

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

CLASS: MTECH
BRANCH: EEE

SEMESTER : I
SESSION : MO/19

SUBJECT: EE509 ADVANCED POWER SYSTEM ANALYSIS

TIME: 3:00 HOURS

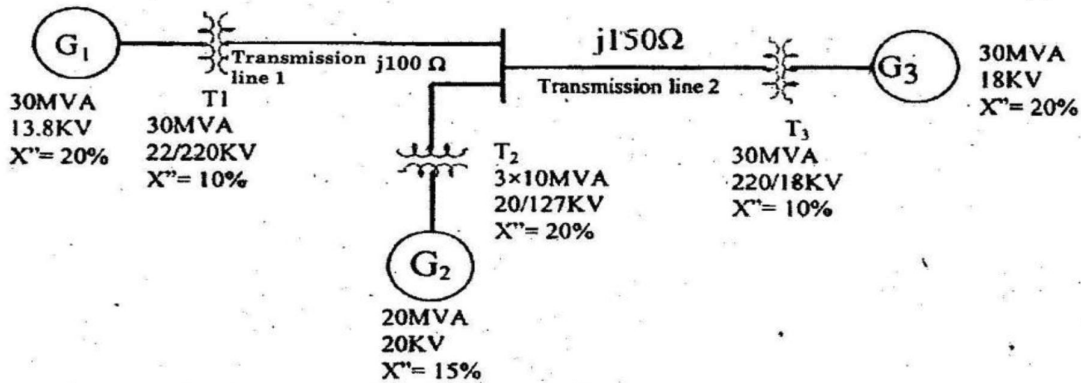
FULL MARKS: 50

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.

Q.1(a) Discuss the modeling of synchronous generator used in load flow and stability analysis? [5]

Q.1(b) The single line diagram of a power system is shown in the figure along with components data. Determine the new per unit values and draw the reactance diagram. Assume 25 MVA, and 20 kV as new base on generator G_1 . [5]



Q.2(a) Formulate the power flow equation for n bus system and also discuss the Sparsity oriented technique for reducing storage requirements with an example. [5]

Q.2(b) For a three bus network carry out two iteration of load flow solution by NRLF method. [5]

Line data	Line impedance (p.u)	Half line charging admittance (p.u)
1-2	$0.021+j0.04$	$j0.006$
2-3	$0.013+j0.03$	$j0.002$
1-3	$0.016+j0.05$	0

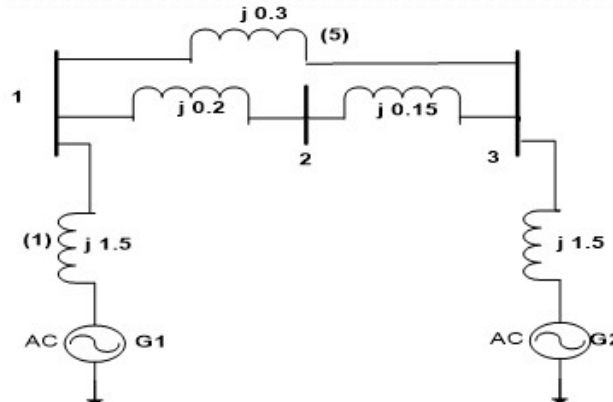
Bus 1, Voltage: $1.0 \angle 0$; Bus2, Load: $50+j60$; Bus 3, Load: $40+j20$. If required take the proper assumptions.

Q.3(a) Discuss the steps involved in continuation load flow technique. [5]

Q.3(b) Draw the sequence network and derive the fault current equation for line to line fault. [5]

Q.4(a) Discuss the Zbus building algorithm in detail by using a four bus system. [5]

Q.4(b) The generators at buses 1 and 3 of the network have impedances $j1.5$ p.u. If a 3-phase short circuit fault occurs at bus 3, when there is no load (all bus voltages are $1 \angle 0$ p.u), find the initial symmetrical current in fault in the line 1-3, and post fault voltages using bus building algorithm. [5]



- Q.5(a) A four bus system with Z_{bus} given in per unit has bus voltages $V_1=1\angle 0$, $V_2=0.98\angle 0$, $V_3=0.96\angle 0$, and $V_4=1.04\angle 0$. Using the compensating current method, determine the change in voltages at bus 2, and 3 when the outage involves (i) only line 1-4 of series impedance $j0.2$ p.u and (ii) both lines 1-4 and 1-3 of series impedance $j0.3$ p.u. [5]

$$Z_{bus} = \begin{bmatrix} j0.041 & j0.031 & j0.027 & j0.018 \\ j0.031 & j0.256 & j0.035 & j0.038 \\ j0.027 & j0.035 & j0.158 & j0.045 \\ j0.018 & j0.038 & j0.045 & j0.063 \end{bmatrix}$$

- Q.5(b) Why state estimation is required and evaluates state variables using weighted least square estimate. [5]

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