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B.E. (Full Time) DEGREE END SEMESTER EXAMINATIONS, Nov/ Dec 2011

ELECTRICAL & ELECTRONICS ENGINEERING

SIXTH SEMESTER

**EE 9353 – POWER SYSTEM OPERATION AND CONTROL**

(Regulations 2008)

Time: 3 hr Max. Marks: 100

Answer ALL Questions

PART-A (10 X 2 = 20 Marks)

1. Define load factor.
2. What is 'Area Frequency Response Co-efficient' with reference to load frequency control? What does it signify?
3. What is economic load dispatch and why is it necessary?
4. What is participation factor with respect to economic load dispatch?
5. By how many percent will the reactive load drop if the voltage is reduced by one percent in the impedance type of load.
6. Explain the use of static shunt capacitor for voltage control.
7. Explain about the cross coupling between P-f and Q-V loops.
8. What are plant and system level controls implemented in power system?
9. A 150 MW unit with 0.05 p.u. regulation operates in parallel with a 600 MW unit of 0.03 p.u. regulation. For a specific amount of power demand increase find the ratio of sharing of the load by the units. System frequency is 50 Hz.
10. What is the need for state estimation?

PART-B – (5x16 = 80 marks)

11.(i) . A diesel station supplies the following loads to various consumers:

| | | |
|---|---|---|
| Industrial consumer | = | 1200 kW |
| Commercial load | = | 750 kW |
| Domestic load | = | 600 kW |
| Domestic light | = | 500 kW |

If the maximum demand on the station is 2500 kW and kWh generated per year is $45 \times 10^5$, determine the diversity factor and annual load factor. (10)

(ii). Frequency regulation is better in a two area interconnected system than a single area system against step load variation. Justify this statement. (6)

12(a). Derive the transfer function model and draw the block diagram for a single control area provided with governor system. From the transfer function derive the expression for steady state frequency error for a step load change. (16)

[OR]

12.(b) Two synchronous machines with the following data are operating in parallel to feed a common load of 300 MW.

Machine 1 : Governor speed droop: 4%

Operating limits: 40 MW $\leq P_{G1} \leq$ 200 MW

Speed changer set to give 75% rated load at rated speed.

Machine 2 : Governor speed droop: 3%

Operating limits: 30 MW $\leq P_{G2} \leq$ 175 MW

Speed changer set to give 50% rated load at rated speed.

The nominal frequency of operation of the set is 50 Hz.

(i) Determine the load taken by each machine and the frequency of operation. (12)

(ii) What adjustment should be made for the machines to share the loads as in (i) but with a frequency of 50 Hz? (4)

13(a). Draw the circuit diagram for a typical excitation system and derive the transfer function model and draw the block diagram. Discuss the stability aspects of the AVR. (16)

[OR]

13.(b).(i). A three phase overhead line has resistance and reactance per phase of 5Ω and 25 Ω, respectively. The load at the receiving-end is 15 MW, 33kV, 0.8 p.f. lagging. Find the capacity of the compensation equipment needed to deliver this load with a sending-end voltage of 33 kV. (8)

(ii) Discuss the generation and absorption of reactive power. (8)

14 (a) (i) What is EMS? What are its major function in power system operation and control? (6)

(ii) Draw a block diagram to show the hardware components of a SCADA system for a power system and explain the application of SCADA in monitoring and control of power system. (10)

[OR]

14.(b). Draw a state transition diagram and explain the various operating states of a power system and the associated control actions. (16)

15.(a)(i). What is unit commitment problem? Discuss the constraints that are to be accounted in unit commitment problem. (8)

(ii). Explain the procedure for solving unit commitment problem using priority list method. (8)

[OR]

15. (b) In a power system having two units, the loss co-efficients are

$B_{11}$= 0.0015 $MW^{-1}$, $B_{12}$= -0.0006 $MW^{-1}$,

$B_{21}$= -0.0006 $MW^{-1}$, $B_{22}$= 0.0024 $MW^{-1}$

The incremental production cost of the units are

$$\frac{dF_1}{dP_{G1}} = 0.08\ P_{G1} + 20 \text{ Rs/ MWhr}$$

$$\frac{dF_2}{dP_{G2}} = 0.09\ P_{G2} + 16 \text{ Rs/ MWhr}$$

Find the generation schedule for $\lambda$ = 18 and 22. Find also the change in transmission losses between the two schedules. (16)