Ref. No.: Ex/PG/EE/T/127C/2024

**M.E. ELECTRICAL ENGINEERING**

**FIRST YEAR SECOND SEMESTER EXAM, 2024**

**POWER SYSTEM ANALYSIS**

**Full Marks- 100 Time- Three hours**

**Answer any Five of the following questions**

1. Explain, how optimum multiplier method may be used to
i) improve the convergence of the Newton-Raphson load flow.
ii) find a second solution adjacent to the steady state solution of the Power System. (13+ 7=20)

2. (a) Derive expressions for the elements of the Jacobean matrix of the Newton-Raphson Load flow. (10)

(b) With the help of a flowchart, explain the solution algorithm of Newton-Raphson Load flow. (10)

3. (a) Discuss how the elements of Bus impedance matrix may be calculated when a new line is added to a network that also adds a new node. (10)

(b) Why Fault admittance matrices are used for fault analysis? Derive the Fault admittance matrix for a single line to ground fault. (10)

4. (a) Explain the necessity of contingency analysis in Power System. (5)

(b) How contingencies may be ranked for active and reactive power contingency analysis? (8+7)

5. (a) Classify the various stability problems in power system. (7)

(b) Explain the steps to be followed to solve the Swing equation. How the solutions of Swing equations may be interpreted to assess the stability/instability of the generators? (10 +3)

6.(a) Discuss the Objective functions and Control variables generally used in Optimal power flow problems. (10)

(b) Explain how linear programming technique may be used to solve the optimal power flow Problem. (10)

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7. (a) Discuss the representation of the Generator and load for reliability analysis of Power System using Loss of Load Expectation (LOLE) approach. (8+7)

(b) How the generation and load models may be used to evaluate the value of LOLE? (5)

8. (a) How the reliability model of repairable components of Power Systems may be obtained from the models of the individual components when they are connected (i) in series (ii) in parallel? (6+6=12)

(b) Two 100 MW generators have identical forced outage characteristics of failure and repair rates as $\lambda = 0.00488$ and $r = 1.066$ days respectively. What is the duration and frequency of overlapping forced outages? What is the mean duration and frequency of 200 MW capability? (8)