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

***(An Autonomous Institution affiliated to VTU, Belagavi)***

**Fifth Semester, B.E. - Electrical and Electronics Engineering**

**Semester End Examination; Dec - 2017/Jan - 2018**

**Electrical Power Transmission and Distribution**

*Time: 3 hrs* *Max. Marks: 100*

***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

**UNIT - I**

| | | | |
|---|---|---|---|
| 1 a. | List out any five advantages and three disadvantages of high voltage transmission. | | 5 |
| b. | Derive an expression for sag when the supports of equal heights are placed on a level ground. | | 10 |
| c. | Deduce the relation between transmission efficiency and operating voltage of transmission. | | 5 |
| 2 a. | Draw the one line diagram of power system and specify the operating voltage of each section. | | 4 |
| b. | Two towers of height 40 m and 30 m support a transmission line conductor at water crossing. The horizontal distance between the towers is 300 m. If the tension in the conductor is 1500 kg. Find the clearance of the conductor at midway between the tower weights of the conductor is 0.8 kg/m. Bases of these towers are considered to be at water level. | | 8 |
| c. | In the case of a transmission line having the following data, calculate the factor of safety allowed for :<br>i) Span across level supports is 200 m<br>ii) Cross sectional area of a conductor is 1.2 $cm^2$<br>iii) Weight of the conductor is 1 kg/m<br>iv) Wind pressure is 82.5 $kg/m^2$<br>v) Breaking stress is 4220 $kg/cm^2$<br>vi) Vertical sag is 3.95m | | 8 |

**UNIT - II**

| | | | |
|---|---|---|---|
| 3 a. | Show that the potential distribution across the string of insulations is not uniform (Consider minimum of 4 insulators in the string) | | 6 |
| b. | Define string efficiency and explain any two methods for improving string efficiency. | | 8 |
| c. | What is grading of a cable and explain the method of capacitance grading. | | 6 |
| 4 a. | Briefly explain the tests to be carried on Insulators before they were installed. | | 8 |
| b. | A string of 6 suspension insulators is to be graded to obtain uniform distribution of voltages across the string. If pin to earth capacitanjce of each unit is equal to 'C' and the mutual capacitance of top insulator is "10 C" Find the mutual capacitance of other units in terms of 'C' | | 6 |

Contd…2

c. Determine the operating voltages of a single core cable of diameter 2 cm and having three insulating materials of permittivity 5, 4 and 3. The overall diameter of the cable is 5 cm and the maximum working stress is 40 kV/cm. Compare the operating voltage with the voltage if the cable were not graded and the material with same working stress was used. 6

**UNIT - III**

5 a. Derive an expression for induction of a 3 phase transmission line with conductors spaced at the corners of an equilateral triangle. 8

b. Find the inductance per phase per km of a transmission line of 3 phase double circuit as shown in figure 5(b) conductor diameter is 3 cm. 6

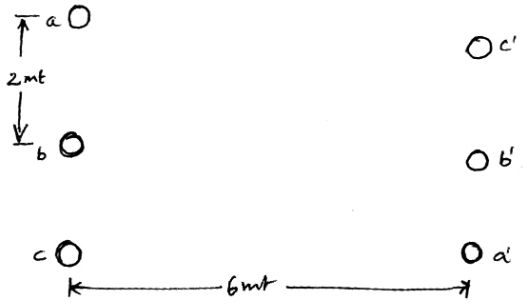


Figure 5(b)

c. The figure 5(c) shows the arrangement of conductors of a single phase supply. Find the inductance per km of the line. Diameter of conductor is 8 mm. 6

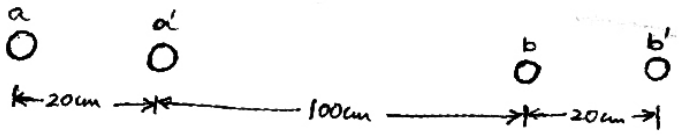


Figure 5(c)

6 a. Derive the expression for Induction of a composite conductor transmission line of single phase in terms of their GMD and GMR. 8

b. Find the capacitance of a single phase line 40 km long consisting of 2 parallel wires each of 5mm diameter and 1.5 m apart. Determine the capacitance of the line taking into account the effect of ground. The height of the conductor above the ground is 7 m. 6

c. A 3 phase 50 Hz, 66 kV overhead line conductors are placed in a horizontal plane separated by 2 m apart and conductor diameter is 1.25 cm. If the line length is 100 km. Calculate the capacitance per phase and charging current per phase. Assume transportation of the line. 6

**UNIT - IV**

7 a. Derive the ABCD constants of a short transmission line, draw its vector diagram, and develop the equations for % regulation. 8

b. A 3 phase transmission line has the following constants (line to neutral). Resistance = 10 Ω. Induction reactance of 20Ω, capacitance of $4x10^{-4}$ mho. Using nominal T – method, calculate sending end voltage, line current, pf. 6

Contd…3

c. Obtain the expression for ABCD constants of $\pi$ - model medium line. 6

8 a. Derive the expression for power flow in transmission line at receiving end and thereby deduce the relation between P and $\delta$. 8

b. Derive ABCD constants of a medium transmission line assuming nominal 'T' configuration and draw its vector diagram. 8

c. Explain Ferranti effect. 4

**UNIT - V**

9 a. Explain the theory of corona formation. 6

b. Find the corona characterisation of a 132 kV, 50 Hz 3 phase transmission line 175 km long consisting of 3 conductors of 1.2cm diameter stranded copper conductors, spaced in 3m delta configuration. Temperature = 26ºC and borometric pressure of 74 cm, surface irregularity factor of 0.85, for local corona 0.72 and for general corona is 0.82. 8

c. A 2 wire DC distribution system is 3 km long and it supplies a load of 200 A, 100 A, 75 A and 50 A at 800 m, 1200 m and 2000 m and 3000 m from feeding point 'A'. Each conductor has, load and returns resistance of 0.004 $\Omega$ per 100 m. Calculate the voltage at each load point, if voltage at feeding point is 250 V. 6

10 a. Derive the expression for critical disruptive voltage. 8

b. Find the disruptive critical voltage for a transmission line having conductor spacing of 1mt, conductor radius =1cm, barometric pressure of 76 cm of Hg temperature = 40ºC air breakdown potential gradient (at 76 cm of Hg and at 25ºC) is 21.2 kV/cm (rms) 7

c. Write a short note on DC ring main distributor. 5

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