10)

B) Brief about

I.Masking (5)

II.Photolithography (5)

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End Semester Examinations - Nov-Dec 2015 Exams

14EE3054 Passive Solar Architecture

Set A

Time : 3 hrs
Total Marks: 100

1. a) A building has 1,500 m^2 of exterior wall area which is constructed with concrete blocks, 200 mm thick with an R value of 0.395 m^2 $^oC/W$. A retrofit is being planned to reduce the heat flow through the wall by installing a layer of fibre glass insulation, 38 mm thick with an R value of 0.795 m^2 $^oC/W$, on the outside surface of the wall, and then covering the insulation with metal cladding. Calculate the reduction in heat flow through the wall when the outdoor temperature is -5^oC and the indoor temperature is 21^oC (5)

   b) With necessary diagrams, explain the role of building orientation in passive solar architecture and also state the Rule of thumb for achieving best solar gain (15)

OR

2. a) Demonstrate the principles of passive solar heating and cooling with necessary diagrams. (14)

   b) Do you think landscapping play arole in passive solar design? Justify. (6)

3. a) Explore the basic tools and techniques of passive cooling (10)

   b) Outline the strategies for achieving passive cooling in various climatic zones (10)

OR

4. a) Why engineers use natural light in building and passive home designs? (5)

   b) Illustrate day lighting techniques used in various types of architecture, such as windows, solar tubes, light shelves, clerestory windows and skylights. (15)

5. Write short notes:

   a) Trombe Wall (6)

   b) Solarium (6)

   c) Site Selection (8)

OR

6. a) How thermal mass works? Where to locate thermal mass? (5)

   b) Assess the role of thermal mass in the effectiveness of the heating and cooling discharge operations. (15)

7. a) Discuss about the computer packages available for carrying out thermal design of buildings. (5)

   b) Summarize Thumb Rules for the following: (15)

   1. Buiding Construction
   2. Building Shape
   3. Shading
   4. Glazing
   5. Thermal Mass

OR

8. Write the passive design strategies appropriate for various climatic zones in India in terms of site planning, orientation, building envelope, materials & shading to control heat and energy conservation measures to improve occupant comfort. (20)

9. a) A ventilation system supplies 1,200 litres/second of outdoor air into a building. Calculate the rate of energy required when the outdoor temperature is -5^{o}C and the building space are maintained at 23^{o}C (2)

b) Summarize the Energy management opportunities for the building envelope to reduce heat losses due to conduction,convection and radiation (16)

c) Determine the length of the overhang projection for a window with 6 feet height and F factor of 2.7 (2)

Wishing you All the Best
