MAX TIME: 3Hrs   MAX MARKS: 100

ANSWER ALL QUESTIONS

PART A (10*2=20)

1. Compare the performance of shunt capacitor and synchronous condenser in voltage control.
2. Give the static performance characteristics of a speed governor when changes occur in both reference setting and frequency.
3. Is there a cross coupling between Control loops?
4. Define the term "Bottling of the reserve".
5. What are the differences between installed and spinning reserve?
6. What are the factors affecting Power System Security?
7. Compare Unit Commitment and Economic Dispatch problem.
8. What are the various features of SCADA system?
9. What are the types of excitation systems?
10. What are the input data for Power System State Estimation?

PART B (5*16=80)

11. Consider two interconnected area as follows: (16)
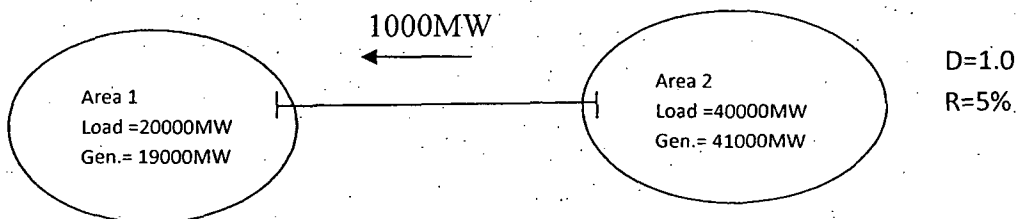
The connected load at 60Hz is 20000MW in area 1 and 40000MW in area 2. The load in each area varies 1% for every 1% change in frequency. Area 1 is importing 1000MW from area 2. The speed regulation is 5% for all units. Area 1 is operating with spinning reserve of 1000MW spread uniformly over a generation of 4000MW capacity, and area 2 is operating with spinning reserve of 1000MW spread uniformly over a generation of 10000MW. Determine the steady-state frequency, generation and load of each area, and tie line power for loss of 1000MW load in area 1, assuming that there are no supplementary controls.

12.a) (i) Explain the classification of the various levels of control in a power system?   (8)
   (ii). A generating station has a maximum demand of 50 MW. Load Factor is 55% , Plant Capacity factor is 65% and Plant use factor 80%.Find the reserve capacity and the daily energy?   (8)

(OR)

12 b) With a functional diagram of the ALFC for a single area, derive its transfer function and represent the block diagram for the primary ALFC loop. (16)

13 a)i. Explain why reactive power management and control is critical for overall system stability. Write about the various Reactive power sources and sinks. (10)

    ii. Why should voltage be maintained within acceptable levels? Explain the Voltage Collapse phenomenon. (6)

(OR)

13 b) Draw the circuit diagram for a typical excitation system and derive the transfer function model and draw the block diagram. Discuss the Static performance and the Dynamic response of the AVR loop? (16)

14 a) Four units to be committed to serve 4 hr load pattern. Each period is two hours long. Find the optimum unit commitment. Use forward dynamic programming method following a strict priority order. Fuel cost of each unit is 2.15 Rs/MBtu. (16)

UNIT	Max (MW)	Min (MW)	Inc. heat rate(Btu/Kwh)	No load cost Rs/h	Start Up cost Rs	Inc Cost Rs/Mw h
1	80	25	10440	213	350	20.88
2	250	60	9000	585.62	400	18
3	300	75	8730	684.74	-	17.46
4	60	20	11900	252	0	23.8

Load pattern

Period	1	2
Load(MW)	450	600

(OR)

14 b) Assume that all three of the thermal units described are running. Find the economic dispatch schedules as requested in each part. Use the method and starting conditions given. (16)

Unit Data	Minimum (MW)	Maximum (MW)	Fuel Cost(Rs/MBtu)
$H_1=225+8.4P_1+0.0025P_1^2$	45	350	0.80
$H_1=225+8.4P_1+0.0025P_1^2$	45	350	1.02
$H_1=225+8.4P_1+0.0025P_1^2$	47.5	450	0.90

i. Use Lambda iteration method to find the economic dispatch for a total demand of 450MW
ii. With the solution obtained in (i), using base point and participation factor find the economic schedule for a demand of 495 MW.

15 a) With a neat diagram explain the hardware components of a SCADA system and explain the application of SCADA in monitoring and control of power system. (16)

(OR)

15 b) Draw a state transition diagram of a power system showing different sets of operating states classified according to security level. Mark on the diagram and explain the state transitions that may occur due to system disturbances and also the different control actions that can be taken to improve the security level of the system. (16)