Roll No.:								

B.E. / B.Tech. (Full Time) DEGREE END SEMESTER EXAMINATIONS, May 2012

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SEVENTH SEMESTER (REGULATIONS 2008)

EE 9039 –ADVANCED POWER SYSTEM ANALYSIS

Time: 3 hr Max. Marks: 100

Answer ALL Questions

PART-A (10 X 2 = 20 Marks)

1. How many system and torsional modes of oscillation can occur in a turbine-generator and exciter with five rotating masses?
2. What is the effect of shunt compensation on maximum deliverable power?
3. Justify the slopes in the constant current and constant extinction angle control of rectifier and inverter respectively of a HVDC link.
4. Explain the need for FACTS controllers.
5. Draw the load and network PV curves and indicate the maximum power and loadability limit for constant power load.
6. Identify the state variable and demand that play an important role in load restoration in the case of load behind LTC.
7. A system has two stability limits, 200 MW and 250 MW. Which is the steady state stability limit? Which is transient stability limit?
8. What are the causes of oscillatory and non-oscillator instabilities in power systems?
9. What are PV curves and VQ curves?
10. A turbine-generator unit is connected to an infinite bus through a step-up transformer and a transmission line. The natural frequency of induced currents in the rotor of the generator for a disturbance near the infinite bus is 35Hz. The nominal system frequency is 50 Hz. Calculate the percentage of compensation used and the frequency of induced currents in the rotor of the generator for a disturbance near the infinite bus?

PART-B (5 X 16 = 80 Marks)

11. Derive the expressions for maximum deliverable power of a SLIB system under the following conditions:
    - (i). unconstrained case (5)
    - (ii). under a given load power factor (6)
    - (iii). from power flow equations. (5)

12(a). Derive the power flow model and then obtain the Fast-decoupled power flow model for an 'N' bus system. Explain the algorithmic steps for getting power flow solution using Fast-decoupled power flow method. (16)

(Or)

12(b) Fig. Q12 shows the one-line diagram of a simple three-bus power system with generators at buses 1 and 3. The line impedances are marked in per unit on a 100 MVA base. Find out the bus voltages after one iteration using Fast Decoupled method. (16)

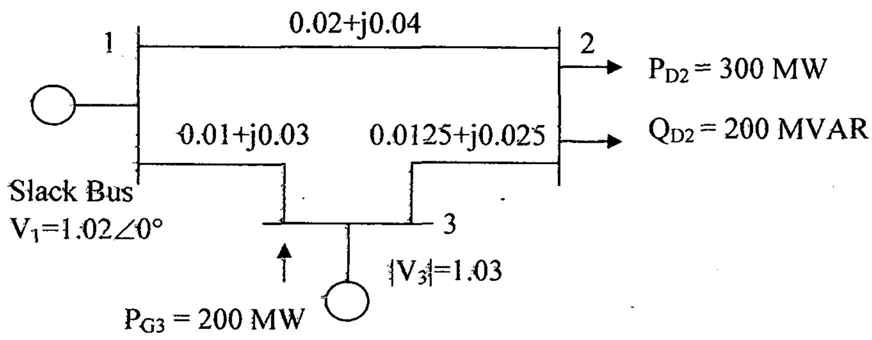

Fig. Q12

13(a). Derive the linearized state equations of a SMIB system. Also obtain the expressions for undamped natural frequency of oscillations and damping ratio. (16)

(Or)

13(b). Describe stepwise computations involved in interfacing a classical model of a synchronous machine with the transient stability algorithm based on implicit integration to advance simulation from time "t-Δt" to time "t."

14.(a) (i) Explain the various operating modes of TCSC.(6)

(ii) Draw the actual converter control steady-state characteristics of a HVDC link and explain the various modes of operation of HVDC link.(10)

(Or)

14(b). Explain the operation of SVC in controlling the voltage of HVAC bus using V-I characteristics of power systems and SVC. Derive the necessary equations.(16)

15(a). (i) Explain how self-excitation can occur in a generator connected to a series-compensated transmission line.(8)

(ii) Explain about any two methods that can be used for enhancing transient stability(8)

(Or)

15(b). The mechanical system of a steam turbine unit consists of 4 masses that correspond to the generator (mass no.1), LP, IP and HP (mass no.4) respectively. The torques of the turbine stages are given by T_{HP}, T_{IP}, and T_{LP}. The opposing electromagnetic torque of the generator is given by T_e. Derive the expression for the dynamics of the shaft system in the standard state variable canonical form $p\mathbf{x} = \mathbf{A}\mathbf{x} + \mathbf{B}\mathbf{u}$. The state variables are the speeds and angular positions of the masses with respect to a common reference.