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06EE53

Fifth Semester B.E. Degree Examination, Dec.09/Jan.10
Transmission and Distribution

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. For the same power transmitted over the same distance, show that increase in transmission voltage of a transmission line results in
   i) increased efficiency
   ii) decreased line loss
   iii) reduced weight of conductor material. **(10 Marks)**

   b. Explain how the wind and ice affects the sag of an overhead transmission line. Derive the formula to include their effects. **(10 Marks)**

2 a. Prove that a transmission line mounted between supports at equal heights takes the form of a catenary. **(10 Marks)**

   b. Two towers of height 30m and 90m respectively support a transmission line conductor at a water crossing. The horizontal distance between the towers is 500m. If the tension in the conductor is 1600 kg, find the minimum clearance of the conductor from water and also clearance midway between the supports. Weight of conductor is 1.5 kg/m. Bases of the towers can be considered to be at water level. **(10 Marks)**

3 a. Considering a suspension insulator string of 4 units, obtain expressions for the voltages across various units in terms of V_1, the voltage across the top most unit and m the ratio between ground capacitance and mutual capacitance. **(10 Marks)**

   b. In a transmission line , each conductor is at 20 kV and is supported by a string of 3 suspension insulators. The air capacitance between each cap-pin junction and tower is one fifth of the capacitance of each insulator unit. A guard ring, effective only over the line-end insulator unit is fitted, so that the voltages on 2 units nearest the line end are equal. Calculate
   i) the voltage on the line end unit.
   ii) the voltage of capacitance required between the line and the pin. **(10 Marks)**

4 a. Draw and explain the general construction of an underground cable. **(07 Marks)**

   b. What is meant by grading of cable? With a neat sketch, explain intersheaths grading of a cable. **(07 Marks)**

   c. Explain the phenomenon of corona on transmission lines and discuss the factors used to control corona. **(06 Marks)**

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – B

5 a. Derive an expression for inductance of a 3-phase line, with unsymmetrical spacing but transposed. **(08 Marks)**

b. Derive an expression for capacitance of a 3-phase line with equilateral spacing. **(08 Marks)**

c. A two conductor single phase line operates at 50 Hz. The diameter of each conductor is 20mm and the spacing between the conductor is 3 m. Calculate

i) the inductance of each conductor per km.

ii) the loop inductance of the line per km.

iii) the inductive reactance per km. **(04 Marks)**

6 a. Derive expressions for sending end voltage and current and hence ABCD constants for medium transmission line, using nominal Π method. **(10 Marks)**

b. A 3 phase, 50 Hz, 150 km line has a resistance, inductive reactance and capacitive shunt admittance of 0.1 ohm, 0.5 ohm and 3×10^{-6} mho respectively, per phase per km. If the line delivers 50 MW at 110 kV and 0.8 Pf lag, determine the sending end voltage, current and power factor. Assume nominal Π circuit for the line. **(10 Marks)**

7 a. Prove that the shape of voltage drop diagram for a distributor, with uniform loading of *i* A/m fed at one end, is a parabola. **(05 Marks)**

b. A distributor is fed at both the ends at the same voltage of 250 V. The total length of the feeder is 200m and the loads are tapped off as follows:
50 A at 50m from A ; 40 A at 75m from A ; 30 A at 100m from A ; 25 A at 150m from A. Calculate
i) the point of minimum potential ii) the current in each section iii) the voltage at each load point.
The resistance per 1000m of the conductor for go and return is 0.8 ohm. **(08 Marks)**

c. A two wire distributor 1200m long is loaded as shown in Fig.7(c), B is the midpoint. The power factors at the two load points refer to the voltage at C. The impedance of each line is (0.15 + j0.2) ohm. Calculate the sending end voltage current and power factor. The voltage at point C is 220 V. **(07 Marks)**

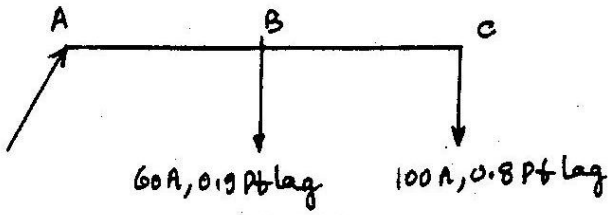

Fig.7(c)

8 Write short notes on :

a. Feeders, distributors and service mains

b. Classification of transmission lines

c. Insulator materials for overhead line insulator

d. Radial and ring main distribution. **(20 Marks)**

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