



Name :

Roll No. :

Invigilator's Signature :

CS/B.TECH(EE)/SEM-7/EE-702/2011-12

2011

POWER SYSTEM - 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) Steady-state stability of the power system is improved by
- a) reducing fault clearing line
 - b) using double circuit line instead of single circuited line
 - c) single pole switching
 - d) decreasing generation inertia.



- ii) Earth wire on overhead transmission line is provided to protect the line against
- a) Lightning surge
 - b) Switching surge
 - c) Excessive fault voltages
 - d) corona effect.
- iii) 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.
- iv) For a line terminated by a load having resistance as characteristic impedance of line
- a) there is no reflected wave
 - b) transmitted current wave is twice the reflected wave
 - c) transmitted voltage wave is twice the reflected wave
 - d) incident current wave is twice the reflected wave.



v) If the speed regulation is 5% and the rated frequency is 60 Hz, then change in frequency is

- a) 3Hz
- b) 6Hz
- c) 5Hz
- d) none of these.

vi) Spinning reserve is

- a) a part of the UCP
- b) the difference between all unit productions to present load with losses
- c) the difference between all unit productions to present load
- d) none of these.

vii) Series compensation in transmission lines

- a) increases stability limit
- b) decreases stability limit
- c) has no effect on stability limit
- d) none of these.

viii) The unit of B-coefficient is

- a) MW
- b) MW^{-1}
- c) Pure Number
- d) None of these.



- ix) In a power station the cost of generation of power reduces most effectively when
- a) diversity factor alone increases
 - b) load factor alone increases
 - c) both diversity and load factor increase
 - d) both diversity and load factor decrease.
- x) With the increase in supply frequency, power consumption of an induction motor load
- a) decreases
 - b) increases
 - c) remains unchanged
 - d) depends upon the motor winding connection.
- xi) In an open circuited transmission line, the voltage developed at the open end due to surge voltage e_f is
- a) $4 e_f$
 - b) $2 e_f$
 - c) $1.5 e_f$
 - d) e_f .
- xii) For increasing the reactive power output of a synchronous generator
- a) field current has to be reduced
 - b) field current has to be increased
 - c) generator speed has to be increased
 - d) generator speed has to be decreased.



GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following.

3 × 5 = 15

2. Define heat rate, incremental heat rate and incremental transmission loss.
3. What do you mean by distributed and dispersed generations ? What are the reasons for growing interests world wide on these types of generations ?
4. Specify a surge wave. What are the different causes of over-voltages in transmission line ?
5. Compare the performance and operation of SVC with that of STAT COM.
6. A 200 MVA synchronous generator operates on 80% loading condition with unity power factor load.

The speed governor of the generator has a regulation of 4% and the no load operating frequency is 50 Hz. The load on the generator is suddenly reduced by 30 MW. Due to time lag in the governing system, the steam valve begins to close after 0.5 sec. Determine the change in frequency during this time. Inertia constant of the generator is 5 MW-s/MVA.



GROUP – C

(Long Answer Type Questions)

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

7. a) Explain the necessity of keeping frequency constant in power system. 4
- b) Draw and label the block-diagram representation of a single area power system incorporating the supplementary control. 8
- c) Explain, why supplementary control is slower than the Governor control. 3
8. a) Derive condition for the most economic power generation of the generators of a power station. 5
- b) The input-output curves of the generators of a power plant are :
 $C_1 = 200 + 6.5 P_1 + 0.004 P_1^2$ Rs/hr.
 $C_2 = 300 + 6.4 P_2 + 0.001 P_2^2$ Rs/hr.
 Find the generation schedule for a load of 400 MW.
 Given that $100 \leq P_1 \leq 300$ MW; $100 \leq P_2 \leq 300$ MW.
 Comment on the solution you obtain. 8
- c) What is penalty factor ? 2
9. a) Derive expression for the current and voltage surges travelling on transmission lines when a short circuit is encountered at the receiving end. 7
- b) A 220 kV transmission line has a surge impedance of 350Ω . The line terminates at 50 MVA, 220/66 kV transformer which may be represented by a lumped inductance of 20H and a capacitance of $0.004 \mu\text{F}$ in parallel. A rectangular surge of 1500 kV travels along the line towards the transformer. Calculate the transmitted voltage into the transformer. 6
- c) What is a surge arrester ? 2



10. a) Derive expression for the reactive power output of a synchronous generator. 5
- b) Discuss the functions of an excitation system. 4
- c) What is a 'Tie line' ? Derive a model for the representation of Tie line for frequency control analysis. 6
11. Write short notes on any *three* of the following : 3 × 5
- a) Economic benefits of pumped storage plants.
 - b) Flexible AC transmission systems.
 - c) Unit commitment problem for thermal power stations.
 - d) Surge protection devices.
 - e) Environmental issues of power generation.

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