Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH (EE-New)/SEM-7/EE-702/2009-10

2009

POWER SYSTEMS III

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.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

i) The characteristics impedance of a 250 km long overhead line is 400 ohms. For a line of 200 km length of the same line, the characteristics impedance will be

a) 50 ohms b) 400 ohms

c) 200 ohms d) 800 ohms.

ii) The transient phenomenon lasts in a power system for a period ranging from

a) few ms to 1s

b) 1s to 2s

c) 2s to 3s

d) greater than 3 seconds.

iii) Unit of regulation of speed governor is

a) Hz/MW b) MW/Hz

c) Unit less d) km/sec.

iv) An overhead transmission line is provided with earth wire for potection against

a) switching surge

b) lightning surge

c) power frequency over voltage

d) none of these.

v) A valve type lightning arrestor in a substation should be placed

a) close to the circuit brake

b) close to the transformer

c) away from the transformer

d) none of these.

vi) The unit of transmission loss coefficient is

a) MW b) $(MW)^{-1}$

c) $(MW)^{-2}$ d) unit less

e) none of these.

vii) If penalty factor of a plant is unity, its incremental transmission loss is

a) 1·0 b) – 1·0

c) 0·0 d) 2·0.

viii) The highest transmission voltage used in India is

a) 400 kV b) 220 kV

c) 132 kV d) 765 kV.

ix) In AGC, the voltage and frequency is controlled by

a) excitation control

b) turbine control

c) turbine speed control and turbine speed control respectively

d) excitation control and turbine speed control respectively.

x) The generating station suitable to operate as peak load plant is
   a) Thermal Power Station
   b) Nuclear Power Station
   c) Pumped Storage Power Station
   d) none of these.

xi) Ferranti effect happens in transmission line when the line is
   a) short and loaded b) long and loaded
   c) long and unloaded d) none of these.

xii) A synchronous condensor is a
   a) Synchronous generator
   b) Paper condensor
   c) Synchronous motor
   d) none of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Explain how the location of a valve type lightning arrestor from a transformer in a substation effects its protection.
3. The reactive power supplied by a synchronous generator to an infinite bus can be varied by varying the excitation. Explain.
4. What is incremental cost criteria ? How is the incremental cost calculated ?
5. Explain Bewby's Lattice diagram.
6. A surge of 100 kV travelling in a line of natural impedance 600 ohms arrives at a junction of two lines of impedances 800 ohms and 200 ohms respectively. Find the surge voltages and currents transmitted into each of the branch lines.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Discuss the basic concept of initiation of transients in power system. What are the different causes of switching over-voltages ? 2 + 3

   b) Deduce the expression for current and voltage across the capacitor when a capacitor is switched on in line and prove that the transient over voltage appearing across an unloaded cable may rise to 5 times the system per phase voltage. 5

   c) A 132 kV transmission line having a surge impedance of 450 ohm terminates at a 7·5 MVA, 132/33 kV transformer which may be represented by a lumped inductor of 15 H and lumped capacitance of 0·003 μF in parallel. A rectangular surge of 1500 kV travels along the line towards the transformer. Calculate the refracted voltage into the transformer when the incident wave reaches the transformer terminals. 5

8. What is an exciter ? What is its role in AVR loop ? Show the complete block diagram of an AVR loop taking into account modern static excitation system of the alternator.

9. What is hydro-thermal scheduling ? What do you mean by long term and short term hydrothermal scheduling ? How do you justify for the cost of water ?

10. What is passive compensation ? Compare series and shunt compensators. Write notes on SVC and STATCOM.

11. Write short notes on any *three* of the following : 3×5

    a) Necessity of restructuring in electricity market

    b) FACTS

    c) Reactive power and voltage control

    d) Pumped storage plants

    e) Environmental aspects of electric power generation.