Code No: 136DK **R16**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year II Semester Examinations, February - 2023

POWER SYSTEMS ANALYSIS

(Electrical and Electronics Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

1.a)	Define the following terms: (i) Co-tree (ii) loop.	[2]
b)	What is a cut set and what are basic cut sets?	[3]
c)	What are P-V buses?	[2]
d)	What are the assumptions in NR method to speed up the rate of convergence?	[3]
e)	What are different types of buses used in load flow studies?	[2]
f)	Define sensitivity and its importance in designing J matrix.	[3]
g)	What do you mean by symmetrical fault?	[2]
h)	What are effects of unsymmetrical faults on the power system?	[3]
i)	Define transfer reactance and inertia constant.	[2]
j)	Give the assumptions made in steady state stability analysis.	[3]

PART – B

(50 Marks)

2.a) What do you understand by branch path incidence matrix P? What are the elements of matrix P and is the nature of this matrix? What is the relationship between the branch path incidence matrix P and the submatrix A_b of the bus incidence matrix A (A_b is of dimensions bX(m-1))?

b) Derive the expressions for bus admittance and impedance matrices by singular transformation. [4+6]

OR

3.a) Derive the expressions for the Z_{loop} using singular transformation in terms of primitive impedance matrix Z and basic loop incidence matrix I.

b) The transpose of a bus incidence matrix of a transmission network is

$$A^T = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ -1 & 0 & 0 & 1 \\ 0 & 0 & -1 & 0 \\ 0 & -1 & 0 & 1 \\ 0 & 1 & -1 & 0 \end{bmatrix}$$

. Draw the oriented graph of the network. [6+4]

4.a) What steps must be taken if the reactive power limits of a PV bus is violated?

b) Draw the flow chart for load flow solution by GS Method using Y_{BUS}. What are PV buses? How are they handled in the GS Method? [4+6]

OR

5. Describe the Newton-Raphson method for the solution of power low equations in power systems. [10]

6.a) Get the algorithm for DC load flow method and give its limitations?

b) Explain the necessary equations for the load flow solution using the Decoupled load flow method. What is the Jacobian matrix and the steps to get it? [4+6]

OR

7. Explain with a flow chart, the computational procedure for load flow solution using fast decoupled method, deriving the necessary equations. [10]

8.a) Draw the positive, negative and zero sequence impedance diagrams for different 3-phase transformer winding connections.

b) Derive the expressions for the fault current and the terminal voltages of a 3-phase alternators, when there is a double line to ground fault occurs at the terminals of Alternator. Assume generator neutral is solidly earthed.

i) Neglect fault impedance $Z_{fault.}$

ii) Consider fault impedance Z_{fault}. [4+6]

OR

9.a) Write short note on series reactors used in power system.

b) Derive an expression for fault current in case of line to line fault occurs in a 3-phase system. [4+6]

10.a) How do you determine the transient stability to single machine infinite system using equal area criterion?

b) Derive the inertia constant for a multi machine system. [6+4]

OR

11.a) What a swing equation? Derive its expression from fundamentals.

b) Discuss any two methods to improve steady state stability. [5+5]

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