Total No. of Questions : 8]

SEAT No. :

PA-923

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[5927]-355

B.E. (Electrical Engineering)

POWER SYSTEM OPERATION AND CONTROL

(2019 Pattern) (Semester - VII) (403141)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Figures to the right indicate full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Assume suitable additional data, if necessary.***
5) ***Use of a non-programmable calculator is alowed.***

Q1) a) What is a coherent and non-coherent group of generators? Explain. **[4]**

b) Derive the steady-state frequency analysis of single area LFC. **[6]**

c) With the neat block diagram, explain two areas of load frequency control. **[8]**

OR

Q2) a) Draw the schematic diagram of the steam turbine speed governor system indicating all its components. **[4]**

b) Draw the complete block diagram of single area load frequency control. Write the associated equations of the speed governor system, turbine model, and generator load model. **[6]**

c) Explain the block diagram as well as the frequency response of the proportional plus integral controller in the single area load frequency control. **[8]**

Q3) a) What is the concept of unit commitment in the power system? Explain the need for Unit Commitment. **[4]**

b) The fuel cost of two units is given by, **[6]**

$F_1 = 1.5 + 25P_{g1} + 0.12P_{g1}^2$ Rs/hr

$F_2 = 1.8 + 35P_{g2} + 0.12P_{g2}^2$ Rs/hr

Where P_{g1}, P_{g2} are in MW.

Find the optimum scheduling neglecting losses for a demand of 150 MW.

P.T.O.

c) Determine the Priority list method using full-load average production cost for the data given below. If the load demand is 1100 MW, which units should be prioritized? Comment. **[7]**

Unit No.	Loading Limits		Heat rate curve Parameters			Fuel Cost (Ki) (Rs/kCal)
	Min (MW)	Max (MW)	a	b	c	
1	80	400	0.007	2	300	1.1
2	20	300	0.01	3	200	1.2
3	120	500	0.003	7	100	1.0

OR

Q4) a) Define the Economic Load Dispatch (ELD) studies in the power system. **[4]**

b) There are three power plants having a total capacity of 425 MW are scheduled for an operation to supply total load demand of 250 MW. Find the optimum load scheduling if plants have the following incremental cost characteristics and generator constraints? **[6]**

$$(IC)_1 = \frac{dC_1}{dC_{g1}} = 30 + 0.2P_{g1}; \qquad 50 \le P_{g1} \le 125$$

$$(IC)_2 = \frac{dC_2}{dP_{g2}} = 40 + 0.18P_{g2}; \qquad 20 \le P_{g2} \le 100$$

$$(IC)_3 = \frac{dC_3}{dP_{g3}} = 15 + 0.2P_{g3}; \qquad 100 \le P_{g3} \le 165$$

c) Obtain the economic scheduling for the two units, the production cost of which is given as follows to supply a load of 3 MW, in the step of 1 MW. **[7]**

$F_1 = C_1 = 0.25P_1^2 + 30P_1$

$F_2 = C_2 = 1.25P_2^2 + 35P_2$

Use the Dynamic Programming (DP) method.

Q5) a) What is the interconnection of the power system? State its advantages. **[4]**

b) Consider that there are two cities A and B operating in different time zone. It is required to transmit the power from city A to city B when there is an increase in load demand at city B at different time spans. How the interchange of power takes place? Explain in detail. **[6]**

c) Explain the concept of a power pool in energy control. What are the potential advantages associated with a power pool? Explain. Also, discuss constraints related to the power pool. **[8]**

OR

Q6) a) Explain in detail: Interchange evaluation with unit commitment. **[4]**

b) Write a short note on: Capacity Interchange. **[6]**

c) Explain: **[8]**

i) Energy Banking

ii) Emergency Power Interchange

Q7) a) Draw the QV curve with appropriate labeling showing stable and unstable regions. What is the use of the QV curve in voltage stability study? **[4]**

b) Explain the following voltage stability indices with their formula: **[6]**

i) Fast Voltage Stability Index (FVSI)

ii) Line Stability Index (L_{mn})

iii) Line stability factor (LQP)

c) What happens when there is voltage instability in the power system? Explain in detail. **[7]**

OR

Q8) a) Define the following terms: **[4]**

i) Voltage Stability

ii) Voltage Collapse

b) Give the detailed classification of the voltage stability based on the time frame and based on nature of the disturbance. **[6]**

c) Derive the expression of the power-voltage relationship for drawing the PV curve in detail and hence draw the PV curve with appropriate labeling showing stable-unstable region. **[7]**

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