U.S.N | | | | | | | | | | |

P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Fifth Semester, B.E. - Electrical and Electronics Engineering
Semester End Examination; Dec - 2016/Jan - 2017
Power Transmission and Distribution

Time: 3 hrs *Max. Marks: 100*

***Note**: i) Answer **FIVE** full questions selecting **ONE** full question from each unit.*
ii) Assume missing data suitably, if any.

UNIT - I

1 a. Draw the line diagram of a typical transmission and distribution scheme indicating standard voltages. 6

b. Derive an expression for sag in an overhead line conductor supported by the towers situated at different level. 8

c. The two towers of height 95 m and 70 m respectively support the line conductor at a river crossing. The horizontal distance between the towers is 400 m. If the tension in the conductors is 1100 kg and its weight is 0.8 kg/m calculate,
i) Sag at lower support 6
ii) Sag at upper support
iii) Clearance of lowest point of trajectory from water level.
Assume bases of towers to be at the water level.

2 a. For the same power transmitted over the same distance, show that increase in transmission voltage of a line results in, 8
i) Increased efficiency ii) Decreased line losses iii) Reduced weight of conductor material.

b. A 132 kV transmission line has ACSR conductors whose data are,
nominal copper area 110 mm^2; size (30 + 7/2.79) mm; weight 844 kg/km; ultimate strength 7950 kg. The line is subjected to a horizontal wind pressure of 40 kg/m^2 of projected area and 1.25 cm radial ice coating. If the maximum permissible sag is 6 m, calculate the permissible span between the two towers, allowing for a factor of safety of 2, weight of ice in 915 kg/m^3. 8

c. Write a note on stringing charts. 4

UNIT - II

3 a. Mention different types of overhead line Insulators. Explain any one with neat diagram. 6

b. An insulator for 66 kV is provided with 5 discs. The capacitance between the each joint and tower is $\left(\frac{1}{6}\right)^{th}$ of the self capacitance of each disc. Find the voltage across each disc and also the string efficiency. 7

c. Derive an expression for a capacitance of a single core cable. 7

4 a. Define string efficiency. Explain any one methods of improving string efficiency. 7

b. A single core cable has a conductor of diameter 2.5 cm and a sheeth of inside diameter 6 cm. Calculate the maximum stress. If it is desired to reduce the maximum stress by using two inter sheeth, determine their best position, the maximum stress and voltage on each, if the system voltage is 66 kV, 3-phase. 7

c. Find the most economical diameter of a single core cable to be used on 66 kV, 3-phase system, if the peak permissible stress is not to exceed 50 kV/cm. Also find the overall diameter. 6

UNIT - III

5 a. Calculate the inductances of a conductor due to internal flux and external flux. 10

b. Find the inductance per phase per km of a double circuit line 3-phase shown in Fig. – 5b. The line is completely transposed and operates at a frequency of 50 Hz. 10

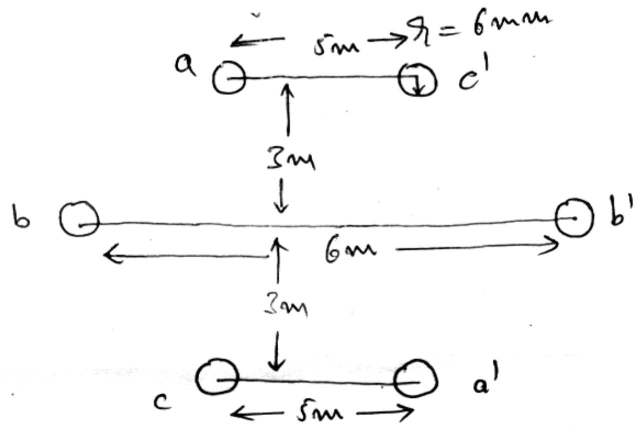

Fig – 5b.

6 a. Obtain an expression for capacitance of a 3-phase symmetrically spaced transmission line. 10

b. Three conductors of a 3-phase overhead line are arranged in Horizontal plane 6 m apart. The diameter of each conductor is 1.24 cm. Find the capacitance per 100 km of the line in μ F. 6

c. Explain the factors influencing the skin effect. 4

UNIT - IV

7 a. Derive expressions for sending end voltage and current and hence ABCD constants for a medium transmission line using nominal π method. Draw the vector diagram. 10

b. A 3-phase 50 Hz, 150 km line has a resistance, inductive reactance and capacitive shunt admittance of 0.1 Ω, 0.5 Ω and 3×10^{-6} ℧ 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 line. 10

8 a. Derive an expression for sending end voltage and current for long transmission line using rigorous solution. 10

Contd…3

b. A 3 phase 50 Hz transmission line, 100 km long, delivers 20 MW at 0.9 power factor lagging and at 110 kV. The resistance and reactance of the line per phase per km are 0.2 Ω and 0.4 Ω respectively, while the capacitive admittance is 2.5×10^{-6} ℧ per phase per km. Calculate, 10

i) Voltage and current at the sending and

ii) Efficiency of the transmission line use nominal T method.

UNIT - V

9 a. Explain the following terms with respect to corona and derive the expressions for them,

i) Disruptive critical voltage 10

ii) Visual critical voltage.

b. A three phase, 50 Hz, 132 kV transmission line consists of conductors of 1.17 cm diameter and are spaced equilaterally at a distance of 3 m. The surface irregularity factor (m) of the line is 0.96. The barometric pressure is 72 cm of Hg and temperature of 20ºC. Determine the fair and foul weather corona loss per km per phase. Assume that at foul weather the critical disruptive voltage drops down to 80% of the value during fair weather. 10

10 a. Write a short note on Feeders, Distributors and service Mains. 6

b. A distributor is fed at both ends at the same voltage of 250 V. The total length of the feeder is 200 m and the loads are tapped off as follows: 50 A at 50 m from A; 40 A at 75 m from A; 30 A at 100 m from A ; 25 A at 150 m from A.

Calculate; 8

i) The point of minimum potential

ii) The current in each section

iii) The voltage at each load point.

The resistance per 1000 m of the conductor for go and return is 0.8 Ω.

c. A two wire distributor is loaded as shown in the Fig. -10C. B is the midpoint. The power factors at the two load points refers to the voltage at C. The impedance of each line is (0.15 + j0.2) Ω. Calculate the sending end voltage, current and power factor. The voltage at point C is 220 V. 6

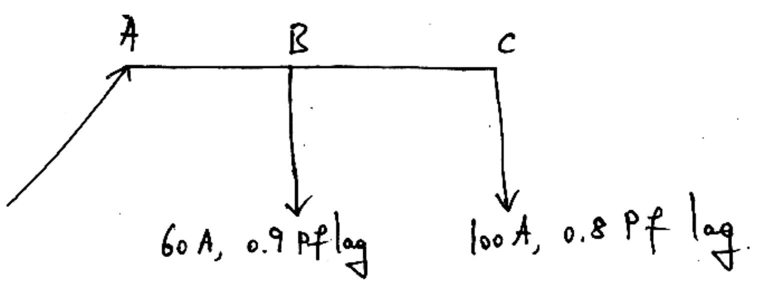

Fig - 10c.

* * *