Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII EXAMINATION – WINTER 2015

Subject Code: 170807 **Date: 04/12/2015**

Subject Name: Power System Analysis

Time: 10:30am to 1:00pm **Total Marks: 70**

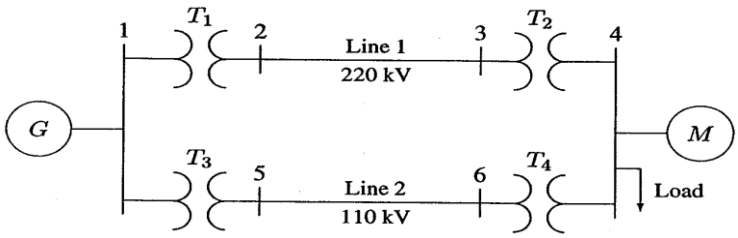
Instructions:

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

Q.1 **(a)** Prove that per unit impedance of transformer is the same whether computed from primary or secondary side. Draw per unit equivalent circuit of single-phase transformer. **07**

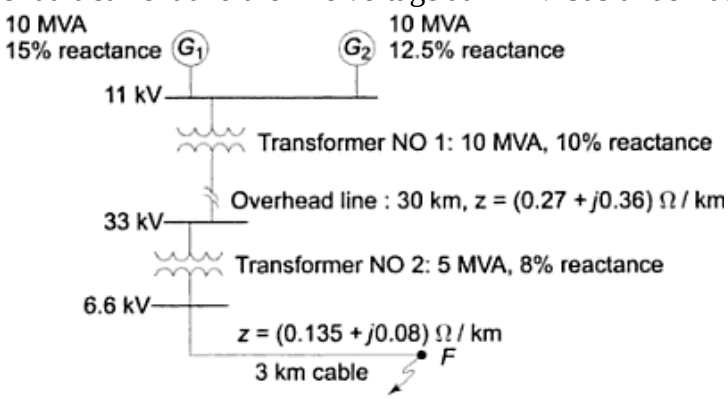
(b) Prepare per unit impedance diagram for the power system as shown in figure. Choose a base of 100 MVA, 22 kV on the generator side. The three phase load at bus 4 absorbs 60 MVA, 0.6 p.f. lagging at 10.5 kV. Line 1 and line 2 have a reactance of 50 Ω and 65 Ω respectively. The rating of generator, motor and transformers are: **07**

G:	100 MVA	22 kV	X= 0.18 p.u.
T_1:	50 MVA	22/220 kV	X= 0.1 p.u.
T_2:	40 MVA	220/11 kV	X= 0.06 p.u.
T_3:	40 MVA	220/110 kV	X= 0.065 p.u
T_4:	50 MVA	110/11 kV	X= 0.08 p.u.
M:	70 MVA	11 kV	X= 0.2 p.u



Q.2 **(a)** Draw the waveforms for fault current for a 3-phase fault on alternator terminals. Explain the sub-transient, transient and steady state reactance. What is their significance in fault calculations? **07**

(b) For the radial network shown in fig. , a three phase fault occurs at F. Determine the fault current and the line voltage at 11 kV bus under fault condition. **07**



OR

	(b)	Derive fault current equation $I^f = V_r^0/(Z_{rr} + Z^f)$ Using Z_{bus} Matrix when n bus system is given. (assume that the rth bus is faulted)	**07**
Q.3	**(a)**	Derive expression for sequence impedances of transmission line and draw their sequence networks.	**07**
	(b)	Explain Zero Sequence Networks of Transformers showing various connections.	**07**

OR

Q.3	**(a)**	Explain double line-to-ground fault. Derive expression of fault current and draw the connection of sequence networks.	**07**
	(b)	Three 6.6 kV, 3-phase, 10 MVA alternators are connected to a common bus. Each alternator has a positive sequence reactance of 0.15 pu. The negative and zero sequence reactance are 75% and 30% of positive sequence reactance. A single line to ground fault occurs on the bus. Find the fault current if (1) all the alternator neutrals are solidly grounded (2) one alternator neutral is grounded through 0.3 Ω resistance and the other two neutrals are isolated.	**07**
Q.4	**(a)**	Explain the concept of Equal Area Criterion. Draw diagrams to illustrate its application when there is a sudden short circuit on one of the parallel lines feeding an infinite bus and the fault is very close to the sending end bus.	**07**
	(b)	What do you mean by economic loading of alternators? Write the necessary conditions for economic loading of alternator.	**07**

OR

Q.4	**(a)**	Explain and draw the flow chart for a load flow study on a power system having only P-Q buses using Gauss - Seidel Method.	**07**
	(b)	Explain the procedure of formulation of Y_{BUS} using singular transformation. Derive the necessary equations.	**07**
Q.5	**(a)**	Describe the traditional technique and new approaches for improvement of transient stability limit of a power system.	**07**
	(b)	A 50 Hz, 4 pole turbo- generator rated at 20 MVA and 13.2 kV has an inertia constant of 9 KW-sec/kVA. (i) Find the kinetic energy stored by the rotor at synchronous speed. (ii) If the input power less rotational loss is 20 MW and output power is 15MW, find the acceleration in degrees per sec^2 and in r.p.m. per sec	**07**

OR

Q.5	**(a)**	Explain the effect of increasing the torque of prime mover of one of the alternator.	**07**
	(b)	A 3000 -kVA ,6 pole alternator runs at 1000 r.p.m. in parallel with other machines on 3,300 –V bus bars .The synchronous reactance is 25%.Calculate the synchronizing power for one mechanical degree of displacement and the corresponding synchronizing torque.	**07**

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