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

III B.Tech II Semester Supplementary Examinations, Dec - 2015

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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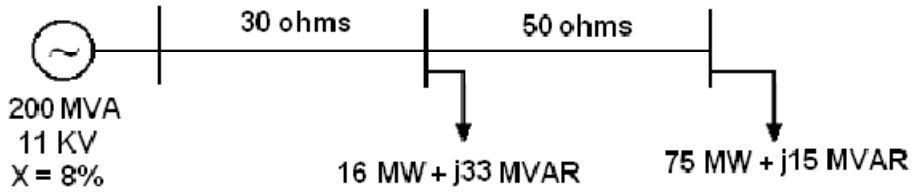
1 a) Draw p.u impedance diagram of the network shown in figure. [8]



b) Why do you use a single line diagram for power system representation? What are the assumptions that are being made while drawing a single line diagram? [7]

2 a) Explain the relationship between [6]
i) The basic loops and links ii) Basic cut-sets and the number of branches.

b) Derive static load flow equations of a power system and mention the assumptions made. [9]

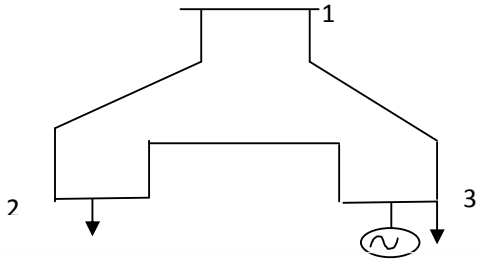
3 Consider the single line diagram of a Power system shown in figure below. Take bus 1 as slack bus and the Y_{BUS} matrix is given below: [15]

$$Y_{BUS} = \begin{bmatrix} 2-j15 & -1.3+j6 & -1.5+8j \\ -1.3+j6 & 4-j12 & -3+j6 \\ -1.5+j8 & -3+j6 & 5-j6 \end{bmatrix}$$

Scheduled generation and loads are as follows:

Bus No.	Generation		Load		Assumed Bus Voltages
	MW	MVAR	MW	MVAR	
1	0	0	0	0	1.04+j0.0
2	0	0	250	150	1.0+j0.0
3	100	70	50	20	1.0+j0.0

Using Newton-Raphson method, obtain the bus voltages at the end of 1st iteration.



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4 a) Explain the algorithm for the addition and removal of lines in power system. [7]

b) A Two - Bus system has $Z_{BUS} = \begin{bmatrix} j0.11545 & j0.0468 \\ j0.0468 & j0.13894 \end{bmatrix}$ p.u [8]

If an impedance Z_b = j0.6 p.u. is connected between buses 1 and 2, what is the new Z_{BUS}?

5 a) Explain the short circuit currents of synchronous machine. [9]

b) A synchronous generator is rated 80 MVA, 11 KV, Xd=0.5 p.u. The generator is connected to a step-up transformer with ratings of 150 MVA, 12 KV(delta)/132 KV(star), X=0.12 p.u. Compute fault current in amps for three-phase fault at H.T. terminals of the transformer. [6]

6 a) Obtain the sequence impedances of transmission lines with mutual effect. [5]

b) A 3 phase, 50 MVA, 6.6kV alternator having 8% reactance is connected through a 50 MVA, 6600/33,000 V delta-star connected transformer of 5% reactance to a 33 kV transmission line having a negligible resistance and a reactance of 6 ohms. At the receiving end of the line there is a 30 MVA, 33,000/6600 volt delta-star connected transformer of 5% reactance stepping down the voltage to 6.6 kV. Both the transformers have their neutral solidly grounded. Draw the one-line diagram and the positive, negative and zero sequence networks of this system. [10]

7 a) Derive the expression for LG fault current and draw the connection diagram off its sequence networks. [7]

b) A 50 MVA, 11 kV, 3-phase alternator was subjected to different types of faults. The fault currents were: 3-phase fault 1870 A, line to line fault 2590 A, single line to ground fault 4130 A. The alternator neutral is solidly grounded. Find X_0, X_1 and X_2 in ohm. [8]

8 a) Explain the power angle curve. [3]

b) Discuss the methods to improve steady state stability. [7]

c) Draw diagrams to illustrate the application of equal area criterion to study transient stability when a fault on one of the parallel lines of a two circuit line feeding an Infinite bus. The fault is very close to the sending end bus and is subsequently cleared by the opening of faulted line. Mark the accelerating and decelerating areas in the diagram. [5]