Total No. of Questions : 8]

SEAT No. : ____

PA-923

[Total No. of Pages : 3

[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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Total No. of Questions : 8]

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[6004]-503

B.E.(Electrical Engineering)

POWER SYSTEM OPERATION AND CONTROL

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

Time : 2.30 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 and Q.7 or Q.8.***
2) ***Figures to the right indicate full marks.***
3) ***Neat diagram must be drawn wherever neccesary.***
4) ***Assume suitable data, if necessary.***
5) ***Use of a non-programmable calculator is allowed.***

Q1) a) Explain the necessity of maintaining frequency constant. **[4]**

b) Explain the droop characteristics of the speed governor system. **[6]**

c) Explain the working of proportional plus integral load frequency control of an isolated power system along with its frequency response curve. **[8]**

OR

Q2) a) Draw the complete block diagram of single area load frequency control. **[4]**

b) Explain the necessity of automatic generation control (AGC). Also, explain the concept of area control error (ACE) of a single area and two area case. **[6]**

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

Q3) a) Define the terms related to the constraints of the Unit Commitment: **[4]**

i) Crew Constraints

ii) Minimum uptime

iii) Minimum downtime

iv) Spinning reserve

P.T.O.

b) State the various methods for the unit commitment. Hence, explain the 'priority list method' for unit commitment. **[5]**

c) Explain with the mathematical formulation, the Lagrange Multiplier method of economic load dispatch with transmission loss and no constraints of generation limit while meeting the load. **[8]**

OR

Q4) a) What is the need for a unit commitment study in the power system? Explain. **[4]**

b) Write a short note on: **[5]**

i) Heat rate curve of a thermal generating unit.

ii) Cost curve of a thermal generating unit.

c) Using the priority list method prepare a unit commitment table using three generating units, for load values such as 400MW, 900MW, and 1100MW.The incremental fuel cost of three units and other details are as follows: **[8]**

$$(IC)_1 = (0.003P_1 + 8)*10^3 \text{ Kcal/MWhr}$$

$$(IC)_2 = (0.002P_2 + 8.5)*10^3 \text{ Kcal/MWhr}$$

$$(IC)_3 = (0.004P_3 + 9)*10^3 \text{ Kcal/MWhr}$$

Maximum and minimum generation limits are,

$50<P_1<500$ MW; $40<P_2<400$ MW; $20<P_3<200$ MW

The fuel cost is $(CP)_1$ = 1.1 Rs / Kcal, $(CP)_2$ = 1.05Rs / kcal, $(CP)_3$ = 1.25Rs / kcal.

Q5) a) What is the need for interconnection of the power system? **[4]**

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

c) With an example explain the economic interchange between interconnnected utilities. **[10]**

OR

Q6) a) What do you mean by power pool? What is the role of the power pool in energy control? **[6]**

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

c) Explain: **[6]**

i) Energy Banking.

ii) Emergency Power Interchange.

Q7) a) State the procedure to draw the QV curve. Hence, draw the QV curve with appropriate labeling showing stable-unstable regions. **[4]**

b) What are the effects of voltage instability on the power system? Explain in detail. **[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]**

OR

Q8) a) What is the use of the PV curve in voltage stability analysis? State the drawbacks associated with the PV curve method. **[4]**

b) Write a short note on load characteristics in the voltage stability. **[6]**

c) What is the concept of voltage collapse in the power system? What are the causes of voltage collapse? **[7]**

Total No. of Questions : 8]

SEAT No. : ____

P-6574

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[6181]-125

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 allowed.***

Q1) a) Comment on : The necessity of automatic generation control. **[4]**

b) Explain following concepts **[6]**

i) Control area concept

ii) Area control error

c) Explain the working of the speed governor system of the turbo generator with a schematic diagram. **[8]**

OR

Q2) a) Draw the complete transfer function block diagram representing single are load frequency control including the speed governing model, turbine model and generator load model. **[4]**

b) Draw and explain the complete block diagram of proportional and integral load frequency control of an isolated power system. **[6]**

c) Explain the steady state analysis of single area load frequency control along with its block diagram and two cases: **[8]**

Case i) When the speed changer has a fixed setting and load demand is varying

Case ii) When load demand is fixed and the speed changer setting is varying

P.T.O.

Q3) a) Explain the heat rate curve and cost curve of a thermal generating unit. **[4]**

b) Discuss the economic scheduling of thermal plants (method of Lagrange's multiplier) neglecting the effect of transmission losses. **[6]**

c) Three power plants of total capacity 425MW are scheduled for operation to supply a total load of 300 MW. Find the optimum load scheduling if the pants have the following incremental cost characteristics and generator constraints. **[7]**

$$\frac{dF_1}{dP_{g1}} = 30 + 0.15P_{g1};\ 25 \le P_{g1} \le 125$$

$$\frac{dF_2}{dP_{g2}} = 40 + 0.20P_{g2};\ 30 \le P_{g2} \le 100$$

$$\frac{dF_3}{dP_{g3}} = 15 + 0.18P_{g3};\ 50 \le P_{g3} \le 200$$

OR

Q4) a) Discuss hydro constraints and thermal constraints used for Unit Commitment. **[4]**

b) Discuss the economic scheduling of thermal plants considering the effect of transmission losses. **[6]**

c) Determine the Priority list method using full-load average production cost for the data given below : **[7]**

Unit No.	Loading Limits		Heat rate curve Parameters			Fuel Cost (K_i) (Rs/kCal)
	Mm (MW)	Max (MW)	a	b	c	
1	100	400	0.006	7	600	1.1
2	50	300	0.01	8	400	1.2
3	150	500	0.008	6	500	1.0

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

b) Explain the operation of power pools. **[6]**

c) Explain the following type of power interchange: Diversity Interchange. **[8]**

OR

Q6) a) Explain in detail: Capacity Interchange. **[4]**

b) Write a short note on Interchange evaluation with unit commitment. **[6]**

c) Comment on : **[8]**

i) Inadvertent Power Exchange

ii) Energy Banking

Q7) a) Draw the QV curve with appropriate labeling showing stable and unstable regions. **[4]**

b) What happens when there is voltage instability in the power system? Explain in detail. **[6]**

c) Why voltage stability study has to gain importance in the power system study? Explain. **[7]**

OR

Q8) a) Draw the PV curve with appropriate labeling showing a stable-unstable region. **[4]**

b) What observations were obtained from the PV curve? Enlist the disadvantages of the PV curve. **[6]**

c) Give the detailed classification of the voltage stability based on the time frame and based on nature of the disturbance. **[7]**

Total No. of Questions : 8]

SEAT No. :

PB2266

[Total No. of Pages : 2

[6263]-104
B.E. (Electrical Engineering)
POWER SYSTEM OPERATION & CONTROL
(2019 Pattern) (Semester - VII) (403141)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

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

Q1) a) What is control area concept? Define control area error. **[4]**

b) Develop the block diagram of the load frequency control (LFC) of a single area system. **[6]**

c) Explain clearly about proportional plus integral LFC with a block diagram. **[8]**

OR

Q2) a) Explain the necessity of maintaining the constant frequency of the system. **[4]**

b) Explain droop characteristics of the speed governor system. **[6]**

c) Derive transfer function of speed governor system used in single area load frequency control. **[8]**

Q3) a) Discuss operating cost of thermal unit? What is incremental cost curve.**[3]**

b) A generating unit has two 200 MW units whose input cost data is as under

$F1 = 0.004\ P_1^2 + 2.0\ P_1 + 80$ Rs/hr

$F2 = 0.006\ P_2^2 + 1.5\ P_2 + 100$ Rs/hr

For a total load of 250 MW find the load division between the two units for economic operation. **[6]**

c) Derive the expression for optimal system operation considering transmission loss (penalty factor) for economic load Dispatch (ELD).**[8]**

OR

P.T.O.

Q4) a) What is the concept of unit commitment in the optimal operation of power system? **[3]**

b) With an example, explain the priority list method for unit commitment. **[6]**

c) Determine the saving in fuel cost in Rs/hr for the economic distribution of a total load of 225 MW between the two units with IFCs **[8]**

$dC_1/dP_{g1} = 0.075\ P_{g1} + 15$ Rs/hr

$dC_2/dP_{g2} = 0.085\ P_{g1} + 12$ Rs/hr

Compare with equal distribution of the same total load.

Q5) a) State the advantages of interconnection of power system. **[4]**

b) Write a short note on power pool? **[6]**

c) Explain: **[8]**

i) Diversity interchange

ii) Energy banking

OR

Q6) a) Explain the concept of power pool? **[4]**

b) Discuss the economy interchange between interconnected utilities **[6]**

c) Explain:

i) Capacity Interchange. **[8]**

ii) Interchange evaluation with unit commitment.

Q7) a) Define Voltage stability? Write equation for active power and reactive power for stability. **[3]**

b) Plot a typical P-V curve and write the observations form PV curve. **[6]**

c) Explain problem associated with voltage instability in power system. **[8]**

OR

Q8) a) Discuss the causes of voltage collapse. **[3]**

b) Write a short note on Q-V curve. **[6]**

c) Explain the following voltage stability indices. **[8]**

i) Line stability factor (LQP)

ii) Line stability index (LSI)

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