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Question Paper Code : 11298

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2026.

Sixth Semester

Electrical and Electronics Engineering

EE3602 — POWER SYSTEM OPERATION AND CONTROL

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. State the importance of voltage regulation.
2. Define deregulation.
3. State the need for speed governor in LFC.
4. Mention the role of tie line in interconnected systems.
5. List the advantages of brushless AC excitation system.
6. State the function of tap changing transformer.
7. Define economic dispatch.
8. List the steps in priority list method to solve unit commitment problem.
9. Mention the need of computer based control of power systems.
10. State any four key functions of EMS.

PART B — ($5 \times 13 = 65$ marks)

11. (a) Explain the functions of National and regional load dispatching center. Also, specify the locations of these centers in India.

Or

- (b) Outline any three computational methods used for load forecasting.

12. (a) (i) Derive the expression of change in frequency if the load changes. (5)
- (ii) Two generators with ratings 100 MW and 300 MW operate at 50Hz frequency. The system load increases by 100 MW when both the generators are operating at about half of their capacity. The frequency then falls to 49.5Hz. If the generators are to share the increased load in proportion to their ratings what should be the individual regulations? What should be regulations if expressed in per unit Hertz/per unit megawatt? (8)

Or

- (b) (i) Draw the block diagram of two area system. (5)
- (ii) Load frequency control of two area system have the following characteristics

Area 1: $R_1 = 0.011$ p.u $D_1 = 0.85$ p.u.; Base MVA = 1000

Area 2: $R_2 = 0.018$ p.u $D_2 = 0.95$ p.u.; Base MVA = 1000

A load change of 200 MW occurs in area 1. Determine the new steady state frequency. (8)

13. (a) (i) With neat block diagram, explain a typical excitation control system. (8)
- (ii) Obtain the steady state voltage error of AVR model. (5)

Or

- (b) Explain how SVC and STATCOM help in voltage control and compare their operation.

14. (a) (i) Exhibit the differences between heat rate curve and cost curve. (4)
- (ii) Determine the economic operating point of three units supplying a load of 800 MW. The incremental fuel costs of the three units are as follows:

$$\frac{df_1}{dp_1} = 6.48 + 0.00256 p_1 \text{ Rs. / MWh}$$

$$\frac{df_2}{dp_2} = 7.97 + 0.00964 p_2 \text{ Rs. / MWh}$$

$$\frac{df_3}{dp_3} = 7.85 + 0.00388 p_3 \text{ Rs. / MWh}$$

(9)

Or

- (b) Illustrate the formulation of short-term and long-term hydro-thermal scheduling problems and discuss typical solution methods.

15. (a) (i) Describe the SCADA based power system control using block diagram. (8)
- (ii) Outline any one method used for state estimation in power system. (5)

Or

- (b) (i) Describe the various operating states of a power system. (8)
- (ii) Explain the features of PMUs and the advantages of PMU System monitoring. (5)

PART C — (1 × 15 = 15 marks)

16. (a) A Power system is operating at 1000 MW, 132 kV, 50Hz, with 0.8 p.f. lagging in parallel with another line at 750 MW, 132 kV, 50Hz with 0.707 p.f. lagging. Both are interconnected at the station. When a compensating device is switched on, the overall system power factor is to be improved to 0.9 lagging. Determine the suitable shunt/series capacitors required to improve the power factor of
- (i) Each individual line and (8)
- (ii) The combined load to 0.9 lagging. (7)

Or

- (b) Consider a power system with two plants having incremental cost as follows :

$$IC_1 = 200 + 1.1p_1 \text{ Rs. / MWh}$$

$$IC_2 = 150 + 1.05p_2 \text{ Rs. / MWh}$$

Loss coefficient matrix is given as follows:

$$B = \begin{pmatrix} 0.001 & -0.0005 \\ -0.0005 & 0.0024 \end{pmatrix}$$

Find the optimum scheduling for a system load of 100 MW using suitable method.