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Question Paper Code : 91042

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2025.

Sixth Semester

Electrical and Electronics Engineering

EE 3602 — POWER SYSTEM OPERATION AND CONTROL

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. The values of demand factor and load factor are always less than 1. Why?
2. What happens to power grid frequency, if the load on the generator increases?
3. State the necessary conditions to be satisfied for operating alternators in parallel?
4. What do you mean load frequency control in a two-area power system to maintain constant frequency in an inter-connected power system?
5. State how a synchronous machine can be configured as a synchronous condenser.
6. List some of the voltage control techniques that maintains voltage stability in power system networks.
7. List the equality and inequality constraints considered in the economic dispatch problem.
8. Differentiate between unit commitment and Economic load dispatch.
9. State how Phasor measurement units are utilized for Wide Area Monitoring System
10. Mention the significance of Energy Control Centers.

PART B — (5 × 13 = 65 marks)

11. (a) A power station has to meet the following demand:

Group A : 200 kW between 8 A.M. and 6 P.M.

Group B : 100 kW between 6 A.M. and 10 A.M.

Group C : 50 kW between 6 A.M. and 10 A.M.

Group D : 100 kW between 10 A.M. and 6 P.M. and then between 6 P.M. and 6 A.M.

- (i) Diversity factor (4)
- (ii) Units generated per day (4)
- (iii) Load factor (5)

Or

- (b) Explain the need for voltage and frequency regulation in power system.

12. (a) Draw the transfer function model diagram of uncontrolled two area load frequency control system and describe the salient features under static condition.

Or

- (b) Enumerate the need for speed governing mechanism and explain how load sharing can be accomplished between two alternators running in parallel using governor speed - droop characteristics.

13. (a) With neat schematics explain in detail the different types of FACTS controllers. Also discuss the significance of reactive power management.

Or

- (b) What is a STATCOM? Discuss its construction and working. Compare between STATCOM and SVC in the following

- (i) V-I characteristics (6)
- (ii) Voltage compensation and stability (7)

14. (a) With a neat flowchart, explain how unit commitment problem can be solved using priority list method. Also discuss its merits and demerits.

Or

- (b) The cost characteristic of two units in a plant are:

$$C_1 = 0.4 P_1^2 + 160 P_1 + K_1 \text{ Rs./h}$$

$$C_2 = 0.45 P_2^2 + 120 P_2 + K_2 \text{ Rs./h}$$

Where P_1 and P_2 are power output in MW. Find the optimum load allocation between the two units, when the total load is 162.5 MW.

15. (a) What is a SCADA system and what role does it play in an electrical power system. With a neat block diagram, explain the various hardware components involved and the functional aspects of SCADA system

Or

- (b) Utilizing the state transition diagram, explain the various states of the power system network and its associated control actions.

PART C — (1 × 15 = 15 marks)

16. (a) Two 50 Hz generators of rating 100 MW and 300 MW are operating in parallel. Each of them has a speed regulation of 5%. They supply a total load of 320 MW. Assume that the speed changers are set to give rated frequency at 100% rated output power. Determine the output power of each generator and the operating frequency.

Or

- (b) (i) Draw the block diagram of AVR. Explain the significance of stability compensation in AVR loop? (7)
- (ii) In AVR, high open loop gain is needed for better static accuracy; but this causes undesirable dynamic response, possibly instability. Justify the statement. (8)

