



K. K. Wagh Institute of Engineering Education & Research, Nashik
(An Autonomous Institute From A.Y. 2022-23)

WINTER-2025	
Exam Seat No.:	
Academic Year:2025-2026	Semester:I
Class:PG-I	Program:M.Tech
Branch Code:ELE	Pattern:2024
Name of Course:Computer-Aided Power System Analysis	Course Code:2406501
Max. Marks:60	Duration:2.30 Hrs.

Instructions: Candidates should read carefully the instructions printed on the Question Paper and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains __02__ page(s).
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. Draw the neat labelled diagrams, wherever necessary.
5. The last columns indicates the Course Outcome and level of Blooms Taxonomy of the Question/sub-question.

Marks CO

Question No. 1

- 1a) Compare the GS method, NR method and fast decoupled load flow method. (6) CO3

Question No. 2

- 2a) The symmetrical components of a phase voltage in a 3-phase unbalanced system are (6) CO2

$$V_{a0} = 10\angle 180^\circ V, V_{a1} = 50\angle 0^\circ V, V_{a2} = 20\angle 90^\circ V$$

Determine the phase voltages V_a , V_b and V_c .

Question No. 3

- 3a) Consider a simple power system with three buses. Measurements are given for the real power flows and bus voltages. Formulate the state estimation problem using the WLS method. (8) CO4

OR

- 3b) Explain the significance of Jacobian matrices in state estimation. (8) CO4
- 3c) Develop the mathematical formulation for the Weighted Least Squares (WLS) method in state estimation. (8) CO3

OR

- 3d) Explain the false data injection attacks and their impact on state estimation. (8) CO3

Question No. 4

- 4a) There are two generating units in a thermal power plant having cost characteristics (8) CO2

$$C_1 = 200 + 2.5P_1 + 0.01P_1^2 \text{ Rs/hr}$$

$$C_2 = 400 + 2P_2 + 0.02P_2^2 \text{ Rs/hr}$$

Where P_1 and P_2 in MW.

The system is operating with economic dispatch with $P_1=325$ MW and $P_2=175$ MW and $\frac{dP_L}{dP_2} = 0.2$.

Find the penalty factor of plant 1 and plant 2.

OR

- 4b) In a generating plant, the fuel cost characteristics are: (8) CO2

$$F_1 = 60 + 30P_1 + 0.2P_1^2 \text{ Rs/hr}$$

$$F_2 = 80 + 20P_2 + 0.15P_2^2 \text{ Rs/hr}$$

The Lagrangian Multiplier 120 Rs/MWhr. Assume the transmission line losses are neglected. Then, find the most economic power generation of the units and also find the total power demand.

- 4c) Differentiate between economic load dispatch and unit commitment. (8) CO1

OR

- 4d) Describe the Lagrange multiplier method for solving optimal power flow problems with an example. (8) CO1

Question No. 5

- 5a) Derive the formula for calculating loss coefficients using the sensitivity approach. (8) CO4

OR

- 5b) Define loss coefficients and explain their significance in power system analysis. (8) CO4
5c) Describe the Generation Shift Sensitivity Distribution (GSSD) and provide its application in power systems. (8) CO1

OR

- 5d) Derive the transmission loss formula in terms of generation and demand at different buses. (8) CO1

..... End of question paper.....