Code No: **R32022** **R10** **Set No. 1**

III B.Tech II Semester Supplementary Examinations, April/May- 2019
POWER SYSTEM ANALYSIS
(Electrical and Electronics Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks
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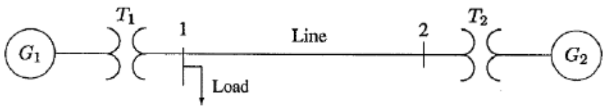
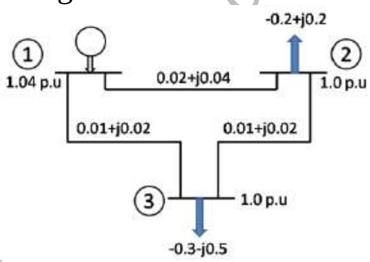
1 a) Discuss and explain the importance of per unit system in power system analysis. Deduce the necessary expression to calculate load impedance in per unit. [5M]

b) Draw an impedance diagram for the electric power system shown below with all impedances in per unit on a 100 MVA base. Choose 20 kV as the base voltage for generator. The three phase power and line ratings are given below. [10M]

Component name	MVA rating	kV level	Percent reactance
G1	90	20	9
T1	80	20/200	16
T2	80	200/20	20
G2	90	18	9
Line		200 kV	120 Ω
Load		200 kV	S=48 MW+j64 MVAr



2 a) Formulate Y-bus for the following network [7M]



b) Solve the given system of PQ buses other than slack bus using Gauss Seidel iterative method (With algorithm & Flow chart) [8M]

Line data

Element No	From Bus	To Bus	R (p.u)	X (p.u)
1	1	2	0.045	0.13
2	1	3	0.2	0.32
3	2	3	0.15	0.45

Bus data

Bus No	Type	Vi	Delta	P (p.u)	Q (p.u)
1	0	1.05	0	0	0
2	1	1.0	0	0.45	0.22
3	1	1.0	0	-0.98	0.4

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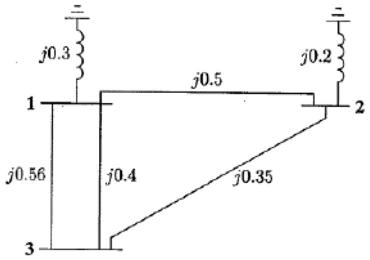
3 Develop a methodology to solve power flow problem for a n-bus system with necessary power injections, power mismatches, Jacobian terms, System equations using polar coordinates. [15M]

4 a) Explain the step by step procedure for building the bus impedance matrix which takes us from a given bus impedance matrix to a new impedance matrix. [6M]

b) The bus impedance matrix for the network is shown below is found to be [9M]

$$\mathbf{Z}_{bus} = \begin{bmatrix} j0.183 & j0.078 & j0.141 \\ j0.078 & j0.148 & j0.106 \\ j0.141 & j0.106 & j0.267 \end{bmatrix}$$



The line between buses 1 and 3 with impedance j0.56 is removed by the simultaneous opening of breakers at both ends of the line. Determine the new bus impedance matrix.

5 a) Explain about the short circuit capacity (SCC) of a bus in a power system. Deduce the expression for SCC in terms of base MVA and per unit reactance to the point of fault with necessary mathematics and assumptions. [10M]

b) Deduce the necessary expressions to perform symmetrical fault analysis using bus impedance matrix. [5M]

6 a) Explain the procedure to resolve unbalanced current phasors of a 3-ph system can be resolved into balanced system of phasors. [8M]

b) The line to line voltages in an unbalanced three phase supply are $V_{ab} = 1000\angle 0^0; V_{bc} = 866.0254\angle -150^0; V_{ca} = 500\angle 120^0$. Determine the symmetrical components for line and phase voltages, then find the phase voltages Van, Vbn, Vcn. [7M]

7 a) Deduce the necessary expressions to calculate fault current for the following unsymmetrical faults. [8M]
i) Single line to ground fault. ii) Double line to ground fault.

b) Compare the effect of unsymmetrical faults on power system operation over the symmetrical faults. [7M]

8 a) Explain the procedure to calculate steady state stability limit, synchronizing power coefficient. [8M]

b) Explain about the different methods to improve steady state and transient stabilities of power system [7M]

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