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10EE71

Seventh Semester B.E. Degree Examination, June/July 2015
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 subgraph, tree, co-tree as applied to graph theory. Give example for each. **(06 Marks)**

b. For the graph shown in Fig.Q.1(b), select tree T(1, 2, 3, 4) and write i) Element-node incidence matrix; ii) Branch-path incidence matrix; iii) Basic cut set incidence matrix; iv) Basic loop incidence matrix. **(14 Marks)**

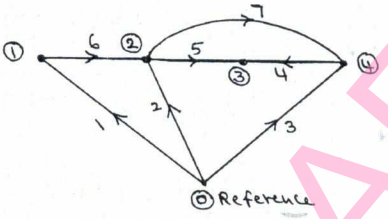

Fig.Q.1(b)

2 a. With the usual notations derive $Y_{Bus} = A^t[y]A$. **(06 Marks)**

b. In the 3 bus system shown, each line has series impedance of 0.1j pu and negligible shunt admittance. A regulating transformer with turns ratio 1.5 is present at bus (2) in the line 2-3. Assuming ground as reference determine Y_{Bus} by direct inspection method. **(06 Marks)**

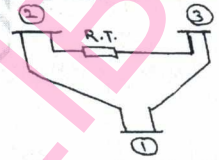

Fig.Q.2(b)

c. The series impedances of the lines are shown in Fig.Q.(c). Taking the elements in the order 0-1, 0-2, 1-2, develop Z_{Bus} by building algorithm method. **(08 Marks)**

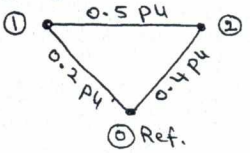

Fig.Q.2(c)

3 a. What are the advantages of Y_{Bus} over Z_{Bus} for load flow analysis? **(04 Marks)**

b. Draw the flow chart for GS method of load flow analysis for the power system with PQ buses. **(08 Marks)**

c. For the 3 bus system shown, the elements of Y_{Bus} are as follows: $Y_{11} = Y_{22} = Y_{33} = 5.868 - 23.514j$ pu and $Y_{12} = Y_{13} = Y_{21} = Y_{23} = Y_{31} = Y_{32} = -2.934 + 11.767j$ pu. Reactive power limits at bus 3 are; $0 \le Q_3 \le 1.5$ p.u. Determine whether bus 3 continues as pv bus and there after determine new estimate of voltage at bus 3 using GS method.

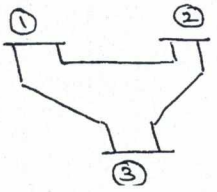

Fig.Q.3(c)

Bus power data

Bus	P pu	Q pu	Voltage pu	Remark
1	-	-	1.04	Slack bus
2	0.5	1	1 + j0	PQ bus
3	-1.5	-	1.04	pv bus

(08 Marks)

4 a. Write the algorithm for NR method of load flow analysis of power systems having both PQ and PV buses. **(10 Marks)**

b. For a 3 bus system the elements of Y_{Bus} are as follows:

$Y_{11} = Y_{22} = Y_{33} = 24.23 \angle -75.95^\circ$ pu

$Y_{12} = Y_{13} = Y_{21} = Y_{23} = Y_{31} = Y_{32} = 12.13 \angle 104.04^\circ$ pu

Bus voltages are;

$V_1 = 1.04 \angle 0^\circ$ pu (slack bus); $V_2 = 1 \angle 0^\circ$ (PQ bus); $V_3 = 1.04 \angle 0^\circ$ (pv bus). Determine the elements of sub-matrix J_1 and J_4 of Jacobian matrix J in NR load flow equation in polar form. **(10 Marks)**

PART – B

5 a. Draw and explain the following:

i) Input-output curve
ii) Cost curve
iii) Incremental cost curve
iv) Heat rate curve. **(08 Marks)**

b. The fuel costs of 2 units are given by

$F_1 = 1.5 + 20P_1 + 0.1\,P_1^2$ Rs/hr

$F_2 = 1.9 + 30P_2 + 0.1\,P_2^2$ Rs/hr

Where P_1 and P_2 are in MW. Neglecting losses find the optimal scheduling when the total demand is 200MW and the corresponding total cost in Rs./hr. If the total load is shared equally by the generating units, find the difference in the total cost in Rs./hr. **(12 Marks)**

6 a. Indicating the assumptions made, derive the equations for general loss formula co-efficients and the transmission loss. **(10 Marks)**

b. For a 2 plant system; $B_{11} = 0.0015$, $B_{12} = -0.0005$, $B_{22} = 0.0025$, $\frac{dF_1}{dP_1} = 0.01P_1 + 2$; $\frac{dF_2}{dP_2} = 0.01P_2 + 1.5$. The objective is to determine the operating scheduling corresponding to $\lambda = 2.6$. Using iterative method determine at the end of first iteration P_1, P_2, total transmission loss and the total power received. **(10 Marks)**

7 a. What is transient stability analysis? What are the assumptions and simplifications made during this study? **(08 Marks)**

b. With the help of neat figures and equations explain point-by-point method of solving swing equation. **(12 Marks)**

8 a. Draw the flow chart for transient stability analysis using modified Euler's method. **(10 Marks)**

b. Write the algorithm for Runge-Kutta method of solving swing equation. **(10 Marks)**

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10EE72

Seventh Semester B.E. Degree Examination, June/July 2015
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. State the advantages of electric heating over other forms of heating. **(06 Marks)**

b. With neat sketch, explain the working of a Coreless Induction furnace. **(06 Marks)**

c. A 10KW, single phase, 230 volts resistance over employed nichrome strip of thickness 0.03cm. If the wire temperature is to be 1100^0C and that of the charge to be 700^0C, calculate the length and width of the strop required. If the radiating efficiency is 0.6 and emissivity is 0.9. The resistivity of nicrome allay is 1.03 $\mu\Omega$ – m. **(08 Marks)**

2 a. State and explain the Faraday's laws of electrolysis. **(06 Marks)**

b. Explain the terms : i) Anodizing ii) Polarization. **(06 Marks)**

c. Discuss the factors affecting the electro deposition. **(08 Marks)**

3 a. Define the following terms :
i) Luminous flux ii) MHCP iii) Solid angle. **(06 Marks)**

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

c. Discuss the requirements of good lighting. **(08 Marks)**

4 a. Explain the terms : i) Reflection ii) Refraction iii) Diffusion. **(06 Marks)**

b. Write a note on Flood Lighting. **(06 Marks)**

c. A Lamp of 250 C.P is hung at the centre of a room $8 \times 6m^2$ at a height of 3m from the floor. Calculate the maximum and minimum illumination produced and mention the points where it falls. **(08 Marks)**

PART - B

5 a. Discuss the advantages and disadvantages of electric traction. **(06 Marks)**

b. Explain the terms Tractive effort and co-efficient of Adhesion. **(06 Marks)**

c. Assuming Trapezoidal speed – time curve, derive equations for i) total distance travelled by the train between two stops and ii) Maximum velocity. **(08 Marks)**

6 a. Derive an expression for the specific energy consumption of a train. **(10 Marks)**

b. An electric train weighing 180 tonnes runs at a speed of 75km.hr. The train resistance at this speed is 48 Nw/tone. Determine the current drawn from 1500 voltage dc mains at total efficiency of 82%. How long will it continue to run if the supply is switched off? Assume accelerating weight as 1.05 times the dead weight of the train. **(10 Marks)**

7 a. Discuss the lighting system and its accessories in the train. **(06 Marks)**

b. Explain Regenerative braking in traction system. **(06 Marks)**

c. Explain series parallel control of dc motors. Discuss how the energy is saved in this method. **(08 Marks)**

8 a. Write a note on Electric vehicles. **(10 Marks)**

b. Explain the tractive effort and discuss the performance characteristics of electric vehicles. **(10 Marks)**

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10EE73

Seventh Semester B.E. Degree Examination, June/July 2015
High Voltage Engineering

Time: 3 hrs. Max. Marks:100

Note: ***1. Answer any FIVE full questions, selecting atleast TWO questions from each part.***
2. Missing data may be suitably assumed.

PART – A

1 a. What are the advantages of transmitting electrical power at high voltages? **(06 Marks)**
b. Explain in brief the need for generating high voltages in the laboratory. **(06 Marks)**
c. What are the industrial applications of high voltages? **(08 Marks)**

2 a. Define Townsend's first and second ionization coefficients. Derive from fundamentals the coefficients. Derive from fundamentals the current growth equations and hence the Townsend's criterion for breakdown. **(10 Marks)**
b. Derive and explain Paschen's law. **(05 Marks)**
c. Explain briefly formative time lag and statistical time lag. **(05 Marks)**

3 a. Explain any two theories that explain breakdown in commercial liquid dielectrics. **(10 Marks)**
b. Explain the electromechanical breakdown of solid dielectrics. **(05 Marks)**
c. A solid specimen of dielectric has a dielectric constant 4.2 and tan $\delta = 0.001$ at frequency of 50Hz. If it is subjected to an alternating field 50kV/cm. Calculate the heat generated in the specimen due to the dielectric loss. **(05 Marks)**

4 a. Explain how high direct current, voltages can be generated using a Cockcroft Walton circuit. **(07 Marks)**
b. With the help of a neat sketch, explain the construction and working principle of cascading of transformers of three units. **(07 Marks)**
c. A Cockcroft-Walton type multiplier has right stages with capacitances, all equal to 0.05μF. The supply transformer secondary voltage is 125kV at frequency of 150 Hz. If the load current to be supplied is 5mA, find: i) the percentage of ripple and ii) Regulation. **(06 Marks)**

PART – B

5 a. Explain how impulse voltages are generated in a laboratory using Marx circuit. **(08 Marks)**
b. Explain the working principle of a Trigatron gap tripping circuit used for the impulse generator. **(06 Marks)**
c. A 12 stage impulse generator has 0.126 μF capacitors. The wave front and the wave tail resistances connected are 800 ohms and 5000 ohm respectively. If load capacitor is 1000pF. Find the front and tail times of the impulse wave produced. **(06 Marks)**

6 a. Describe with a neat sketch, the working of a generating voltmeter used to measure high D.C. voltages. **(08 Marks)**

b. Explain the principle and construction of an electrostatic voltmeter for the measurement of high voltages. **(08 Marks)**

c. What are the factors influencing the sparkover voltages of sphere gaps? **(04 Marks)**

7 a. Explain the construction and principle of operation of H.V. Schering bridge used for dielectric loss and loss angle measurements. Derive the expression used. **(08 Marks)**

b. Discuss the method of discharge detection using straight detectors. **(08 Marks)**

c. A Schering bridge was used to measure the capacitance and loss angle of an H.V. brushing. At balance, the observations were: the value of the standard condenser = 100 pF, $R_3 = 3180\ \Omega$, $C_3 = 0.00125\ \mu F$ and $R_4 = 636\Omega$. What are the values of capacitances and tan δ of the brushing? **(04 Marks)**

8 a. Mention the different electrical tests done on circuit breakers. **(10 Marks)**

b. Describe various electrical tests done on transformers. **(10 Marks)**

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10EE74

Seventh Semester B.E. Degree Examination, June/July 2015
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. What are the advantages of electric drive system? **(04 Marks)**

b. Mention the main factors which decide the choice of an electrical drives for a particular application. **(06 Marks)**

c. A motor drives two loads. The rotational load coupled to the motor through reduction gear with a = 0.1 and efficiency of 90%. The load has a moment of inertia of 10kg/m^2 and a torque of 10N-m. Other load has a translational motion and consists of 1000kg weight to be lifted up at a uniform speed of 1.5 m/sec. The coupling between this load and motor has an efficiency of 85% motor has an inertia of 0.2kg/m^2 and runs at a constant speed of 1420 rpm. Calculate equivalent inertia and torque refereed to the motor shaft and also power developed by the motor **(10 Marks)**

2 a. Derive an expression to determine the power ratings of electric motors for continuous duty for fluctuating and intermittent loads by equivalent current, torque and power methods. **(10 Marks)**

b. Explain the method of determination of motor rating for short time duty loads. **(06 Marks)**

c. A constant speed motor has the following duty cycle

i) Load rising linearly from 200 to 500kW for 4 minutes.

ii) Uniform load of 400kW for 2 minutes.

iii) Regenerative power returned to the supply, reducing linearly from 400kW to 0 kW for 3 minutes, and remains idle for 4 minutes. Calculate the power rating of the motor. Assuming loss to be proportional to (power)^2. **(04 Marks)**

3 a. With circuit diagram and wave forms explain the operation of continuous conduction mode for a single phase half controlled rectifier of separately excited d.c. motor. And also obtain the average output voltage and speed/torque equation. **(10 Marks)**

b. A 220V, 1500 rpm, 10A separately excited d.c. motor is fed from a single phase fully controlled rectifier with an a.c. source voltage of 230V, 50Hz, Ra = 2Ω. Conduction can be assumed to be continuous. Calculate the firing angles for i) Half the rated motor torque and 500rpm; ii) Rated motor torque and -1000 rpm. **(10 Marks)**

4 a. With circuit diagram and waveforms explain three phase fully controlled rectifier control of separately excited d.c. motor. **(10 Marks)**

b. A 230V, 1200rpm, 15A separately excited motor has an armature resistance of 1.2Ω. Motor is operated under dynamic braking with chopper control. Braking resistance has a value of 20Ω. Calculate: i) The duty ratio of chopper for motor speed of 1000rpm and braking torque equal to 1.5 times the rated motor torque; ii) Motor speed for duty ratio of 0.5 and motor torque equal to its rated torque. **(10 Marks)**

PART – B

5 a. Explain the effect of unbalanced voltages and single phasing on the induction motor performance. **(10 Marks)**

b. A 400V, star connected, 3 phase 6 pole, 50Hz induction motor has following parameters referred to the stator $R_S = R_r^1 = 1\Omega$, $X_S = X_r^1 = 2\Omega$. For regenerative braking operation calculate the maximum overhauling torque and range of speed for safe operation. **(10 Marks)**

6 a. With circuit diagram and wave form, explain the operation of voltage source inverter fed induction motor drives. **(10 Marks)**

b. With circuit diagram and speed/torque curves explain the operation of static Scherbius drive for slip power recovery scheme. **(10 Marks)**

7 a. Explain the operation of synchronous motor from fixed frequency supply. **(10 Marks)**

b. With circuit diagram, explain the self controlled synchronous motor drive employing load commutated thyristor inverter. **(10 Marks)**

8 a. Classify and explain the drives used in cement industry. **(10 Marks)**

b. Explain the various stages in paper mill and motors used in various stages. **(10 Marks)**

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10EE756

Seventh Semester B.E. Degree Examination, June/July 2015
Testing and Commissioning of Electrical Equipment

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 standard specifications of a power transformer? **(10 Marks)**
b. Name the various accessories and fitments on a transformer. **(10 Marks)**

2 a. Describe the method of impulse testing on transformers. **(08 Marks)**
b. What are the desired characteristics of transformer oil? **(04 Marks)**
c. With a neat schematic, explain the Bucholz relay used for transformer protection. **(08 Marks)**

3 a. Explain the sudden 3 phase short circuit test on a 3 phase synchronous generator. How to calculate X_d', X_d'' and X_d from the sudden 3 phase short circuit test? **(10 Marks)**
b. State and explain various abnormal conditions in synchronous generator and their effect on generator. **(10 Marks)**

4 a. Mention the various specification of alternators. Explain the suitability of hydrogen as coolant used in turbo alternators. **(10 Marks)**
b. State the routine tests required to be done for a synchronous machine. **(10 Marks)**

PART – B

5 a. State the various steps in installing and commissioning of induction motors. **(10 Marks)**
b. Explain the significance of balancing of rotor. How is the balancing achieved? **(10 Marks)**

6 a. What is hazardous location? What is explosion proof equipment? What are the desired specialties of 3 ϕ IM? What are the modifications required for an induction motor when it is used for hazardous location? **(10 Marks)**
b. Explain different methods of drying out of induction motors. **(10 Marks)**

7 a. Explain no–load and blocked rotor tests used to determine the efficiency of IM. **(10 Marks)**
b. State the various steps in installing of a large induction motor received in dismantled condition. **(10 Marks)**

8 a. What are different types of tests conducted on circuit breaker? Explain. **(10 Marks)**
b. State and explain the various ratings of high voltage AC circuit breaker. **(10 Marks)**

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10EE761

Seventh Semester B.E. Degree Examination, June/July 2015

Power system planning

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain least cost utility planning of power system. **(10 Marks)**
b. Explain load forecasting and Load modeling methods. **(10 Marks)**

2 a. Explain national action plan goals briefly. **(10 Marks)**
b. Explain the types of co-generation with block diagrams. **(10 Marks)**

3 a. Explain strategy for transmission expansion. **(10 Marks)**
b. Explain types of Rational Tariffs. **(10 Marks)**

4 a. Explain environmental effects and technological impacts in power system planning. **(10 Marks)**
b. Explain the following :-
i) Insulation coordination ii) Reactive compensation, **(10 Marks)**

PART – B

5 a. Explain power system Reliability and Reliability planning. **(10 Marks)**
b. Explain Load management and Load prediction with diagrams. **(10 Marks)**

6 a. Explain Reactive power balance. **(10 Marks)**
b. Explain the following with diagrams
i) State estimator. ii) Power system simulator. **(10 Marks)**

7 a. Explain optimal power expansion planning. **(10 Marks)**
b. Explain capital, operating and maintenance cost of two different plants. **(10 Marks)**

8 a. Explain the optimization techniques for solution by programming.
i) Linear programming method. ii) Nonlinear programming method.
iii) Dynamic programming method. **(15 Marks)**
b. Explain generation planning expansion. **(05 Marks)**

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