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

**III B.Tech II Semester Supplementary Examinations, April – 2017**

**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) What is the per unit system? Why it is required in power system calculations? [7M]

b) Two generators rated at 5MVA, 11KV and 15MVA, 11KV respectively are connected in parallel to a bus. The bus bars feed two motors rated 6.5MVA and 10MVA respectively. The rated voltage of the motors is 9KV.The reactance of each generator is 12% and that of each motor is 16% on their own ratings. Assume 50MVA, 10KV base and draw the reactance diagram. [8M]

2 a) What are the properties of node to Branch Incidence Matrix? [3M]

b) What is the need of load flow studies? [4M]

c) What is acceleration factor? What is its role in GS-method for power flow studies? [8M]

3 a) Write down the comparisons of decoupled and fast decoupled form of load flow methods. [8M]

b) Develop an algorithm for N-R method in polar coordinate method. [8M]

4 The bus impedance matrix for a 3-bus system is [15M]

$$Z_{BUS} = \begin{bmatrix} j0.6 & j0.3 & j0.287 \\ j0.3 & j0.8 & j0.45 \\ j0.287 & j0.45 & j0.518 \end{bmatrix}$$

There is a line outage and the line from 1 to 2 is removed. Using the method of building algorithm, determine the new bus impedance matrix.

5 a) A 3-phase, 60 MVA, 33 KV alternator has internal reactance of 6% and negligible resistance. Find the external reactance per phase to be connected in series with the alternator so that steady current on short-circuit does not exceed 10 times the full load current. [8M]

b) Derive the relationship between short circuit MVA of a generator and its p.u impedance Z p.u. [7M]

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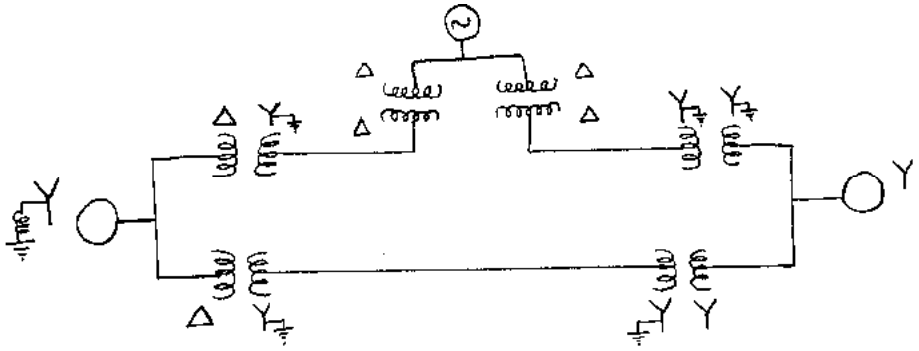
6 a) Explain why construction of positive and negative sequence networks is much simpler when compared to zero sequence networks. What makes zero sequence networks to complicate? Draw the positive and zero sequence network of the following network: [10M]



b) Explain the importance of sequence impedances of an unloaded synchronous generator. [5M]

7 a) Derive the expression for fault current of unloaded alternator when LLG fault occurs on its terminals. [6M]

b) A star connected three phase synchronous generator has a solidly grounded neutral and feeds a line upon which there is a fault. The total impedances upto the fault are as follows [9M]

To positive sequence currents $Z_1$=j3.2Ω

To negative sequence currents $Z_2$ = j1.9Ω

To zero sequence currents $Z_0$ = j1.6Ω.

If the generator induced voltage is 11kV, calculate the fault currents for (i) LG fault (ii) a double line to ground fault (iii) a LL fault. Also calculate the voltages of the lines at the fault.

8 a) Derive the expression for steady state stability limit using ABCD parameters. [6M]

b) A generator having H = 16.0 MJ / MVA is delivering 1.0 pu to an infinite bus via a purely reactive network. When occurrence of a fault reduces the generator output power to zero. The maximum power that can be delivered is 6.5 pu. When the fault is cleared the original network conditions again exists. Determine critical clearing angle and critical clearing time. [9M]