N – 792

Seat No.

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

Day and Date : Wednesday, 19-5-2010 Total Marks : 100
Time: 2.30 p.m. to 5.30 p.m.

*Instructions : 1) Solve **any three** questions from Section I and **any three** questions from Section II.*
*2) Use of non-programmable calculator is **permitted**.*
*3) Assume suitable data **wherever** necessary.*

SECTION – I

1. a) Explain the phenomenon of short-circuit on a synchronous machine with a neat sketch of short-circuit current waveform. Draw short-circuit models of a machine during

I) Sub-transient period

II) Transient period

III) Steady-state. **8**

b) A generator is connected through a transformer to a synchronous motor. Reduced to the same base, the per unit sub-transient reactances of the generator and motor are 0.15 and 0.35, respectively, and leakage reactance of the transformer is 0.1 per unit. A three phase fault occurs at the terminals of the motor when the terminal voltage of the generator is 0.9 per unit and the output current of the generator is 1.0 per unit at 0.8 power factor leading. Find the sub-transient current in per unit in the fault, in the generator, and in the motor. **8**

P.T.O.

2. a) One conductor of three phase line is open. The current flowing to the delta connected load through phase a is 10A. With the current in line a as reference and assuming that line c is open, find the symmetrical components of line currents. 8

b) Obtain the expression for three phase power in terms of symmetrical components. 8

3. a) Obtain sequence circuits for Y/Y transformer with both neutrals grounded. 10

b) For a small power system shown in Fig. 1, obtain the zero sequence diagram. 8

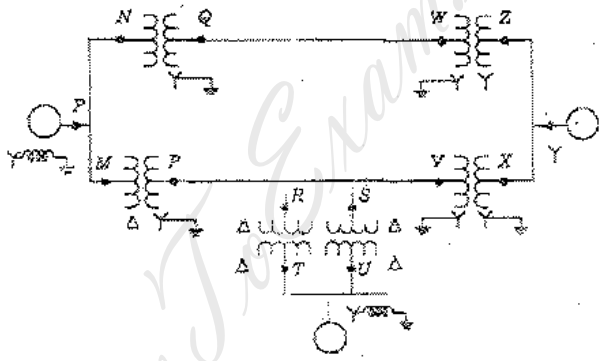

Fig. 1 : Single line diagram of a small power system for Q. 3. b

4. a) Discuss the method of analyzing single line to ground faults. 8

b) Explain how the frequency of the power system varies with the load. 8

SECTION – II

5. a) Discuss different constraints on economic generation. 8

b) The incremental fuel cost in rupees per MWh for a plant consisting of two units are :

$dC_1/dP_{G1} = 0.20\ P_{G1} + 40$

$dC_2/dP_{G2} = 0.20\ P_{G2} + 30$

assume that both units are operating at all times, and total load varies from 40 MW to 250 MW, and the maximum and minimum loads on each unit are to be 125 MW and 20 MW respectively. How will the load be shared between two units as the system load varies over the full range ? What are the corresponding values of the plant incremental costs ?
(assume various values of λ as 35, 44, 50, 55, 60, 61, 25, 65). 10

6. a) With suitable example explain optimal unit commitment. 8

b) What are reliability considerations associated with optimal scheduling ? 8

7. a) A synchronous generator of reactance 1.20 per unit is connected to an infinite bus bar ($|V| = 1.0$ per unit) through transformer and a transmission line having total reactance 0.60 per unit. The generator no load voltage is 1.20 per unit and its inertia constant is H = 4 MW-sec/MVA. The resistance and machine damping may be assumed negligible. The system frequency is 50 Hz. Calculate the natural frequency of oscillations if the generator is loaded to 50%. 8

b) What is equal area criterion for stability assessment ? Define critical clearing time and critical clearing angle. 8

8. a) With suitable example explain voltage collapse. 8

b) What is the need of contingency analysis of a power system ? 8