Register No.: ………………………………… Name: ………………………………………………………………..

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIRST SEMESTER M.TECH DEGREE EXAMINATION (R), DECEMBER **202**3

(Power Systems)

(2021 Scheme)

Course Code : **21PS105-D**

Course Name: **Optimization of Power System Operation**

Max. Marks : **60** **Duration: 3 Hours**

PART A

(Answer all questions. Each question carries 3 marks)

1. Describe the importance of optimization in power system engineering.
2. Suggest and explain a method to solve an optimization problem involving equality constraints.
3. Enlist the penalty terms used in association with inequality constraints.
4. Describe the algorithm for obtaining the composite cost curve.
5. Differentiate between long range and short range hydro scheduling.
6. Explain the characteristics of hydroelectric plant models.
7. Explain the role of spinning reserve in unit commitment problem.
8. Explain about thermal unit constraints in unit commitment problem.

PART B

(Answer one full question from each module, each question carries 6 marks)

MODULE I

9. Explain the classification of optimization problems with the help of examples. (6)

OR

10. Minimize $f(X) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$ with starting point $X_1 = \begin{Bmatrix} 0 \\ 0 \end{Bmatrix}$ with the help of Powell's pattern search method. (6)

MODULE II

11. Minimize the function $f(X) = x_1^2 - x_1x_2 + 3x_2^2$ with starting point $X_1 = \begin{Bmatrix} 1 \\ 2 \end{Bmatrix}$ using Steepest Descent method. Perform two iterations. (6)

OR

12. Minimize $f(X) = (x_1 - 3)^2 + (x_2 - 8)^2$
subject to $g_1(X) = -x_1^2 + x_2 - 2 \leq 0$
$g_2(X) = 3x_1 + x_2 - 12$ using Kuhn-Tucker Conditions (6)

MODULE III

13. Discuss in detail about different characteristics associated with steam generating units. (6)

OR

14. Explain about quadratic programming problem. Derive the necessary conditions. (6)

MODULE IV

15. Determine the economic operation points for a three unit generating units using first order gradient approach when delivering a total load of 850 MW. (6)

$H_1 = 510 + 7.2\,P_1 + 0.00142\,P_1{}^2\left(\frac{MBtu}{H}\right)$, 600MW ≤ P_1≤150MW

$H_2 = 310 + \ 7.85\,P_2 + \ 0.00194\,P_2{}^2\left(\frac{\mathrm{MBtu}}{\mathrm{H}}\right)$; 400MW ≤ P_2 ≤ 100MW

$H_3 = 78 + 7.97\,P_3 + 0.00482\,P_3{}^2\left(\frac{MBtu}{H}\right)$, 200MW ≤ P_3 ≤ 50MW

The fuel cost for the units are, 0.9 Rs/hr, 1 Rs/hr, 1 Rs/hr respectively for the plants.

OR

16. Explain the take-or-pay fuel supply contract. Explain the necessary conditions for optimality including the effects of hard limits and slack variables (6)

MODULE V

17. Explain about hydrothermal coordination. Why it is relevant in power system. (6)

OR

18. Describe the λ-γ iteration scheme for hydrothermal scheduling with the help of flowchart. (6)

MODULE VI

19. Explain the first order gradient search technique for optimal scheduling of hydrothermal power system. (6)

OR

20. Discuss the pumped storage hydro scheduling using λ-γ iteration (6)

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