Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH(EE)(N)/SEM-5/EE-502/2012-13

2012

POWER SYSTEMS - 1

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 from the following : $10 \times 1 = 10$

   i) Corona is accompanied by
      a) Violet visible discharge in darkness
      b) Hissing sound
      c) Vibration
      d) All of these.

   ii) Ferranti effect on long overhead lines is experienced when it is
      a) Lightly loaded
      b) On full load at upf
      c) On full load at 0.8 pf lead
      d) None of these.

iii) Shunt capacitance is suspension insulators can be decreased by increasing in distance of conductor from

a) Tower b) Ground

c) Either (a) or (b) d) none of these.

iv) The economic size of conductor is determined by

a) Kelvin's law b) Kirchhoff's law

c) Faraday's law d) none of these.

v) In a string of suspension insulator, maximum voltage appears across the unit

a) Nearest to the conductor

b) Nearest to the cross arm

c) In between two units

d) None of these.

vi) A string of insulator has 4 insulators. The voltage across the bottom most unit is 30% of total voltage. The string efficiency of insulator is

a) 30% b) 60%

c) 75% d) 83.33%.

vii) ACSR conductor stands for

a) All Conductor Steel Reinforced

b) Aluminum Conductor Steeel Reinforced

c) Aluminum Copper steel Reinforced

d) All Copper Steel Reinforced Condctor.

viii) Vertical sag is

a) S tant θ b) S cos θ

c) S sin θ d) none of these.

ix) The surge impedance of 400 km long transmission line is 50 ohms.

The surge impedance of 100 km of that line is

a) 20 Ω b) 12.5 Ω

c) 50 Ω d) 100 Ω.

x) The transmission efficiency of a line is
   a) directly proportional to the load power factor
   b) inversely proportional to the load power factor
   c) does not depend on load power factor
   d) proportional to the square of load power factor.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Define String efficiency. State how with the help of guard rings string efficiency can be improved ?
3. A 3-phase, 220 KV, 50 HZ transmission line consists of 1.5 cm radius conductors spaced 2 m apart in equilateral triangular formation. If the temperature is 40° C and atmospheric pressure is 76 cm. Calculate the corona loss per km of th line. Take irregularity factor is 0.85.
4. Derive the expression of critical disruptive voltage of corona.
5. Define Skin effect. Why it is not happended in case of DC ?
6. Prove that g_{max} / g_{min} in a single core cable is equal to D/d.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. A 3-phase, 50 Hz overhead transmission line has the following distributed parameters :
   Resistance = 28 ohms;
   Inductive reactance = 63 ohms;
   Capacitive susceptance = 4×10^{-4} mho.
   If the load at the receiving end is 75 MVA at 0.8 pf lagging with 132 kV between lines, calculate (a) voltage (b) current (c) power factor at the sending end (d) regulation and (e) efficiency of transmission for this load.

8. a) What is corona ? What are its characteristic features ? What are the advantages and disadvantages of corona ? How to reduce corono effect ? 1 + 1 + 2 + 3

   b) 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 111 kV. What is the disruptive critical voltage between lines ? What is the corona loss at 113 kV ? 5 + 3

9. a) Explain Kelvin's law for determination of conductor size. 3

   b) A d.c. two wire distributor *AB*, 300 m long is fed from both ends and supplies a uniformly distributed load of 0.15 *A* per metre together with the flollowing concentrated loads : 50 *A* at *C*, 60 *A* at *D* and 40 *A* at *E*. The supply voltages at *A* and *B* are 206 volt and 200 volt respectively and the resistance of each conductor is 0.00015 Ω per metre. If *AC* = 75 metre, *CB* = 100 metre and *DE* = 50 metre, calculate the current supplied at each end. 12

10. a) What is sag ?

    b) What is string chart ? What is its utility ?

    c) A transmission line conductor crossing a river is supported from towers at heights of 30 m and 80 m above the water level. The horizontal distance between the towers is 450 m. If the tension in the conductor is 1500 kg and weight of the conductor is 1.4 Kg/m length, find the minumum clearance of the conductor and water and clearance mid-way between the supports. 2 + 4 + 9

11. a) Describe Suspension thype insulator.

    b) What is string efficiency ?

    c) In a 33 kV overhead line, there are four units in the string insulator. If the capacitance between each insulator pin and earth is 11% of self capacitance of each insulator. Find

       i) The distribution of voltage over 3 insulator

       ii) String efficiency. 5 + 3 + 7