Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- VIIth SEMESTER–EXAMINATION – MAY/JUNE- 2012

Subject code: 170807 Date: 29/05/2012

Subject Name: Power System Analysis

Time: 02:30 pm – 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)** What is meant by per unit system? State advantages of per unit system. **07**

(b) A synchronous generator is rated 645 MVA, 24 kV, 0.9 pf lagging. It has a synchronous reactance 1.2 Ω. The generator is feeding full load at 0.9 pf lagging at rated voltage. Calculate: **07**
(1) excitation emf (E_f) and power angle (δ)
(2) reactive power drawn by the load
Carry out calculations in per unit form and convert the results to actual values.

Q.2 **(a)** With the simplifying assumptions explain the SC transient on a transmission line and hence prove that; **07**
$I_{mm\ (max.\ possible)} = 2[\sqrt{2}V/|z|]$, ie doubling effect.
Also draw necessary waveforms to explain doubling effect.

(b) Explain the short circuit of a synchronous machine on no-load. **07**

OR

(b) Derive expression for sequence impedances of transmission line and draw their sequence networks. **07**

Q.3 **(a)** Explain in detail "phase shift in star delta transformer" for positive & negative sequence voltages. **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 reactances 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**

OR

Q.3 **(a)** With the help of sequence network derive expressions for sequential components for an L-L-G fault on a power system. **07**

(b) A 50 MVA, 11 kV, 3-phase alternator was subjected to different types of faults. The fault currents were: 3-phase fault 1870 A, line to line fault 2590 A and single line to ground fault 4130 A. **07**
The alternator neutral is solidly grounded. Find the per unit values of the three sequence reactances of the alternator.

Q.4 **(a)** Derive the swing equation from the first principle. **07**

(b) The impedances between various buses in a system are as follows **07**

Each bus to reference	j2.0 Ω
Bus 1 & 2	j0.8 Ω
Bus 1 & 3	j0.5 Ω
Bus 2 & 3	j1.0 Ω

Find a bus admittance matrix.

OR

Q.4 **(a)** Explain the procedure of formulation of Y_{BUS} using singular transformation. Derive the necessary equations. **07**

Q.4 **(b)** A large 3-phase cylindrical rotor generator is delivering 1.0 pu power to an infinite bus through a transmission network. The maximum power which can be transferred for pre fault, during fault and post fault conditions is 1.8 pu, 0.4 pu and 1.3 pu. Find the critical clearing angle and sketch the power angle curves to show the equality of accelerating and decelerating areas. **07**

Q.5 **(a)** Explain the computational procedure of load flow by "Fast Decoupled Load Flow" method. **07**

(b) A 6 MVA, 11 kV, 8 pole, 50 Hz synchronous generator having saturated synchronous reactance of 0.5 pu is synchronized to 11 kV bus. Calculate its synchronizing power and torque coefficient per degree mechanical shift of rotor angle at no load. **07**

OR

Q.5 **(a)** State and explain the conditions to be satisfied for successful parallel operation of a 3-phase alternator with an infinite bus bar. **07**

(b) Two alternators are operating in parallel. Explain the effect of increasing excitation of one of the alternator. **07**

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