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10EE71

Seventh Semester B.E. Degree Examination, June/July 2017
Computer Techniques in Power System Analysis

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define the following with example:
(i) Oriented graph (ii) Tree (iii) Primitive network (iv) Cotree. **(08 Marks)**

b. The bus incidence matrix of a power system network is shown below. Construct the oriented graph of the system.

$$A = \begin{bmatrix} 1 & 0 & 0 & -1 & 0 & 0 & 1 \\ -1 & -1 & -1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & -1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & -1 & -1 \end{bmatrix}$$

(06 Marks)

c. Derive the expression for Y bus using singular transformation analysis. **(06 Marks)**

2 a. Determine the bus admittance matrix by singular transformation analysis for the power system defined by the line data shown in table-1. **(08 Marks)**

Table-1

Line No.	1	2	3	4	5
Bus Code p – q	0 – 1	1 – 2	2 – 3	3 – 0	2 – 0
Admittance in p.u.	1.4	0.6	2.4	2.0	1.8

b. Obtain the general expressions for Zbus building algorithm when a branch is added to the partial network. **(12 Marks)**

3 a. What are the types of buses in load flow? Discuss with constraints. **(08 Marks)**

b. For the system given, generators are connected to all the buses while loads are connected to bus 2 and 3. Values of real and reactive power are given in table-3. All buses other than slack bus are of PQ type. For case (a). Assume flat voltage start, find the voltage and bus angles at the buses at the end of first Gauss Siedel iteration.

For case (b) bus 2 is a PV bus with $|V_2| = 1.04$ p.u. and $0.2 \le Q_2 \le 1$ is the constraint for reactive power.

Table-2

Line bus to bus	G (p.u.)	B (p.u.)
1 – 2	2.0	-6.0
1 – 3	1.0	-3.0
2 – 3	0.666	-2.0
2 – 4	1.0	-3.0
3 – 4	2.0	-6.0

Table-3

Bus	P_i	Q_i	V_i	Remarks
1	-	-	$1.04\angle 0°$	Slack bus
2	0.5	-0.2	-	PQ bus
3	- 1	0.5	-	PQ bus
4	0.3	-0.1	-	PQ bus

(12 Marks)

4 a. Explain with a flow chart and equation how the load flow analysis is carried out using Newton Raphson method. **(10 Marks)**

b. With assumptions, explain with procedural steps of fast de-coupled load flow method to solve non-linear load flow equations. **(10 Marks)**

PART – B

5 a. Derive the coordination equations for economic load allocation in a thermal power system with the consideration of transmission losses. **(10 Marks)**

b. Three plants of total capacity 425 MW are scheduled for operating to supply a total load of 300 MW. Find the optimal load scheduling, if the plants have the following incremental cost and generation constraints.

$$\frac{dc_1}{dP_1} = 30 + 0.15P_1 \quad (25 < P_1 < 125\,MW) \quad ; \quad \frac{dc_2}{dP_2} = 40 + 0.2P_2 \quad (30 < P_2 < 100\,MW)$$

$$\frac{dc_3}{dP_3} = 15 + 0.18P_3 \quad (50 < P_3 < 200MW)$$

(10 Marks)

6 a. Derive expressions for loss coefficients and transmission loss in terms of generation in an interconnected system. **(10 Marks)**

b. With relevant equations discuss the optimal scheduling of hydrothermal system. **(10 Marks)**

7 a. Derive swing equation for transient stability analysis. **(06 Marks)**

b. With the help of algorithm, explain the modified Euler method for transient stability studies. **(08 Marks)**

c. Write a note on Runge-Kutta method to solve stability problems. **(06 Marks)**

8 Discuss on the following :

(i) Modeling of prime movers and loads **(08 Marks)**

(ii) Milne's predictor corrector method **(06 Marks)**

(iii) Penalty factors **(06 Marks)**

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10EE72

Seventh Semester B.E. Degree Examination, June/July 2017
Electrical Power Utilization

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. What are the properties of good heating element? **(06 Marks)**

b. With neat sketch, explain the principle dielectric heating. **(06 Marks)**

c. A 20 kN single phase, 220V resistance oven employees circular nichrome wire for its heating elements. If the wire temperature is not to exceed 1127°C and the temperature of the charge is to be 427°C. calculate the size and length of wire requires. Assume e = 0.9 and radiation efficiency k = 0.6. What would be the temperature of wire when the charge is cold? **(08 Marks)**

2 a. Discuss the factors governing the electro deposition process. **(06 Marks)**

b. Describe the process of extraction of metals. Explain how aluminium is extracted from the ore. **(06 Marks)**

c. The worn out part of a shaft 15cm in dia and 30cm long is to be reconditioned by depositing on it 1.5mm of Nickel by electro deposition process. Determine the quality of electricity required and the time taken. If the current density of 160 A/m^2 is adopted. Assume efficiency of 95%. Density of Nickel may be taken as 8.9 gm/cc. **(08 Marks)**

3 a. Define the following terms : i) Solid angle ii) luminous flux iii) candle power iv) MHCP v) reduction factor vi) reflection factor. **(06 Marks)**

b. State and explain the laws of illumination. **(06 Marks)**

c. Explain requirements of good lighting system. **(08 Marks)**

4 a. Explain the terms : i) refraction ii) absorption iii) glare. **(06 Marks)**

b. write a note on the following : i) incandecent lamp ii) CFL. **(06 Marks)**

c. A lamp giving 400 candle power in all directions below the horizontal is suspended 3m above the centre of a square table of 1.5m side. Calculate the maximum and minimum illumination on the table. **(08 Marks)**

PART – B

5 a. Discuss the advantages of electric drives over other drives. **(06 Marks)**

b. Explain the speed–time curves for train movement. **(06 Marks)**

c. The distance between two stations is 1 km and the schedule speed is 30 Kmph. Station stopping time 20 sec. Assume braking retardation 3 Kmph. P.S and maximum speed 1.25 times the average speed. Determine the acceleration required to run the service if the speed-time curve is approximated by a trapezoidal curve. **(08 Marks)**

6 a. Discuss the factors affecting specific energy consumption. **(06 Marks)**

b. Discuss advantages of electric braking over mechanical braking. **(06 Marks)**

c. Define tractive effort. Derive an expression for traction effort of train considering its movement on an upward gradient and having track-resistance. **(08 Marks)**

7 a. Discuss the advantages of series parallel control of starting as compared to the rheostatic starting for a pair of DC traction motors. **(06 Marks)**

b. With neat sketches, explain current collection system in electric locomotives. **(06 Marks)**

c. Two motors rated at 1500V have armature resistance of 0.15ohm and take current of 500A each during starting. The effective weight of the train 140 tonnes, dead weight 120 tonnes, specific resistance of 50N Newton's / tonnes tractive effort/ motor 38000 Newton's, speed at the end of starting period 50 kmph, determine : i) duration of starting period ii) speed of train at transition iii) rheostatic loss. **(08 Marks)**

8 a. Explain conceptual illustration of general electric vehicles with block diagram. **(10 Marks)**

b. With relevant graph, explain the electric vehicle performance characteristics.[speed v/s tractive effort]. **(10 Marks)**

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10EE73

Seventh Semester B.E. Degree Examination, June/July 2017
High Voltage Engineering

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain the need for generation of high voltages in the laboratory. Mention its applications. **(05 Marks)**

b. What are the advantages of transmitting electrical power at high voltage? Mention the industrial applications of high voltage. **(05 Marks)**

c. Describe the working principle of electrostatic precipitator and electrostatic painting. **(10 Marks)**

2 a. Define Townsend's first and second ionization co-efficient. Derive an expression for the current growth in a gas discharge due to secondary mechanism. **(10 Marks)**

b. What are electronegative gases? Why is the breakdown strength of these gases higher compared to that of other gases? **(05 Marks)**

c. A steady current of 600μA flows through the plane electrode separated by a distance of 0.5cm, when a voltage of 10KV is applied. Determine the Townsends's first ionization co-efficient if a current of 60μA flows when the distance of separation is reduced to 0.1cm and the field is kept constant at the previous value. **(05 Marks)**

3 a. What is thermal breakdown in "solid dielectrics" and how it is practically more significant than other mechanisms? **(06 Marks)**

b. Explain briefly suspended particle theory of breakdown in liquid dielectrics. **(06 Marks)**

c. The following observations were made in an experiment for determination of dielectric strength of transformer oil. Determine the power law equation :

Gap spacing (mm)	4	6	8	10
Breakdown voltage (KV)	88	135	165	212

(08 Marks)

4 a. Describe the working of a 3–stage Cockcroft–Walton's cascaded DC–generator. Derive the expressions for ripple and output voltage. **(08 Marks)**

b. With the help of a neat sketch, explain the construction and working principle of cascading of transformers of three units, for producing very high "AC" voltage. **(06 Marks)**

c. A ten-stage Cockcroft–Walton circuit has all capacitors of 0.06μF. The secondary voltage of the supply transformer is 100 KV at a frequency of 150Hz. If the load current is 1 mA determine i) voltage regulation ii) the ripple iii) the optimum number of stages for maximum output voltage. **(06 Marks)**

PART – B

5 a. Describe the method of generation of impulse currents. Derive the related mathematical formulae. How are capacitors arranged in such circuits? **(07 Marks)**

b. Describe the Tesla coil with its equivalent circuit and output waveforms. Give the application of Tesla coil. Show that $v_2 = v_1\sqrt{\frac{c_1}{c_2}\eta}$ with usual notations. **(07 Marks)**

c. An impulse generator has eight stages with each capacitor rated for 0.16 micro-farad and 125 KV the load capacitor available is 1000 Pico-farad. Find the series resistance and the damping resistance needed to produce 1.2/50 micro–second impulse wave. What is the maximum output voltage of the generator if the charging voltage is 120 KV? **(06 Marks)**

6 a. Discuss how resistance potential dividers are used to mesure high voltages. Explain the effect of stray capacitances on such measurements and also suggest suitable remedial measure. **(10 Marks)**

b. Describe with a neat sketch the working of a generating voltmeter used to measure high DC voltages. **(06 Marks)**

c. An absolute electrostatic voltmeter has a moveable circular plate 8cms in diameter. If the distance between the plates during a measurement is 4mm and the applied voltage is 1 KV. Calculate the force on the plate [Assume medium as having $E_r = 1$]. **(04 Marks)**

7 a. What are partial discharges? Explain with a neat diagram the principle of pulse current measurement of partial discharges by straight detection technique. **(07 Marks)**

b. Describe the Schering bridge method of determining the capacitance and loss angle of a dielectric specimen. Derive the relevant formulae. **(07 Marks)**

c. A 33KV, 50Hz high voltage Schering bridge is used to test a sample of insulation. The various arms have the following parameters on balance. The standard capacitance 500pF the resistive branch 800ohm and branch with parallel combination of resistance and capacitance has valued 180 ohms and 0.15μF. Determine the value of the capacitance of this sample its parallel equivalent loss resistance the power factor and the power loss under these test conditions. **(06 Marks)**

8 a. With a neat diagram, explain the impulse testing of transformers. How are the faults detected and located? **(08 Marks)**

b. Mention the different power frequency tests that are carried out in practice on HV insulators. Explain the procedure of conducting each of these tests. **(08 Marks)**

c. Explain any one method of testing cables. **(04 Marks)**

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10EE74

Seventh Semester B.E. Degree Examination, June/July 2017
Industrial Drives and Applications

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Obtain an expression for the equivalent load torque and equivalent moment of inertia for loads rotational and translational motion. **(10 Marks)**

b. List essential parts of electrical drive. Enumerate advantages of an electric drive system. **(06 Marks)**

c. Define active load torque and passive load torque. Give examples. **(04 Marks)**

2 a. Explain the following classes of motor duty with necessary diagram showing variation of load, electrical losses and temperature with respect to time. Also mention the cyclic duration factor for each case.
i) Intermittent periodic duty with starting and braking and
ii) Continuous duty with starting and braking. **(10 Marks)**

b. A 3-phase, 50KW, 6-pole, 960rpm induction motor has a constant load torque of 300 N-m and at wide intervals additional torque of 1500 N-m for 10seconds. Calculate :
i) The weight of the fly wheel used for load equalization, if the motor torque were not to exceed twice the rated torque and the radius of gyration is 0.9mm ii) the time taken after removal of additional load before the motor torque becomes 700N-m.
Assume that the induction motor operates at that portion of the slip torque characteristic, which is linear. **(10 Marks)**

3 a. With a neat circuit and graph, explain the regenerative, dynamic and plugging type of braking system for separately excited DC shunt motor. **(12 Marks)**

b. A DC shunt motor has an armature resistance of 0.2Ω and field winding resistance of 120Ω. Following magnetization characteristics was measured at 1000 rpm.

Field current, A	0.2	0.3	0.4	0.5	0.75	01	1.5	2.0
Basic emf, Y	80	120	150	170	200	220	245	263

Motor is holding an overhauling load at 50 N-m by self-excited dynamic braking. Calculate value of R_B, when motor is required to hold overhauling load at 900 rpm. **(08 Marks)**

4 a. The rating of motor when subjected to a duty cycle of 18 minutes on certain load and 30 minutes on load is 140 KW. Find the cooling time constant when the heating time constant of a 100 KW motor is 90 minutes. Assume that the losses are proportional to square of load. **(04 Marks)**

b. With dynamic equivalent circuit, explain the transient analysis of separately excited motor with armature control. **(06 Marks)**

c. Explain he multi-quadrant of DC separately excited motor fed from fully controlled rectifier for the following schemes : i) single phase fully controlled rectifier with a reversing switch and ii) dual converter. **(10 Marks)**

PART – B

5 a. A squirrel cage induction motor is to be fed from a non-sinusoidal supply. It is preferred to use a motor with large leakage reactance. Why? **(06 Marks)**

b. Explain the reverse voltage braking of an induction motor. **(05 Marks)**

c. A 3-phase, 440V, 50Hz, 6-pole, Y-connected induction motor has the following parameters refereed to the stator : Rs 0.5Ω, $R_r = 0.6\Omega$, $X_s = X_r^1 = 1\Omega$ stator to rotor turns ratio is 2. If the motor is used for the regenerative braking, determine :

i) Maximum over hauling torque it can hold and the range of speed in which it can safely operate

ii) The speed at which it will hold a load with a load torque of 160 N-m. **(09 Marks)**

6 a. Explain the working of voltage source inverter fed (VSI) induction motor drives showing the waveform for stepped wave inverter and PWM inverter. Also explain the dynamic braking operation of VSI induction motor drives. **(11 Marks)**

b. A 440V, 50Hz, 970rpm, 6-pole, Y-connected, 3-ϕ wound rotor induction motor has following parameters referred to the stator $R_s = 0.1\Omega$, $R_r^1 = 0.08\Omega$, $X_s = 0.3\Omega$, $x_r^1 = 0.4\Omega$. The stator to rotor turns ratio is 2 motor speed is controlled by static schertibus drive. Drive is designed for a speed range of 25% below the synchronous speed. Maximum value of firing angle is 165° : calculate :

i) Transformer turns ratio

ii) Torque for a speed of 780 rpm and $\alpha = 140°$. **(09 Marks)**

7 a. What is meant by the term "Pull-in" in case of synchronous motor? Bring out the differences between true synchronous mode and self – controlled mode. **(04 Marks)**

b. With relevant circuit diagram and equation explain the type of braking utilized for synchronous motor. **(06 Marks)**

c. Explain why the load commutated inverter fed synchronous motor drive is found suitable for high speed and high power application. **(10 Marks**

8 a. Explain briefly the 04 points to be noted about the widely used method to start the synchronous motor. **(04 Marks)**

b. What are the requirements of the drive in case of reversing hot rolling steel mills? **(06 Marks)**

c. Classify the drives used in cement industry. Explain briefly the driving motor used in the cement industry for different operation. **(10 Marks)**

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10EE756

Seventh Semester B.E. Degree Examination, June/July 2017
Testing and Commissioning of Electrical Equipment

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 standard specifications of power transformer? **(08 Marks)**

b. Explain the points to be considered in the selection of site and location of power transformer. **(08 Marks)**

c. What are the desired properties of transformer oil? **(04 Marks)**

2 a. With a schematic sketch, explain the Buchholz relay used for protection of transformer. **(10 Marks)**

b. Describe the test set up for impulse testing of power transformer. **(10 Marks)**

3 a. What are the various cooling arrangements employed for synchronous (Generator). **(10 Marks)**

b. Describe the procedure for slip test and calculation of X_q and X_d from the same. **(10 Marks)**

4 a. Explain the sudden 3-phase short circuit test on a 3-ϕ generator. How to calculate X''_d, X'_d and X_d from the 3-ϕ short circuit test? **(10 Marks)**

b. State the various enclosures adopted in a generator. **(05 Marks)**

c. Explain the principle of brushless excitation system. **(05 Marks)**

PART – B

5 a. Explain the requirement of civil engineering works and foundation work for medium and large induction motors. **(10 Marks)**

b. What is drying out? Explain the different drying out method adopted in induction motors. **(10 Marks)**

6 a. Explain how static and Dynamic balancing of rotor of induction motor is done. **(10 Marks)**

b. State the various steps involved in the installation and commissioning of induction motor. **(10 Marks)**

7 a. Explain how no load ad blocked rotor tests are used to determine the efficiency of a given induction motor. **(10 Marks)**

b. Explain the various steps in maintenance of circuit breaker. **(10 Marks)**

8 Write short notes on the following :

a. Polarization index

b. List the different types of test conducted on circuit breaker

c. Types of cooling systems in transformers

d. Specifications of high voltage circuit breaker. **(20 Marks)**

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10EE761

Seventh Semester B.E. Degree Examination, June/July 2017
Power System Planning

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain the functions of power system planning in detail and also discuss advantages and disadvantages of national and regional planning. **(08 Marks)**

b. With the help of block diagram, explain least cost planning. **(06 Marks)**

c. Explain various power system planning tools. **(06 Marks)**

2 a. What is Co-generation? State and explain categories of co-generation system. **(10 Marks)**

b. What are the options available for Power Sector Finance? Explain in detail Rural electrification planning and investment. **(10 Marks)**

3 a. Discuss pricing structure in brief. **(10 Marks)**

b. What is the need of private participation in generation planning? How it can improve power situation in our country? **(10 Marks)**

4 a. Define Wheeling in power system and list typical objective of wheeling. **(05 Marks)**

b. Explain the effect of power generation on environment. **(07 Marks)**

c. What are the sources of generation and absorption of reactive power in transmission and distribution lines? With the help of phasor diagram, explain how parallel capacitor with transmission line improves the power factor **(08 Marks)**

PART – B

5 a. What do you understand by power system reliability? Discuss the term system adequacy and system security as applied to power system reliability. **(10 Marks)**

b. Explain various means of load management. **(10 Marks)**

6 a. What do you mean by state estimation? With the help of neat diagram, explain function of state estimation. **(10 Marks)**

b. What is a Power system simulator? Explain its functions using block diagram. **(10 Marks)**

7 a. Explain the methodology to be adopted for optimal expansion planning of power system. **(10 Marks)**

b. Discuss least cost optimization problem for the power plant. **(10 Marks)**

8 Write short notes on :

a. Reactive power planning.

b. Tarriff making philosophies.

c. Any one method of optimization technique for solution by programming.

d. Constraints observe during optimization process of power system expansion planning. **(20 Marks)**

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