I – 220

Seat No.	

T.E. (Electrical) (Semester – VI) Examination, 2010
POWER SYSTEM STABILITY AND CONTROL (New Course)

Day and Date : Thursday, 18-11-2010 Total Marks : 100

Time : 10.00 a.m. to 1.00 p.m.

Instructions: *1) Answer* ***any three*** *questions from* ***each*** *Section.*

2) Suitable diagrams should be drawn ***wherever*** *necessary.*

3) Figures to ***right*** *indicate* ***full*** *marks.*

4) Assume suitable data ***wherever*** *necessary.*

SECTION – I

1. a) Derive sequence components for three phase system of voltages. **8**

   b) A 30 MVA, 11KV generator has $z_1 = z_2 = j0.2$ PU, $z_0 = j\ 0.05$ PU a) A line to ground fault occurs on the generator terminals. Find the fault current and line to line voltage during fault conditions. Assume that the generator neutral is solidly grounded and that the generator is operating at no load and at rated voltage at the occurrence of fault b) Find the current for a 3 phase fault. **8**

2. a) Develop an equivalent network showing the interconnection of sequence network to simulate single line to ground fault. **8**

   b) A 50 MVA, 11 KV, 3-phase alternator was subjected to different types of faults. The fault currents were : 3 phase fault 1870A, line to line fault 2590A, single line to ground fault 4130A. The alternator neutral is solidly grounded. Find the per unit values of the three-sequence reactances of the alternator. **10**

P.T.O.

3. a) Explain working of an automatic voltage regulator for an alternator. **8**

b) A single area consists of two generating units with the following characteristics.

Speed regulation 'R'

Unit	**Rating**	**(PU on unit MVA base)**
1	600 MVA	6%
2	500 MVA	4%

The units are operating in parallel, sharing 900 MW at the nominal frequency. Unit 1 supplies 500 MW and unit 2 supplies 400 MW at 60 Hz. The load is increased by 90 MW.

Assume there is no frequency dependant load i.e. D = 0. Find the steady-state frequency deviation and the new generation on each unit. **8**

4. a) Explain with diagram load frequency control of an isolated power system. **8**

b) The symmetrical components of a set of unbalanced three phase currents are $Ia^0 = 3 < -30°$, $Ia^1 = 5 < 90°$ and $Ia^2 = 4 < 30°$ obtain the original unbalanced phasors. **8**

SECTION – II

5. a) Derive the condition of economic load dispatch neglecting transmission line losses. **8**

b) The incremental costs in Rs/MWh of two turboalternators is as follows :

$$\frac{dC_1}{dP_1} = 0.2P_1 + 60; \frac{dC_2}{dP_2} = 0.3P_2 + 40$$

The rating of units are 150 MW and 250 MW. How will the load of 200 MW be shared between two units for most economic operation ? Determine the saving in cost in Rs/h for economic load allocation compared to the loading in proportion to the rating of the units. **8**

6. a) Explain the step by step solution of swing equation. **8**

   b) Explain equal area criterion to determine stability of the system for sudden change in mechanical input. **8**

7. a) A 200 MVA, 11KV, 50 Hz 4 pole turbo generator has an inertia constant of 6 MJ/MVA.

      a) Find the stored energy in the rotor at synchronous speed.

      b) The machine is operating at a load of 120 MW. when the load suddenly increases to 160 MW. Find the rotor retardation.

      c) The retardation calculated above is maintained for 5 cycles. Find the change in power angle and rotor speed in rpm at the end of this period. **10**

   b) Explain different methods of improving stability. **8**

8. a) Explain following terms with respect to power system security.

      i) System monitoring

      ii) Contingency analysis

      iii) Corrective action analysis. **8**

   b) A 4 pole 50 Hz turbo alternator is rated at 45 MW, 0.8 Pf lag and has an inertia of 25000 $kg.m^2$. It is connected through a transmission line to another set whose corresponding data is 2 pole, 60 MW, 50Hz, 0.75 Pf lag 9000 $kg.m^2$. Find inertia constant of each machine on its own rating and that of single equivalent set connected to an infinite bus on a base of 100 MVA. **8**