

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER-VII • EXAMINATION – WINTER 2013

Subject Code: 170807**Date: 03-12-2013****Subject Name: Power System Analysis****Time: 10:30 TO 01:00****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1 (a)** For the power system network shown in Fig.1, draw a single diagram and insert the reactances in p.u. on 20MVA, 6.6 kV base. The data is as following; **07**
- Generator G_1 : 10 MVA, 6.6 kV, $j0.1$ p.u.
 Generator G_2 : 20 MVA, 11.5 kV, $j0.1$ p.u.
 Transformer T_1 : 10 MVA, 3-phase 6.6/115 kV, $j0.15$ p.u.
 Transformer T_2 : Single phase units, each rated 10 MVA, 75/7.5 kV, $j0.1$ p.u.

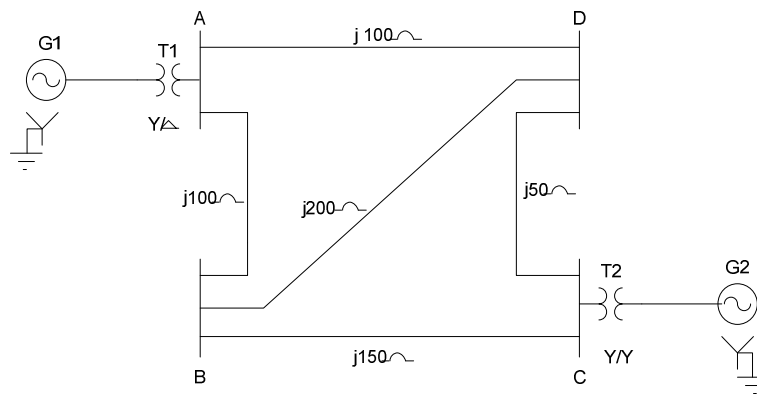


Fig.1

- Q.1 (b)** (i) Describe briefly the role of Load Dispatch Centre. **04**
 (ii) Classify different faults which occur in the power systems. Which of these are the most frequent? **03**
- Q.2 (a)** A constant load of 300MW is supplied by two alternators 1 and 2, for which the incremental fuel costs are $dF_1/dP_1 = 0.1P_1 + 20$ Rs/MWh; $dF_2/dP_2 = 0.12P_2 + 15$ Rs/MWh with power P in MW and cost F in Rs/hr. Determine (i) The most economical division of load between two generators and (ii) the saving in Rs/day thereby obtained compared the equal load sharing between generators. **07**
- Q.2 (b)** What is the significance of load flow in power system? How is load flow analysis done with the help of Gauss Seidel technique? **07**
- OR
- Q.2 (b)** Fig.2 shows the single-line diagram of a simple three-bus system. Table.1 gives the line impedances identified by the buses on which these terminate. The shunt admittance at all the buses is assumed negligible. Calculate Y_{BUS} . **07**

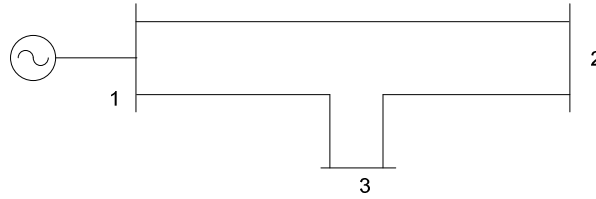


Fig. 2

Line Connecting bus to bus	R	X
1-2	1	j2
1-3	3	j3
2-3	2	j1

Q.3 (a) Explain double line-to-ground fault. Write terminal conditions at fault location. Derive expression of fault current and draw the connection of sequence networks. **07**

Q.3 (b) A 30 MVA, 11kV alternator with solidly grounded neutral has $Z_1=Z_2=j0.2\text{pu}$, $Z_0=0.05\text{ pu}$. A line-to-ground fault occurs at the terminals of an unloaded alternator. Determine fault current and line voltages during fault condition. Assume generator is operating at rated voltage at the occurrence of fault. **07**

OR

Q.3 (a) Explain line-to-ground fault. Write terminal conditions at fault location. Derive expression of fault current and draw the connection of sequence networks. **07**

Q.3 (b) For the power system network shown in Fig.3, if a double line to ground fault occurs at bus no. 2, Calculate the fault current. Assume that the system is operating on no load at the time of fault. **07**

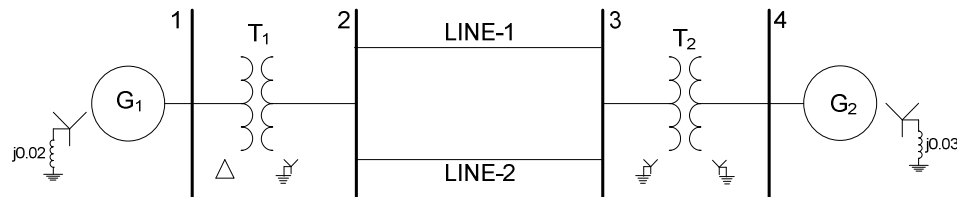


Fig.3

Equipment	MVA Rating	Voltage rating	X_1 p.u	X_2 p.u	X_0 p.u
Generator-1	100	11kv	0.25	0.25	0.05
Generator-2	100	11kv	0.2	0.2	0.05
Transformer 1	100	11/220kv	0.06	0.06	0.06
Transformer 2	100	11/220kv	0.07	0.07	0.07
Line-1	100	220kv	0.1	0.1	0.3
Line-2	100	220kv	0.1	0.1	0.3

Q.4 (a) Explain Z_{BUS} formulation using current injection technique. **07**

Q.4 (b)	(i) Determine original unbalanced voltage phasors in terms of symmetrical components.	04
	(ii) Prove that the zero and negative sequence components of voltage are absent in a balanced three phase system.	03
	OR	
Q.4 (a)	Discuss the short circuit algorithm for large system.	07
Q.4 (b)	(i) What do you mean by p.u. quantity? Why it is superior for short circuit calculation?	03
	(ii) Why do we use reactor in the power system?	02
	(iii) What is the importance of short circuit calculation?	02
Q.5 (a)	Derive the swing equation of a synchronous machine swinging against an infinite bus. Clearly state the assumptions made in deducing the swing equation.	07
Q.5 (b)	Derive the power angle equation $P = \frac{E_G E_M}{X} \sin \delta$ with the usual notations.	07
	OR	
Q.5 (a)	Explain the concept of equal area criterion. How can it be used to study transient stability?	07
Q.5 (b)	Explain point-by-point method of solving the swing equation.	07
