

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)**

**CLASS: B.Tech
BRANCH: EEE**

**SEMESTER : VII
SESSION : MO/2025**

SUBJECT: EE441 COMPUTER-AIDED POWER SYSTEM ANALYSIS

TIME: 3 Hours

FULL MARKS: 50

INSTRUCTIONS:

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
 2. Attempt all questions.
 3. The missing data, if any, may be assumed suitably.
 4. Before attempting the question paper, be sure that you have got the correct question paper.
 5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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Q.1(a)	Draw the equivalent circuit diagram and write mathematical equations of generator, Transmission line and transformer.	[5] 1	2
Q.1(b)	Explain, with the help of a single-phase equivalent model of a three-phase transformer, how Y- Δ and Δ -Y connections produce a 30° phase shift between primary and secondary line-to-line voltages.	[5] 1	4
Q.2(a)	Explain the concept of sparsity in the Y-bus and Jacobian matrices. How does sparsity-oriented computer programming help in reducing storage requirements in large-scale power system load flow studies?	[5] 2	2
Q.2(b)	Discuss the Newton-Raphson method for load flow analysis in detail. In your answer, explain how it is formulated for both load buses and voltage-controlled buses in rectangular and polar coordinates, outline the computational steps and flow chart.	[5] 2	3
Q.3(a)	What is the primary objective of the unit commitment problem in power system operation? Name two common constraints considered in solving the unit commitment problem and briefly describe their significance.	[5] 4	2
Q.3(b)	Explain the concept of equal incremental cost operation and outline the computational steps involved in solving the economic dispatch problem both with and without considering transmission losses.	[5] 4	4
Q.4(a)	Define the bus impedance matrix (Z-bus) in power systems and explain its significance in network analysis	[5] 3	2
Q.4(b)	Describe how unsymmetrical fault calculations are performed using the Z-bus matrix. Why is Z-bus preferred for fault analysis in large power systems?	[5] 3	4
Q.5(a)	Explain the difference between steady-state stability, transient stability, and dynamic stability with examples and suitable diagrams.	[5] 5	2
Q.5(b)	Derive the swing equation for a synchronous generator and discuss its significance in power system stability analysis. How is the numerical solution of the swing equation used to predict system behavior following disturbances?	[5] 5	3

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