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B.TECH. DEGREE EXAMINATION, MAY 2014

Eighth Semester

Branch : Electrical and Electronics Engineering

EE 010 801—POWER SYSTEM ANALYSIS (EE)

(New Scheme—Regular—2010 Admissions)

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

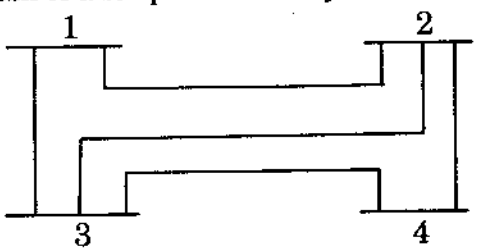
1. What are the advantages of per unit system ?
2. Discuss the main constrains in the unit commitment.
3. Draw the block diagram representation of automatic voltage control.
4. Give reason, for a fault at alternator terminals, a single line to ground fault is more severe than three-phase fault.
5. Discuss why, transient stability limit is lower than steady state stability limit ?

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. For a single line diagram of a simple four bus system as shown, calculate the Y_{bus}.



Line–bus to bus		R	X
1 – 2	...	0.05	0.15
1 – 3	...	0.1	0.3
2 – 3	...	0.15	0.45
2 – 4	...	0.1	0.3
3 – 4	...	0.05	.015

Turn over

7. Explain the equality and inequality constraints to operate power system network.

8. Explain proportional plus integral load frequency control.

9. Distinguish between symmetrical and unsymmetrical faults.

10. Briefly explain about equal area criterion.

(5 × 5 = 25 marks)

Part C

Answer **all** *questions.*
Each full question carries 12 *marks.*

11. Two generators are connected in parallel to the same bus and have X'' = 10%

Generator 1 is rated as 2,500 KVA, 2.4 KV

Generator 2 is rated as 5,000 KVA, 2.4 KV

Find the P.U. reactance of each generator on a 15,000 KVA, 2.4 KV base. What is the P.U. reactance of a single generator equivalent to the two generators in parallel on the same base ?

(12 marks)

Or

12. (a) Draw and explain the impedance diagram for the power system. (4 marks)

(b) Two generators rated as 10 MVA, 13.2 KV and 15 MVA, 13.2 KV respectively are connected in parallel to a bus. Bus feeds two motors rated at 8 MVA and 12 MVA respectively. The rated voltage of the motor is 12.5 KV, the reactance of each generator is 15% and that of each motor is 20% on its own rating. Assume 50 MVA, 13.8 KV base and draw the reactance diagram.

(8 marks)

13. A two-bus system is shown in figure. If a load of 125 MW is transmitted from plant 1 to the load, a loss of 15.625 MW is incurred. Determine the generation schedule and load demand, if the cost of received power is Rs. 24/MWh. The incremental production cost of the plants are

$$\frac{dF_1}{dP_1} = 0.025\,P_1 + 15 \text{ Rs./MWhr.}$$

$$\frac{dF_2}{dP_2} = 0.05\,P_2 + 20 \text{ Rs./MWhr.}$$

(12 marks)

Or

14. Incremental fuel cost in rupees per megawatt-hour for a plant consisting of two units are given by

$$\frac{dF_1}{dP_1} = 0.005\,P_1 + 6.0 \text{ Rs./MWhr.}$$

$$\frac{dF_2}{dP_2} = 0.0075\,P_2 + 4.0 \text{ Rs./MWhr.}$$

Assume that both units are operating at all times , that load varies from 250 to 1250 MV and that maximum and minimum loads on each unit are to be 625 and 100 MW respectively. Find the incremental fuel costs and the allocation of load between units for minimum cost of various total loads.

(12 marks)

15. Draw the complete block diagram representation of load frequency control of an 'isolated power system. Hence explain its steady state analysis.

(12 marks)

Or

16. (a) Draw the transfer function block diagram for a two area system provided with governor control and obtain the steady state frequency error, following a step load change in both the areas.

(6 marks)

(b) Briefly discuss the automatic voltage control and explain the function of ACE.

(6 marks)

17. (a) Derive the necessary equation to determine the fault current for a single line to ground fault.

(6 marks)

(b) Show that positive and negative sequence currents are equal in magnitude but out of phase by 180°, in the line to line fault.

(6 marks)

Or

18. Three 6.6 KV, 12 MVA three-phase alternators are connected to a common set of bus bars. The positive, negative and zero sequence impedance of each alternators are 15%, 12% and 4.5% respectively. If an earth fault occurs on one bus bar, determine the fault current

    (i) if all the alternator neutrals are solidly grounded.

    (ii) if one of the alternator neutrals is earthed through a reactance of 0.05 ohm and others are isolated.

(12 marks)

19. Explain the equal area criterion to determine stability of a system. (12 marks)

Or

20. Derive the swing equation used for stability in a power system. (12 marks)

[5 × 12 = 60 marks]