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10EE61

Sixth Semester B.E. Degree Examination, June/July 2017
Power System Analysis and Stability

Time: 3 hrs. Max. Marks:100

Note: *Answer FIVE full questions, selecting at least TWO questions from each part.*

PART – A

1 a. What is meant by one line diagram of a power system? With typical example explain its significance. **(08 Marks)**

b. Draw the per unit reactance diagram for the power system shown in Fig Q1(b) on 20MVA, 6.6kV base in the generator 1 circuit.

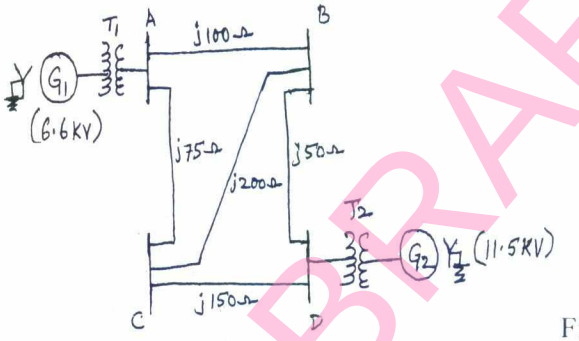

Fig Q1(b)

The rating of the various components.
Gen 1 : 10MVA, 6.6KV, X″ = 0.1 Pu
Gen 2 : 20MVA, 11.5KV, X″ = 0.1 Pu
Transformer 1 : 10MVA, 3phase, 6.6/115KV, X = 0.15Pu
Transformer 2 : 3 1-ϕ units each rated 10MVA, 7.5/75KV, X = 0.1 Pu **(12 Marks)**

2 a. What are symmetrical components and their significance and obtain the equations for their average power and reactive power in terms of symmetrical components. **(08 Marks)**

b. The voltage at the terminals of a three phase balanced load consisting of three (10 + j8)Ω connected in star are $V_{ab} = 100\ \underline{|0^\circ}\ V$, $V_{bc} = 90\ \underline{|240^\circ}\ V$ and $V_{ca} = 94\ \underline{|120^\circ}\ V$. Find the power consumed in load using symmetrical components. **(12 Marks)**

3 a. What are sequence impedances and sequence network? Draw the single phase zero sequence networks for the transformers connected in different configuration. **(08 Marks)**

b. A 25MVA, 11KV, 3-ϕ generator has a sub transient reactance of 20%. The generator supplies two motors over a transmission line with transformers at both sides as shown in the one line diagram of Fig Q3(b). The motors have rated inputs of 15MVA and 7.5MVA both at 10KV with 25% sub transient reactance. The three phase transformers are both rated 30MVA, 10.8/121KV, connection Δ-Y with leakage reactance of 10% each. The series reactance of the line is 100Ω. Draw the positive, negative and zero sequence network of the system with all reactances marked in Pu. Assume that the negative sequence reactance of each machine is equal to the sub transient reactance. Select the generator rating as the base in the generator circuit. Assume the zero sequence reactance for the generator and motors are 0.6Pu each. Current limiting reactors of 2.5Ω each are connected in the neutrals of the generator and motors. The zero sequence reactance of the transmission line is 300Ω. **(12 Marks)**

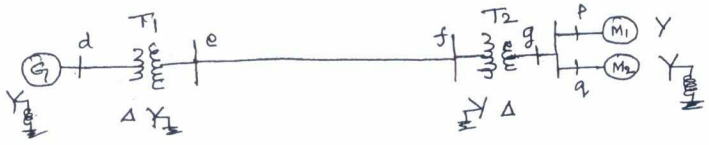

Fig Q3(b)

4 Determine the fault MVA, if a fault takes place at 'F' in the diagram shown in Fig Q4. The P.u values of reactance are given with 100 MVA as base. **(20 Marks)**

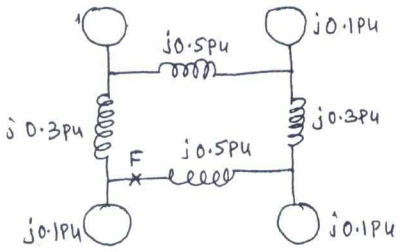

Fig Q4

PART – B

5 a. What are the different types of unsymmetrical faults and explain in brief their frequency of occurrence? **(08 Marks)**

b. A double line to ground fault occurs at the terminals of an loaded generator. Derive an expression for the fault currents; draw the connection of sequence networks. **(12 Marks)**

6 a. For one conductor open fault, derive expressions for currents and show the connections of sequence network to represent the fault. **(08 Marks)**

b. A synchronous motor is receiving 10MW of power at 0.8 p.f lag at 6kV. An LG fault takes place at the middle point of the transmission line as shown in Fig Q6(b) . Find the fault current. The rating of the generator motor and transformer are as under, **(12 Marks)**

Generator	:	20MVA, 11KV, $X_1 = 0.2$Pu, $X_2 = 0.1$Pu, $X_0 = 0.1$Pu
Transformer T_1	:	18MVA, 11.5Y/34.5Y KV, X = 0.1 Pu
Transmission line	:	$X_1 = X_2 = 5\Omega$, $X_0 = 10\Omega$
Transformer T_2	:	15MVA, 6.9Y/34.5Y KV, X = 0.1 Pu
Motor	:	15MVA, 6.9KV, $X_1 = 0.2$Pu, $X_2 = X_0 = 0.1$Pu

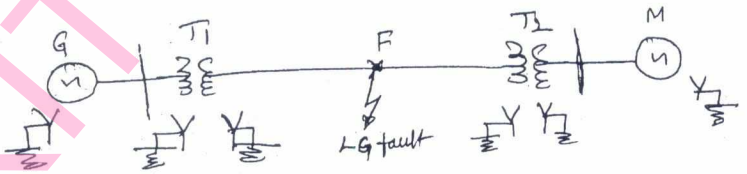

Fig Q6(b)

7 a. Define stability as applied to power system studies and distinguish between i) Steady state stability and ii) Transient stability. **(08 Marks)**

b. The transfer reactance between a generator an infinite bus bar operating at 200KV under various conditions on interconnection are

Pre fault	:	150Ω per phase
During fault	:	400Ω per phase
Past fault	:	200 Ω per phase

If the fault is cleared when the rotor has advanced 60° electrical from the prefault position, determine the maximum load that could be transferred without loss of stability. **(12 Marks)**

8 a. Explain clearly the methods of improving transient stability. **(08 Marks)**

b. Explain the effect of unbalanced voltage on the performance of an induction motor. Find the expressions for power developed and Torque developed under such operating conditions. **(12 Marks)**

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10EE62

Sixth Semester B.E. Degree Examination, June/July 2017
Switch Gear and Protection

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Draw the single line diagram to connect a CB, Isolator, Earthing switches and write the sequence of operation while opening and closing of a circuit. **(06 Marks)**

b. With neat sketch describe the working principle of a liquid fuse. **(06 Marks)**

c. Explain the cut-off characteristics and time – current characteristics of a fuse. **(08 Marks)**

2 a. Explain recovery rate theory related to current zero method of arc interruption. **(06 Marks)**

b. Derive an expression for restriking voltage and rate of rise of restriking voltage of circuit breaker. **(07 Marks)**

c. For a 132KV system, the reactance and capacitance upto the location of the circuit breaker is 3Ω and 0.015 μF respectively. Calculate the following :
i) The frequency of transient oscillation.
ii) Maximum value of restriking voltage across the contacts of the circuit breaker and
iii) Maximum value of rate of rise of restriking voltage. **(07 Marks)**

3 a. With a neat sketch, explain the operating principle of axial air blast circuit breaker. **(06 Marks)**

b. Sketch and explain the working principle of buffer type of sulphur hexa fluoride circuit breaker. **(06 Marks)**

c. Explain the procedure adopted in unit test and synthetic testing of circuit breaker. **(08 Marks)**

4 a. Explain the construction and working of a vacuum circuit breaker. **(10 Marks)**

b. What are the types of lightning strokes? Explain each of them. **(06 Marks)**

c. State the essential requirements of a surge diverters. **(04 Marks)**

PART – B

5 a. What is a relay? Define i) Pickup level ii) Burden iii) Chop out, with respective to relay. **(04 Marks)**

b. State and briefly explain the characteristics of good protective relying. **(08 Marks)**

c. With a neat sketch, explain the working of induction type directional over current relay. **(08 Marks)**

6 a. Explain the working principle and characteristics of an impedance relay. **(08 Marks)**

b. With a suitable diagram, explain a negative sequence relay and mention its applications. **(08 Marks)**

c. What are the advantages of microprocessor based protective relays over electromagnetic and static relays? **(04 Marks)**

7 a. Explain the protection of a generator against :
i) Loss of excitation ii) Stator inter turn fault and iii) Over speeding. **(12 Marks)**

b. The neutral point of a 10,000V alternator is earthed through a resistance of 10Ω, the relay is set to operate when there is an out of balance current of 1A. The CT's have a ratio of 1000/5. What percentage of the winding is protected against fault to earth and what must be the minimum value of earthing resistance to give 90% protection to each phase winding? **(08 Marks)**

8 a. Describe the harmonic restraints relay use to protect the transformer. **(08 Marks)**

b. Explain single phasing in induction motors. How motor is protected from single phasing? **(08 Marks)**

c. List the various abnormal conditions against which large induction motor has to be protected. **(04 Marks)**

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10EE63

Sixth Semester B.E. Degree Examination, June/July 2017
Electrical Machine Design

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer FIVE full questions, selecting at least TWO questions from each part.***
2. Any missing data may be suitably assumed.
3. Design data book may be used if necessary

PART – A

1 a. Discuss the factors which imposes limitations on design. **(06 Marks)**

b. What are the desirable properties of insulating materials? Explain the classification of insulating materials based on thermal considerations with two examples on each class. **(08 Marks)**

c. Explain the terms specific loadings in the design of electrical machines. **(06 Marks)**

2 a. Determine the main dimensions of the armature core, number of ventilating ducts, number of conductors of a 350 KW, 500 V, 450 rpm, 6 pole, shunt generator assuming square pole faces with pole arc 70% of pole pitch. Assume the mean flux density to be 0.7 T and ampere-conductor per centimeter to be 280. **(10 Marks)**

b. A 8 pole, 500 V, DC shunt generator with all the field coils connected in series requires 5000 AT/pole. If the poles are of rectangular dimensions 12×20 cm and winding cross section is 12×2.5 cm, determine the C/S area of wire, number of turns, dissipation in watts/cm^2 based on outside and two end surfaces of the coil. The conductor of circular C/S is used. Resistivity is 0.021 ohm/m/mm^2 and insulation increases the diameter by 0.02 cm. Allow a voltage drop in the field regulator of 50 V. **(10 Marks)**

3 a. Derive the output equation of a three phase core type transformer. **(06 Marks)**

b. Prove that emf per turn of a single phase transformer = $K\sqrt{KVA}$. **(04 Marks)**

c. Calculate the dimensions of the core, the number of turns and C/S area of the conductor for a 100 KVA, 2300/400 V, 50 Hz, single phase shell type transformer assuming ratio of magnetic to electric loading as 480×10^{-8}; Maximum flux density in the core is 1.1 T; Current density is 2.2×10^6 A/m^2; Window space factor is 0.3; ratio of depth of stacked core to width of central limb is 2.6; $H_w / W_w = 2.5$; $K_i = 0.9$. **(10 Marks)**

4 a. A 250 KVA, 6600/440 V, 50 Hz, Three phase star delta, core type transformer gave the following results during design calculations: length + twice the height of yoke = 85 cm; Centre to Centre distance of the core = 32 cm; Outside diameter of HV winding = 31 cm; Total iron loss = 1500 W; Total copper loss = 3750 W. Calculate

(i) The dimension of the tank
(ii) The temperature rise of the transformer.
(iii) The number of cooling tubes if the temperature rise is not to exceed 35°C. **(10 Marks)**

b. Calculate the No load current and power factor of a 3300/220 V, 50 Hz, single phase core type transformer with the following data:
Mean length of magnetic path = 300 cm; Gross area of iron core = 150 cm^2; Specific iron loss at 50 Hz and 1.1 T is 2.1 W/kg; Ampere turns/cm for transformer steel at 1.1 T is 6.2. The effect of joints is equivalent to that of an airgap of 1 mm in the magnetic circuit. Density of iron is 7.55 gm/CC and iron factor is 0.92. **(10 Marks)**

PART – B

5 a. Explain the factors which influence the choice of length of airgap of a induction motor. **(08 Marks)**

b. Determine the diameter of stator bore and core length of a 70 HP, 415 V, Three phase, 50 Hz, star connected, 6 pole, induction motor for which q = 32000 AC/m, B_{av} = 0.51T . Take efficiency as 90% and power factor as 0.91. Assume pole pitch equal to core length. Estimate the number of stator conductor required for a winding in which the conductors are connected in two parallel paths. Choose a suitable number of conductors / slot so that the slot loading does not exceed 750 amp-conductors. **(12 Marks)**

6 a. Discuss the design procedure for slip ring rotor of a 3 phase induction motor. **(08 Marks)**

b. Calculate the equivalent resistance of rotor per phase with respect to stator, the current in each bar and end ring and the total rotor copper loss for a 415 V, 50 Hz, 4 pole, 3 phase Induction motor having the following data:
Stator : Slots = 48, Conductors / Slot = 35, Current in each conductor = 10 Amp.
Rotor : Slots = 57, length of each bar = 0.12 m, area of each bar (9.5×5.5) mm^2, Mean diameter of end ring = 0.2 m, area of each end ring = 175 mm^2; Resistivity of copper is 0.02 ohm/m/mm^2, full load power factor is 0.85. **(12 Marks)**

7 a. Derive the output equation of a synchronous machine interms of its main dimension and specific loadings. **(08 Marks)**

b. During the design of stator of a 3 phase, 7.5 MVA, 6.6 KV, star connected, 50 Hz, 3000 rpm, turbogenerator, following information have been obtained : D = 0.75 m; L = 0.9 m; Number of slots/pole/phase = 7; C/S area of stator conductor = 190 mm^2; number of stator conductor per slot = 4. Calculate (i) flux per pole (ii) Average flux density (iii) Specific electric loading (iv) Current density. **(12 Marks)**

8 a. Explain the factors to be considered in the selection of number of armature slots of a synchronous machine. **(08 Marks)**

b. A 1250 KVA, 3300 V, 50 Hz, 250 rpm, 3 phase, star connected alternator having two parallel path/phase has 216 slots with 8 conductors/slot. Single layer winding with full pitch coils is used. Determine the specific magnetic and electric loadings if the diameter is 240 cm and axial length is 41.4 cm. Using the same loadings and other relevant data with marginal modifications if necessary find D, L, Z_1, S_1 and conductors/slot of a star connected 1000 KVA, 3300 V, 50 Hz, 300 rpm, 3 phase alternator having single layer winding with full pitch coils and with no parallel circuits in phase winding. The machine have 60° phase spread. **(12 Marks)**

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10EE64

Sixth Semester B.E. Degree Examination, June/July 2017
Digital Signal Processing

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. What are the advantages and limitations of digital signal processing over analog signal processing? **(04 Marks)**

b. Consider the sequence $x(n) = 4\delta(n) + 3\delta(n-1) + 2\delta(n-2) + \delta(n-3)$. Find the 6-point DFT of the sequence x(n). Sketch the magnitude and phase spectra. **(08 Marks)**

c. State and prove circular time shift property of DFT. **(04 Marks)**

d. Compute the N-point DFT of the signal,

$x(n) = e^{j\frac{2\pi}{N}Kon}$; $0 \le n \le N-1$. **(04 Marks)**

2 a. Compute the 4-point DFT of the following sequences using suitable property of the DFT:
$x_1(n) = \{1, 2, 3, 2\}$ and $x_2(n) = \{3, 2, 1, 2\}$ **(06 Marks)**

b. Consider a length-6 sequence $x(n) = \{1, 3, -2, 1, -3, 4\}$ with a 6-point DFT given by X(K). Evaluate $\sum_{K=0}^{5} |X(K)|^2$. **(04 Marks)**

c. Find the 4 point circular convolution of the sequences $x_1(n) = \{1, 2, 3, 1\}$ and $x_2(n) = \{4, 3, 2, 2\}$ using the time domain approach based on formula. Verify the result using frequency domain approach. **(10 Marks)**

3 a. Compute the 4-point circular convolution of two sequences given by $x(n) = \{1, 2, 3, 4\}$ and $h(n) = \{1, 2, 2, 1\}$ using circular array method. **(04 Marks)**

b. Find the output y(n) of a FIR filter whose impulse response h(n) = (1, 1, 1) and input signal $x(n) = (3, -1, 0, 1, 3, 2, 0, 1, 2, 1)$ using overlap save method. Use 5-point circular convolution in your approach. **(08 Marks)**

c. Find the 8-point DFT of the sequences $x(n) = 2^n$; $0 \le n \le 7$ using Radix-2 DIT-FFT algorithm. **(08 Marks)**

4 a. Given $x(n) = n+1$; $0 \le n \le 7$. Find X(K) using radix-2 DIF-FFT algorithm. **(10 Marks)**

b. Develop a DIT-FFT algorithm for evaluating the DFT for composite number N = 9. **(10 Marks)**

PART – B

5 a. Explain Bilinear method of transforming an analog filter into digital filter. Also show the mapping from S to Z plane. **(06 Marks)**

b. Convert the following second order analog filter with system transfer function, $H(s) = \frac{(s+a)}{(s+a)^2 + b^2}$ into a digital filter with infinite impulse response by the use of impulse invariance mapping technique. **(06 Marks)**

c. Design an analog filter with maximally flat response in the passband and an acceptable attenuation of -2dB at 20 rad/sec. The attenuation in the stopband should be more than 10 dB beyond 30 rad/sec. **(08 Marks)**

6 a. Determine H(z) for a lowest order butterworth filter satisfying the following constraints:

$$\sqrt{0.5} \le |H(e^{j\omega})| \le 1;\ 0 \le |\omega| \le \frac{\pi}{2}$$

$$|H(e^{j\omega})| \le 0.2;\ \frac{3\pi}{4} \le \omega \le \pi$$

with T = 1 sec. Apply impulse invariant transformation. **(10 Marks)**

b. Design the digital filter using Chebyshev approximation and Bilinear transformation to meet the following specifications. Passband ripple = 1 dB for $0 \le \omega \le 0.15\pi$. Stopband attenuation ≥ 20 dB for $0.45\pi \le \omega \le \pi$. **(10 Marks)**

7 a. Design a lowpass digital filter to be used in an A/D – H(z) – D/A structure that will have a -3dB cutoff at 30π rad/sec and an attenuation of 50 dB at 45π rad/sec. The filter is required to have a linear phase and the system will use a sampling rate of 100 samples / second. **(10 Marks)**

b. Design a normalized linear phase FIR filter having the phase delay of Z = 4 & at least 40 dB attenuation in the stopband. Also obtain the magnitude / frequency response of the filter. **(10 Marks)**

8 a. An IIR filter is given by the difference equation,

$$y(n) - \frac{1}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n) + \frac{1}{2}x(n-1)$$

Draw direct form – I and Direct form – II structures. **(10 Marks)**

b. A digital system is given by,

$$H(z) = \frac{1 - \frac{1}{2}z^{-1}}{\left(1 - \frac{1}{3}z^{-1}\right)\left(1 - \frac{1}{4}z^{-1}\right)}$$

. Obtain the parallel form structure. **(05 Marks)**

c. Realize the digital filter with system function given by,

$$H(z) = 1 + \frac{1}{2}z^{-1} + \frac{1}{3}z^{-2} + \frac{1}{7}z^{-3} + \frac{1}{3}z^{-4} + \frac{1}{2}z^{-5} + z^{-6}$$ **(05 Marks)**

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10EE661

Sixth Semester B.E. Degree Examination, June/July 2017
Operation Research

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***
2. ***Normal distribution tables are permitted.***

PART – A

1 a. Briefly explain the engineering applications and limitations of Operation Research. **(10 Marks)**

b. The XYZ electric appliance Company produces two types of products : Refrigeration and televisions. The Company's two product are produced and sold on a weekly basis. The weekly production cannot exceed 25 refrigerators and 35 televisions. The Company regularly employs a total of 60 workers. A refrigerator requires 2 – man – weeks of labour, while TV requires 1 – man – week of labour. A refrigerator contributes a profit of Rs 60 and TV contributes a profit of Rs 40. How many units of refrigerators and TV's should the company produce to realize maximum profit? Formulate LPP and solve it by graphical method. **(10 Marks)**

2 a. Solve the following LPP using Simplex method and comment on the results.
Maximize $Z = 3x_1 + 2x_2$
Subject to $x_1 - x_2 \leq 1$
$3x_1 - 2x_2 \leq 6$
$x_1, x_2 \geq 0$. **(08 Marks)**

b. Solve the following LPP using two – phase Simplex method.
Maximize $Z = 8x_2$
Subject to $x_1 - x_2 \geq 0$
$1 + 3x_2 \leq -6$
x_1 and x_2 are unrestricted. **(12 Marks)**

3 a. Construct the dual for the following LPP : **(10 Marks)**
i) Maximize $Z = 5x_1 + 12x_2 + 4x_3$
Subject to $x_1 + 2x_2 + x_3 \leq 10$
$2x_1 - x_2 + 3x_3 = 8$
x_1, x_2 and $x_3 \geq 0$.
ii) Minimize $Z = x_2 + 3x_3$
Subject to $2x_1 + x_2 \leq 3$
$x_1 + 2x_2 + 6x_3 \geq 5$
$-x_1 + x_2 + 2x_3 = 2$
x_1, x_2 & $x_3 \geq 0$.

b. Solve the following LPP using dual Simplex method. **(10 Marks)**
Minimize $Z = 2x_1 + x_2$
Subject to $3x_1 + x_2 \geq 3$
$4x_1 + 3x_2 \geq 6$
$x_1 + 2x_2 \leq 3$
x_1, & $x_2 \geq 0$.

4 a. Four different jobs can be done on four different machines. The matrix below gives the cost in rupees of producing job 'i' and on machines 'j'.

		Machines			
		M_1	M_2	M_3	M_4
Jobs	J_1	5	7	11	6
	J_2	8	5	9	6
	J_3	4	7	10	7
	J_4	10	4	8	3

Represent the problem as an LP problem and how should the jobs be assigned to the various machines, so that the total cost is minimized. **(08 Marks)**

b. An electrical service engineer has to visit five places A, B, C, D and E. The cost of going from one place to another are given below. Determine the optimal route and cost. **(08 Marks)**

	A	B	C	D	E
A	∞	7	6	8	4
B	7	∞	8	5	6
C	6	8	∞	9	7
D	8	5	9	∞	8
E	4	6	7	8	∞

c. Write the algorithm for revised Simplex method. **(04 Marks)**

PART – B

5 a. The power company has three power plants that supply the needs of four cities. The cost of sending 1 million kWh of electricity from plant to city is given in the following table :
Solve the following transportation problem to minimize the cost of meeting each city peak power demand. (Use North – west corner method and UV method). **(12 Marks)**

	City - 1	City - 2	City - 3	City - 4	Supply (million)
Plant - 1	8	6	10	9	35
Plant - 2	9	12	13	7	50
Plant - 3	14	9	16	5	40
Demand (in million)	45	20	30	30	

b. Obtain the initial basic feasible solution (IBFS) to the following TP using Vogel's Approximation method.

		Destinations				
		D_1	D_2	D_3	D_4	Supply
Sources	S_1	5	1	3	3	34
	S_2	3	3	5	4	15
	S_3	6	4	4	3	12
	S_4	4	1	4	2	19
Demand		21	25	17	17	

The unit transportation costs are represented in the TP table. **(08 Marks)**

6 a. Briefly explain the Maxmin and Minmax principle. **(05 Marks)**

b. Solve the following game graphically whose payoff matrix for the player – A is given in the following table : **(10 Marks)**

		Player A			
		I	II	III	IV
Player B	I	2	2	3	-2
	II	4	3	2	6

c. Using dominance property, obtain the optimal strategies for both the players and determine the value of game. The Payoff matrix for Player 'A' is given by **(05 Marks)**

		Player B				
		I	II	III	IV	V
Player A	I	2	4	3	8	4
	II	5	6	3	7	8
	III	6	7	9	8	7
	IV	4	2	8	4	3

7 a. Draw the PERT network for the following project and number the events. **(06 Marks)**

Event Number	A	B	C	D	E	F	G	H	J	K	L
Preceded by :	Start event	A	B	B	D	B	E	G,E	D,F,H	C,J	K

b. Define the following :
i) Optimistic time estimate ii) Pessimistic time estimates iii) Most likely time estimate iv) Average time. **(04 Marks)**

c. For the network shown in fig. Q7(c), calculate the probability of finishing the project within 22 days. **(10 Marks)**

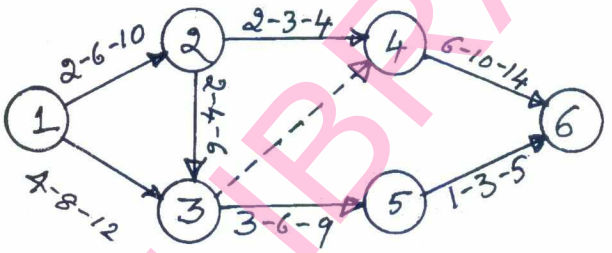

Fig.Q7(c)

8 a. The cost of a electric machine is Rs 6100 and its scrap value is Rs 100. The maintenance costs found from the experience are as follows : **(10 Marks)**

Year	1	2	3	4	5	6	7	8
Maintenance cost (in Rs)	100	250	400	600	900	1200	1600	2000

When should the machine be replaced?

b. A computer contains 10,000 resistors. The cost of replacing a single resistor is Re 1 only. If all the resistors are replaced at the same time, the cost per resistor would be reduced to 35 paise. The percent surviving by the end of month 't' is given by :

Month (t)	0	1	2	3	4	5	6
Percent surviving by the end of month	100	97	90	70	30	15	0

What is the Optimum plan? **(10 Marks)**

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10EE666

Sixth Semester B.E. Degree Examination, June/July 2017
Electrical Engineering Materials

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer FIVE full questions, selecting at least TWO questions from each part.***
2. ***Support your answer with relevant diagram and equation if necessary.***

PART – A

1 a. Explain the effect of temperature on resistance and hence, derive an expression for the temperature coefficient of resistance. **(08 Marks)**

b. Explain the different materials that can be used for Lamp filaments. **(06 Marks)**

c. Calculate the resistance of a wire at 50°C, which is 300m long and has an area of cross-section of 25mm^2. The wire is made of aluminium. Resistivity of aluminium at 15°C is 2.7Ωm. Temperature coefficient of aluminium is 0.004Ω/°C at 0°C. **(06 Marks)**

2 a. Draw a typical hysteresis loop for a ferromagnetic material. Define residual magnetism and coercive force. **(08 Marks)**

b. With a necessary sketch explain the concept of Hall effect. **(06 Marks)**

c. The mobilities of silicon are $\mu_e = 0.17 m^2/V\text{-}s$ and $\mu_h = 0.035 m^2/V\text{-}s$ at room temperature. If the carrier density in the material is known to be 1.1×10^{16}, calculate the resistivity of silicon. **(06 Marks)**

3 a. Explain the following : i) Ionic polarization ii) Orientational polarization. **(10 Marks)**

b. A homogeneous slab of lossless dielectric material is characterized by a dielectric susceptibility of 0.12 and carrier of uniform flux density within it of 1.6 n C/m^2. Find the electric field, polarization, dipole moment and voltage across dielectric if there are 2×10^{19} dipoles per cubic meter and distance between opposite surfaces of dielectric is 2.54cm. **(10 Marks)**

4 a. Explain the procedure for testing the dielectric strength of transformer oil, with a neat sketch. **(08 Marks)**

b. What are the properties and applications of mica and glass? **(06 Marks)**

c. List out the properties of SF_6 gas. **(06 Marks)**

PART – B

5 a. What are the fuel cells? What are the major problems that are encountered in its commercial applications? **(08 Marks)**

b. Give the working principle of solar cell with its V-I characteristics. **(08 Marks)**

c. State the difference between hot mirror and cold mirror. **(04 Marks)**

6 a. Draw a neat sketch of electron microscopy and explain its working principle. **(08 Marks)**

b. How does magnetic resonance imaging work? **(06 Marks)**

c. List the applications of NMR and ESR. **(06 Marks)**

7 a. What is piezoelectricity? Explain the working of piezoelectric device and hence state its applications. **(08 Marks)**

b. What is rheology? Explain magnetorheological fluid with their modes of operation. **(08 Marks)**

c. Briefly explain magnetostriction. **(04 Marks)**

8 a. What are plastics? Explain the properties of plastics and give their classification. **(08 Marks)**

b. Explain the following :
i) Rubber ii) Thermostats iii) Applications of conductive ceramics. **(12 Marks)**

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