Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 11229

M.E./M.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

First Semester

Power Systems Engineering

PS 4102 – POWER SYSTEM OPERATION AND CONTROL

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. The maximum demand of a generating station is 80 MW and load factor is 60% calculate utilization factor if the plant capacity factor and plant use factor are 50% and 80% respectively.
2. Discuss the present power scenario in Indian power sector.
3. What are the type load frequency controls for interconnected power system?
4. Draw the block diagram of load frequency control of a two-area control system.
5. Classify hydro plants based on the location.
6. Write the objective equation and the constraints of hydro plants in series.
7. Illustrate the incremental cost curve.
8. What are the assumptions made for solving the unit commitment using dynamic programming method?
9. List the factors affecting the power system security.
10. Define over load performance index.

PART B — (5 × 13 = 65 marks)

11. (a) Discuss the various reserve capacity in power system.

Or

(b) Discuss any one of the short term load forecasting technique with an example.

12. (a) Derive the expression for steady state frequency change for single area system with changes in speed with fixed demand.

Or

(b) Explain and derive the equation for a system with regulation 4 Hz/p.u.MW, $K_p = 150$, $T_p = 18$ sec, $\Delta P_0 = 0.01$ p.u. Calculate the dynamic response of uncontrolled case.

13. (a) Explain the pumped storage scheduling by a gradient method.

Or

(b) Explain the hydrothermal scheduling of systems using dynamic programming.

14. (a) The fuel inputs per hour of plants 1 and 2 are given as

$F_1 = 0.2\ P_1^2 + 40\ P_1 + 120$ Rs/hr

$F_2 = 0.25\ P_2^2 + 30\ P_2 + 150$ Rs/hr

Calculate the economic operating schedule and the corresponding cost of generation. The maximum and the minimum loading on each unit are 100 MW and 25 MW. Assume the transmission losses are ignored and the total demand is 200 MW.

Or

(b) Discuss the flowchart for Lagrange relaxation method for unit commitment.

15. (a) Draw the flow chart of contingency analysis using sensitivity factors.

Or

(b) Illustrate the layering procedure in concentric relaxation.

PART C — (1 × 15 = 15 marks)

16. (a) Four units to be committed to serve 1 hour load pattern. Find the optimum unit commitment using forward dynamic programming method. Fuel cost of each unit is 2.15 Rs/MBtu.

UNIT	Max (MW)	Mm (MW)	Incremental Heat Rate (Btu/kWh)	No-Load Cost (Rs/h)	Start Up Cost (Rs)	Inc. Cost (Rs/Mwh)
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

(b) A power station supplies the load as given below :

Time (Hours)	Load (MW)
6 AM – 8 AM	1.2
8 AM – 9 AM	2.0
9 AM – 12 Noon	3.0
12 Noon – 2 PM	150
2 PM – 6 PM	2.50
6 PM – 8 PM	1.80
8 PM – 9 PM	2.0
9 PM – 11 PM	1.0
11 PM – 5 AM	0.50
5 AM – 6 AM	0.80

(i) Plot the load curve and find out the load factor.

(ii) Determine the proper number and size of generating units to supply this load.

(iii) Find the reserve capacity of the plant and plant factor.

(iv) Find out the operating schedule of the generating units selected.