Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.TECH(EE)/SEM-2/MTEE-202/2010

2010

POWER SYSTEM NETWORKING & MANAGEMENT

Time Allotted : 3 Hours Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer any *five* questions. 5 × 14 = 70

1. Explain application of swing equation in the study of power system stability.

   Determine the kinetic energy stored by a 50 MVA, 50 Hz two pole alternator with an inertia constant (H) of 5 kW sec per kVA. If the machine is running steadily at synchronous speed with a shaft input (minus rotational losses) of 65000 HP and when the eleetrical power developed suddenly changes from its normal value to a value of 40 MW, determine the acceleration or deceleration of the rotor. If the acceleration computed for the generator is constant for a period of 10 cycles, determine the change in torque angle in that period and the rpm at the end of the cycles. 7 + 7

2. State and explain 'equal area criterion'. Discuss the application of equal area criterion for the system stability study when a short circuit on one of the parallel feeders takes place which is cleared after certain time. 6 + 8

3. What is load compensation ? Discuss its objectives in power systems. What are the types of compensators ? Write a brief note on any one type. 3 + 3 + 2 + 6

4. Draw complete block diagram model of LFC (load frequency controller) in case of isolated power system and explain.

   Express the steady change in frequency for a sudden change in load demand (for free governor operation) in terms of gains of different parts and speed regulation of the governor. 7 + 7

5. Write the equation which shows the odq (Park's) transformation to rotor coordinates of the stator *abc* quantities of an alternator.

   The terminal conditions of a synchronous generator are $V_a = 1 \angle 0^\circ$ and $I_a = 1 \angle 90^\circ$.

   The generator parameters are $x_d = 1{\cdot}0$, $x'_d = 0{\cdot}2$, $x_q = 0{\cdot}6$ and $r = 0$. Find δ, I_d , I_q , i_d , i_q , I_{ad} , I_{aq} , $|E_a|$, $|E_a'|$ and PG. 5 + 9

6. Two generators rated 200 MW and 400 MW are operating in parallel. The droop characteristics of their governors are 4% and 5% respectively from no load to full load. Assuming that the generators are operating at 50 Hz at no load, how would a load of 600 MW be shared between them ? What will be the system frequency of this load ? Assume free governor operation.

   Repeat the problem if both governors have a droop of 4%.

   Draw and explain the different parts of alternator voltage regulator scheme (AVR). 7 + 7

7. Write short notes on any *two* : 2 × 7

   a) subsynchronous resonance

   b) FACTS devices

   c) SVC.