



Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/B.Tech/EE(O)/SEM-5/EE-502/2012-13**

**2012**

**POWER SYSTEMS – I**

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 × 1 = 10

- i) Stringing chart is useful for
  - a) finding the sag in the conductor
  - b) in the design of tower
  - c) in the design of insulator string
  - d) finding the distance between the towers.
- ii) The use of a guard ring
  - a) equalizes the voltage division between the insulator disc
  - b) is unnecessary complication
  - c) decreases string-efficiency
  - d) none of these.
- iii) The presence of earth in case of overhead lines
  - a) increases the capacitance
  - b) increases the inductance
  - c) decreases the capacitance
  - d) decreases the inductance.



- iv) Effect of increase in temperature in overhead transmission lines
- increases the stress and length
  - decreases the stress and length
  - decreases the stress but increases the length
  - none of these.
- v) The leakage resistance of a 50 km long cable is  $1 \text{ M}\Omega$ . For a 100 km long cable it will be
- $1 \text{ M}\Omega$
  - $2 \text{ M}\Omega$
  - $0.66 \text{ M}\Omega$
  - none of these.
- vi) Corona loss is less when the shape of the conductor is
- circular
  - flat
  - oval
  - independent of shape.
- vii) The corona loss on a particular system at 50 Hz is  $1 \text{ kW / phase per km}$ . The corona loss on the same system with supply frequency 25 Hz will be
- $1 \text{ kW/phase/km}$
  - $0.5 \text{ kW/phase/km}$
  - $0.667 \text{ kW/phase/km}$
  - none of these.
- viii) Three insulating materials with same maximum working stress and permittivities 2.5, 3.0 and 4.0 are used in a single core cable. The location of the materials with respect to the core of the cable will be
- 2.5, 3.0, 4.0
  - 3.0, 2.5, 4.0
  - 4.0, 3.0, 2.5
  - 4.0, 2.5, 3.0
- ix) Ferranti effect on long overhead line is experienced when it is
- lightly loaded
  - on full load at unity p.f.
  - on full load at 0.8 p.f. lagging
  - all of these.



- x) Transmission lines are transposed to
- reduce copper loss
  - reduce skin effect
  - prevent interference with neighbouring telephone lines
  - prevent short-circuit between any two lines.
- xi) For given base voltage and base volt-amperes, the per unit impedance value of an element is  $x$ . What will be the per unit impedance value of this element when the voltage and volt-amperes are both doubled ?
- $0.5 x$
  - $2 x$
  - $4 x$
  - $x$ .

#### GROUP – B

##### ( Short Answer Type Questions )

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

- Discuss the advantages of high voltage transmission.
- Why ASCR ( Aluminium Conductors Steel Reinforced ) conductors are preferred over copper conductors for overhead lines ? Why are the conductors of transmission lines stranded ? Write down the factors affecting corona loss.
- Find out the most economical diameter of conductor of an underground cable.
- How is transmission lines classified ? Define regulation of a transmission line.

#### GROUP – C

##### ( Long Answer Type Questions )

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

- What is Corona ?
  - What are the advantages disadvantages of corona ?
  - A certain 3-phase equilateral transmission line has a total corona loss of 53 kW at 106 kV and a loss of 98 kW at 110.9 kV. What is the disruptive critical voltage between lines ? What will be the corona loss at 113 kV ?  $2 + 5 + 8$



7. a) What are the different causes of failure of overhead line insulators ?
- b) A transmission line conductor at a river crossing is supported from two towers at heights of 50 m and 80 m above water level. The horizontal distance between the towers is 300 m. If the tension in the conductor is 2000 kg, find the clearance between the conductor and water level at a point midway between the towers. Weight of the conductor/meter is 0.844 kg. 7 + 8
8. a) What is the disadvantage of uneven distribution of potential across a string of suspension type insulator ?
- b) What are the advantages of suspension type insulator over pin type insulator ?
- c) The self capacitance of each unit in a string of three suspension insulators is  $C$ . The shunting capacitance of the connecting metal work of each insulator to earth is  $0.15 C$  while for line it is  $0.1 C$ . Calculate (i) the voltage across each insulator as a percentage of the line voltage to earth and (ii) string efficiency. 3 + 6 + 6
9. a) Find out the expressions of maximum and minimum dielectric stresses in a single core cable.
- b) What is the insulation resistance of a single core cable ? Prove that the insulation resistance is inversely proportional to the length of the cable.
- c) A single core cable for use on 11 kV, 50 Hz system has conductor area of  $0.645 \text{ cm}^2$  and the internal diameter of sheath is 2.18 cm. The permittivity of the dielectric used in the cable is 3.5. Find the minimum and maximum electrostatic stresses in the cable. Find the capacitance of the above cable per km length. Find the charging current. 4 + 4 + 7