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10EE71

Seventh Semester B.E. Degree Examination, June/July 2016
Computer Techniques in Power System Analysis

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain the terms: (i) Tree (ii) Co-Tree (iii) Tree branch path incidence matrix with an example. **(10 Marks)**

b. For the power system shown below. Select ground as reference and a tree for which the link elements are 1 – 2, 1 – 4, 2 – 3 and 3 – 4. Write the basic cut set and basic loop incidence matrix. Verify the relation $C_b = -B_l^T$ **(10 Marks)**

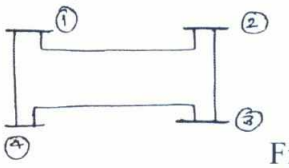

Fig. Q1 (b)

2 a. Consider the power system network shown below:

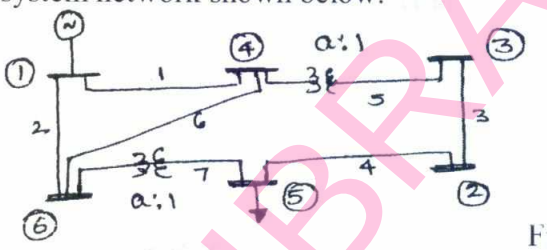

Fig. Q2 (a)

The data is given below:

Line No.	Between lines	Line impedance	$\frac{y'_{pq}}{2}$	Off nominal turns ratio
1	1 – 4	0.08 + j0.37	0.007	-
2	1 – 6	0.123 + j0.518	0.010	-
3	2 – 3	0.723 + j1.05	0	-
4	2 – 5	0.282 + j0.64	0	-
5	4 – 3	0 + j0.133	0	0.909
6	4 – 6	0.097 + j0.407	0.0076	-
7	6 – 5	0 + j0.30	0	0.976

A static shunt capacitor is connected at bus 4 with the admittance j0.005 pu. Formulate Y_{BUS} by inspection method. **(12 Marks)**

b. Form the Z_{BUS} for the power system shown below. Select node ① as reference. The line reactances are marked in pu. **(08 Marks)**

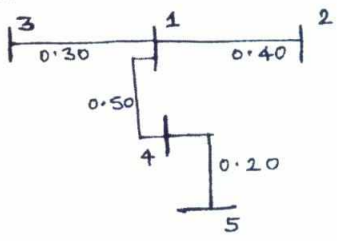

Fig. Q2 (b)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

3 a. Explain with the help of a flow chart Gauss Seidel method of load flow analysis in a power system. **(10 Marks)**

b. Compute the line flows and line losses for a 3-Bus power system network shown below. The data obtained from load flow is as follows: **(10 Marks)**

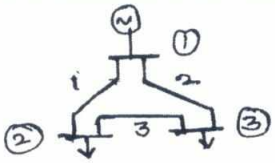

Fig. Q3 (b)

Element No.	Bus From To	R	X	Bus No.	|V|	δ
1	1 – 2	0.02	0.04	1	1.05	0.0
2	1 – 3	0.01	0.03	2	0.9818	-3.5°
3	2 – 3	0.02	0.025	3	1.00125	-2.665°

4 a. In a two bus system shown in Fig. Q4 (a). The bus 1 is slack bus with $V = 1.0\angle 0^\circ$ pu and bus 2 is a load bus with P = 100 MW, Q = 50 MVAr. The line impedance is $(0.12 + j0.16)$ pu on a base of 100 MVA. Using Newton Raphson load flow method compute $|V_2|$ and δ_2 upto one iteration. **(10 Marks)**

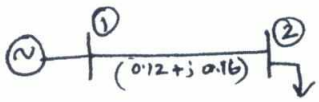

Fig. Q4 (a)

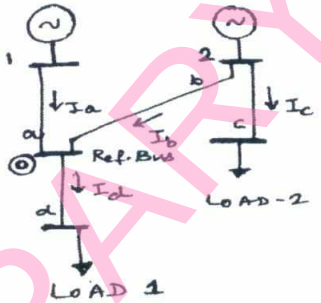

Fig. Q6 (b)

b. Explain the algorithm with Fast Decoupled load flow analysis, clearly stating all the assumptions made. **(10 Marks)**

PART – B

5 a. What is meant by economic load scheduling? Explain the Hydro and Thermal unit input-output curves. **(10 Marks)**

b. A power plant has three units with following cost characteristics:

$F_1 = 0.05P_1^2 + 21.5P_1 + 800$ Rs./hr; $F_2 = 0.10P_2^2 + 27P_2 + 500$ Rs./hr

$F_3 = 0.07P_3^2 + 16P_3 + 900$ Rs./hr

Find the optimum scheduling and total cost in Rs./hr for a total load demand of 200 MW. Given that $P_{imax} = 120$ MW: $P_{imin} = 39$ MW: where i = 1, 2, 3. **(10 Marks)**

6 a. Explain optimal scheduling of hydro-thermal plants and also explain its problem formulation. **(10 Marks)**

b. Figure shown in Fig.Q6(b) is having two plants 1 and 2 which are connected to the buses 1 and 2 respectively. There are two loads and 4 branches. The reference bus with a voltage of $1.0\angle 0^\circ$ pu is shown in the diagram. The branch currents and impedances are as follows:

$I_a = (2 - j0.5)$pu; $I_b = (1.6 - j0.4)$pu; $I_c = (1 - j0.25)$pu; $I_d = (3.6 - j0.9)$pu;

$Z_a = Z_b = (0.015 + j0.06)$pu ; $Z_c = Z_d = (0.01 + j0.04)$pu

Calculate the loss coefficients in the system in pu. **(10 Marks)**

7 a. Explain the computational algorithm for obtaining the swing curves using Runge Kutta method. **(10 Marks)**

b. Explain the load models employed in multi-machine stability analysis with neat sketch. **(10 Marks)**

8 a. Explain Milne's predictor corrector method for solving the swing equation of multi-machine system. **(10 Marks)**

b. Explain the swing equation and its importance in stability studies. **(10 Marks)**

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10EE72

Seventh Semester B.E. Degree Examination, June/July 2016
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. Derive and explain the design procedure for a circular heating element. **(06 Marks)**

b. Discuss briefly various types of resistance welding techniques. **(10 Marks)**

c. A piece of an insulating material is to be heated by dielectric heating. The size of piece is 10 × 10 × 3cm. A frequency of 20MHz is used and the power absorbed is 400 watts. Calculate the voltage necessary for heating and the current that flows in the material. The material has a relative permittivity of 5 and a power factor of 0.05. **(04 Marks)**

2 a. Define the following terms referred to electrolytic processes :
i) Faraday's laws of electrolysis ii) Electro – chemical equivalent iii) Current efficiency iv) Energy efficiency. **(08 Marks)**

b. What is Electro deposition? What are the applications of electrolysis? Briefly explain the factors affecting electro deposition process. **(08 Marks)**

c. Find the thickness of copper deposited on a plate area of $0.00025m^2$ during electrolysis if a current of one ampere is passed for 100 minutes. Density of copper is $8900kg/m^3$ and ECE of copper = 32.95×10^{-8} kg/coulomb. **(04 Marks)**

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

b. State and prove i) Inverse square law ii) Lambert's cosine rule, with respect to the illumination. **(08 Marks)**

c. Two lamp posts are 16m apart and are fitted with a 100 CP lamp each at a height of 6m above ground. Calculate the illumination on the ground i) under each lamp ii) midway between the lamps. **(06 Marks)**

4 a. Explain the following : i) Flood lighting ii) Street lighting. **(06 Marks)**

b. What are the factors, which have to be taken into consideration for design of the lighting scheme? **(08 Marks)**

c. A class room size 30m × 30m is to be illuminated with 75 lux. The lamps are required to be hung 5m above the work bench. Assume a space height ratio around unity, a utilization factor of 0.5, lamp efficiency of 15 lumens/watt, candle power depreciation of 20%. Estimate number, rating and disposition of lamps. **(06 Marks)**

PART – B

5 a. With usual notations, show that

$$V_m = \frac{T}{K} = \sqrt{\left(\frac{T}{K}\right)^2 - \frac{7200D}{K}}, \text{ where } K = \left[\frac{1}{\alpha} + \frac{1}{\beta}\right].$$ **(08 Marks)**

b. What are the various systems of traction? Compare the system of traction with respect to their merits and demerits. **(08 Marks)**

c. A train is required to run between two stations 2km apart at an average speed of 40kmph. The run is to be made according to a simplified quadrilateral speed time curve. If the maximum speed is to be limited to 60kmph, acceleration of 2kmphps, costing retardation to 0.15 kmphps and braking retardation 3kmphps, determine the duration of accelerating, costing and braking periods. **(04 Marks)**

6 a. Define Specific Energy Consumption of an train. Derive an expression for the same. What are the factors that affect the specific energy consumption? **(12 Marks)**

b. A 250 tonnes motor coach having 4 motors each developing 5000 N-m torque during acceleration starts from rest. If up-gradient is 25 in 1000, gear ratio 5, gear transmission efficiency 88%, wheel radius 44cm , train resistance 50N/tone, rotational inertia weight is 10%, calculate the time taken to reach a speed of 45kmph. **(08 Marks)**

7 a. Explain the working principle and construction of a linear induction motor. **(06 Marks)**

b. Write short note on train lighting system. **(06 Marks)**

c. An electric train weighing 132 tonnes is equipped with four 600V motors arranged in two pairs for series parallel control. If during series – parallel starting the current per motor is maintained at 400A, estimate i) the duration of the starting period ii) the speed of the train at transition iii) the rheostatic losses during series and parallel steps of starting. At 400A and 600V, the tractive effort per motor is 19270Nw and the train speed is 39kmph. Assume that the train is started up a gradient of 1 in 100 and the resistance to traction is 44.5 Nw per tonne. Allow 10% for the effect of rotational inertia. Each motor has a resistance of 0.1 ohm. **(08 Marks)**

8 a. What is Hybrid vehicle? Explain configuration and performance of hybrid vehicle. **(06 Marks)**

b. Write a note on tramways and trolley buses. **(06 Marks)**

c. A 400 tonne train travels down a gradient 1 in 70 for 120secs during which period its speed is reduced from 80 kmph to 50 kmph by regenerative braking. Find the energy returned to lines if the tractive resistance is 5kg/tone and allowance for rotational inertia is 7.5%. Overall efficiency of motors is 75%. **(08 Marks)**

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10EE73

Seventh Semester B.E. Degree Examination, June/July 2016
High Voltage Engineering

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain the need for generation of high voltage in the laboratory and what are the limitations of high voltage transmission? **(10 Marks)**

b. Explain Townsend's theory of gas breakdown. Derive equation for current growth and the Townsend's criteria for breakdown. **(10 Marks)**

2 a. Discuss the 'Pachen's law' and explain its significance and limitations. **(10 Marks)**

b. Explain streamer mechanism of breakdown dielectric in gases and obtain the expression for smallest value of α to produce streamer breakdown. **(10 Marks)**

3 a. Briefly explain the electromechanical breakdown and thermal breakdown in solid dielectrics. **(10 Marks)**

b. Explain the various theories that explain breakdown in commercial liquid dielectrics. **(10 Marks)**

4 a. Explain the principle of operation of resonant transformer. With the circuits, explain series and parallel a.c. test systems. What are the advantages and disadvantages of the above? **(10 Marks)**

b. A ten stage Cockraft-Waltons circuit has all capacitors of 0.06 μF. The secondary voltage of the supply transformer is 100 KV at a frequency of 150 Hz if the load current is 1 mA, determine: i) Voltage regulation, ii) The ripple, iii) The optimum number of stages for maximum output voltage, iv) The maximum output voltage. **(10 Marks)**

PART – B

5 a. Explain with a neat sketch the working of a Marx multistage impulse generator. **(08 Marks)**

b. What is trigatron gap? Explain its function and operation. **(06 Marks)**

c. A ten stage impulse generator has 0.250 μF condensers. The wave front and wave tail resistances are 75 Ω and 2600 Ω respectively. If the load capacitance is 2.5 nF, determine the wave front and wave tail times of the impulse wave. **(06 Marks)**

6 a. Explain principle and operation of generating voltmeter used for measuring high D.C voltages. What are the advantages and limitations of the above? **(10 Marks)**

b. Explain the principle and construction of an electrostatic voltmeter for very high voltages. **(10 Marks)**

7 a. Give the schematic arrangement of an impulse potential divider with an oscilloscope connected for impulse voltage measurements. Explain the arrangements to minimize the errors. **(06 Marks)**

b. Explain the high voltage schering bridge for tan δ and capacitance measurement of insulators or bushings. **(08 Marks)**

c. Discuss the method of straight detection for locating partial discharges in electrical equipment. **(06 Marks)**

8 a. Explain in brief the different tests that are conducted on bushings. **(10 Marks)**

b. With a neat sketch, explain the procedure for impulse testing of transformers. **(10 Marks)**

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10EE74

Seventh Semester B.E. Degree Examination, June/July 2016
Industrial Drives and Applications

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 of an electric drive system? **(05 Marks)**

b. With a neat block diagram, explain the essential parts of electric drive. **(05 Marks)**

c. With the help of the quadrantal diagram, explain the four-quadrant operation of a motor driving a hoist load. **(10 Marks)**

2 a. Calculate the starting time of a drive with following parameters J = 10 kg-mt^2, T = 15 + 0.5 w_m and T_L = 5 + 0.6 w_m. **(04 Marks)**

b. Explain the various classes of motors duty with load diagram. **(08 Marks)**

c. Derive an expression for equivalent current I_{eq} for a fluctuating load. **(04 Marks)**

d. The 10 min rating of a motor used in a domestic mixer is 200 Watts. The heating time constant is 40 min and the maximum efficiency occurs at full load (continuous). Determine the continuous rating. **(04 Marks)**

3 a. With speed-torque characteristics, explain the plugging operation of a separately excited DC motor. **(06 Marks)**

b. With a neat circuit diagram and waveforms, explain the operation of discontinuous conduction mode for a single phase fully controlled rectifier of DC separately excited motor. **(08 Marks)**

c. A 220 V, 1500 rpm, 10 A separately excited DC motor is fed from a single phase fully controlled rectifier with an AC source voltage of 230 V, 50 Hz, $R_a = 2\Omega$. Conduction can be assumed to be continuous. Calculate firing angles for:

i) Half the rated motor torque and 500 rpm.

ii) Rated motor torque and -1000 rpm. **(06 Marks)**

4 a. Explain the multi quadrant operation of separately excited DC motor fed from fully controlled rectifier for the following schemes:

i) Single fully controlled rectifier with a reversing switch.

ii) Dual converter. **(08 Marks)**

b. Explain chopper control of separately excited DC motor for motoring control. **(06 Marks)**

c. A 230 V, 960 rpm and 200 A separately excited DC motor has an armature resistance of 0.02Ω. The motor is fed from a chopper which provides both motoring and braking operations. The source has a voltage of 230 Volt. Assume continuous conduction mode:

i) Calculate duty ratio of chopper for motoring operation at rated torque and 350 rpm.

ii) Calculate duty ratio of chopper for braking operation at rated torque and 350 rpm. **(06 Marks)**

PART – B

5 a. Explain the operation of a 3-phase induction motor with unbalanced voltages. **(06 Marks)**

b. Explain plugging of an induction motor. **(06 Marks)**

c. A 500 V, 3ϕ, 50 Hz, 8 pole, Y-connected induction motor has $R_1 = 0.13\ \Omega$, $R_2 = 0.32\ \Omega$, $X_1 = 0.6\ \Omega$, $X_2 = 1.48\ \Omega$, $R_0 = 250\ \Omega$, $X_0 = 20\ \Omega$. The full load slip is 5%. The effective stator to rotor turns ratio per phase is $\frac{1}{1.57}$. The machine is braked from full load speed by changing the stator connections and inserting an external rotor resistance, which in primary terms is 1.5 Ω/phase. Determine the initial braking torque, when the stator is disconnected from the AC supply and DC is fed into two of its terminals. **(08 Marks)**

6 a. Explain the static rotor resistance control. **(06 Marks)**

b. Explain the static Kramer drive system. **(06 Marks)**

c. A Y-connected squirrel cage induction motor has the following ratings and parameters: 400V, 50 Hz, 4 pole, 1370 rpm, $R_s = 2\Omega$, $R'_r = 3\Omega$, $X_S = X'_r = 3.5\ \Omega$, $X_m = 55\ \Omega$. It is controlled by a current source inverter at a constant flux. Calculate the motor torque, speed and stator current when operating at 30 Hz and rated slip speed. **(08 Marks)**

7 a. Explain pull-in process in synchronous motor operation from fixed frequency supply. **(05 Marks)**

b. Explain the operation of a synchronous motor shifting from motoring to regenerative braking. **(05 Marks)**

c. Explain the operation of self controlled synchronous motor drive employing load commutated thyristor inverter. **(10 Marks)**

8 a. Explain the operation of drives in paper mill. **(12 Marks)**

b. Explain the operation of drives in a cement mill. **(08 Marks)**

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10EE756

Seventh Semester B.E. Degree Examination, June/July 2016
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. Explain the principle and application of Buchhol2 relay. **(10 Marks)**
b. Describe the test setup for impulse testing of power transformers. **(10 Marks)**

2 a. Explain the causes of the noise produced by transformers. What are the steps generally taken to reduce the noise? **(10 Marks)**
b. Explain the safety precautions to be taken while commissioning and maintaining transformers. **(10 Marks)**

3 a. List and explain the steps involved in installation of alternator. **(10 Marks)**
b. What is cooling? Explain the different methods of cooling of turbo generators. **(10 Marks)**

4 a. How measurement of insulation resistance of stator winding is carried out? **(10 Marks)**
b. Explain the sudden 3-phase short circuit test on generator. **(10 Marks)**

PART – B

5 a. State the various categories of tests on 3-phase induction motor. **(10 Marks)**
b. Explain how mechanical alignment and air gap symmetry is obtained. **(10 Marks)**

6 a. Explain the foundation details used for induction motors. **(10 Marks)**
b. How maintenance of induction motors is carried out? **(10 Marks)**

7 a. What are the different methods of drying out of an induction motor? Explain. **(10 Marks)**
b. Explain high voltage testing on induction motor. **(10 Marks)**

8 a. Give the specifications of high voltage circuit breaker. **(08 Marks)**
b. Name the important components in protection scheme. **(04 Marks)**
c. List the different tests to be carried on circuit breakers. **(08 Marks)**

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10EE761

Seventh Semester B.E. Degree Examination, June/July 2016
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. What do you understand by planning process? Briefly explain the different planning tool s. **(10 Marks)**

b. Explain briefly the load forecasting techniques. **(06 Marks)**

c. Explain the need for electricity regulations. **(04 Marks)**

2 a. With the help of a flow chart, explain the least–cost utility planning. **(10 Marks)**

b. What is co-generation? Describe the basic co-generation processes. **(10 Marks)**

3 a. Explain distribution planning along with the basic distribution systems in use. **(10 Marks)**

b. Mention the choice of technology to minimize emissions from power plants. Explain the method of post–combustion cleanup process, to reduce gaseous pollutants. **(10 Marks)**

4 a. What are the sources of generation and absorption of reactive power in transmission and distribution lines? Compare the merits and demerits of different types of compensating equipments. **(10 Marks)**

b. Explain the terms system adequacy and security with reference to power system reliability. **(05 Marks)**

c. Explain the following real time operations in brief :
i) Automatic Generation Control (AGC)
ii) State estimation. **(05 Marks)**

PART – B

5 a. What do you understand by load prediction? Explain regression analysis method of load prediction. **(10 Marks)**

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

6 a. Explain the need for computerized management of power systems with the help of computer configuration diagram. **(10 Marks)**

b. Discuss briefly the basic tariff making philosophy. **(10 Marks)**

7 a. Explain least- cost optimization. **(10 Marks)**

b. Explain the optimization techniques for solution by programming. **(10 Marks)**

8 Write short note on :
a. Green house effect
b. Insulation co-ordination in power systems
c. Private participation in generation planning
d. Rural electrification. **(20 Marks)**

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