Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII EXAMINATION – SUMMER 2016

Subject Code:170807 **Date:05/05/2016**

Subject Name:Power System Analysis (Department Elective - I)

Time:02:30 PM to 05:00 PM **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)	Explain the significance of single phase solution of balanced 3 phase network.	**7**
	(b)	Define per unit system. Derive the formulae of per unit impedance with usual notations.	**7**
Q.2	(a)	Derive the per unit model of single phase transformer .	**7**
	(b)	A 100 MVA, 11 kV generator with Xd" = 20 % is connected through a transformer, line and a transformer to a bus that supplies three identical motors as shown in Fig. 1. Each motor has Xd" = 25 % and Xd' = 30% on a base of 15 MVA, 6.6 kV. The three-phase rating of the step-up transformer is 50 MVA, 11/66 kV with a leakage reactance of l0 % and that of the step-down transformer is 50 MVA, 66/6.6 kV with a leakage reactance of l0% .The bus voltage at the motors is 6.6 kV when a three-phase fault occurs at the point F. For the specified fault, calculate (a) the subtransient current in the fault, (b) the subtransient current in the breaker	**7**
		OR	
	(b)	Discuss the Symmetrical Short Circuit MVA Rating of Circuit Breaker.	**7**
Q.3	(a)	State the percentage occurrence of unsymmetrical fault. What is α ? With usual notations prove that $1+\alpha+\alpha^2=0$.	**6**
	(b)	Briefly explain the significance of negative sequence impedance and negative sequence network model of alternator for fault analysis.	**4**
	(c)	What is zero sequence network? State its role in fault analysis. Draw the zero sequence network of 3 phase star to star transformer with both winding grounded and 3 phase delta to delta transformer.	**4**
		OR	
Q.3	(a)	With usual notations prove that $[Vs] = [A]^{-1} [Vp]$.	**8**
	(b)	Briefly Explain the positive sequence network for the electrical power system.	6
Q.4	(a)	Draw the connections of a sequence network for single line to ground fault.	**4**

(b) Derive the formulae for positive sequence current Ia1 when 3 phase transmission line is subjected to double line to ground fault. **6**

(c) Draw the connection of sequence network for the following cases of open conductor fault. (i) one conductor open (ii) two conductor open **4**

OR

Q.4 (a) State the comparisons for various methods of load flow solutions. **6**

(b) Explain the decoupled load flow solution method . **8**

Q.5 (a) Derive the equation of per unit value of moment of inertia for the synchronous machine subjected to acceleration due to input feed of mechanical energy. **7**

(b) With usual notations prove the condition for equal area criterion for a machine swinging with respect to infinite bus. **7**

7

OR

Q.5 (a) Derive the swing equation describing the rotor dynamics for synchronous machines. **6**

(b) A synchronous generator o f reactance1 .20 p. u. is connected to an infinite bus bar (lVl = 1.0 p.u.) through transformers and a line of total reactance o f 0.60 p.u. The generator no load voltage is 1.20 p.u. and its inertia constant is H = 10 MW/MVA.The resistance and machine damping may be assumed negligible. The system frequency is 50 Hz. Calculate the frequency of natural oscillations if the generator is loaded to (1) 60% and (ii) 80% of its maximum power limit. 8