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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. - 2014

Power Transmission and Distribution

Time: 3 hrs *Max. Marks: 100*

***Note**: i) Answer any **FIVE** full questions, selecting at least **TWO** full questions from each part.*
ii) Assume suitable missing data if any.

PART - A

1. a. Draw the line diagram of a typical power system and mention the operating voltages of each section. 4

   b. What are the advantages of High voltage transmission of Electrical power? 6

   c. Derive an expression for sag when the supports of equal height placed on a level ground. Take Hyperbola configuration. 10

2 a. A transmission line conductor at a river crossing is supported from two towers at a height of 50 m and 80 m above water level. The horizontal distance between the towers is 300 m. The weight of the conductor is 0.85 kg/m and the tension in the conductor is 2000 kg. Find the clearance between the conductor and water level at a midpoint of the span. 8

   b. In the case of a transmission line having the following data. Calculate the safety factor allowed for (i) span across the level support in 200 m.
   (ii) cross sectional area of the conductor is 1.2 cm^2 6
   (iii) Weight of the conductor = 1 kg/m (iv) Wind pressure is 82.5 kg/m^2
   (v) Breaking stress = 4220 kg/cm^2 (vi) Vertical sag is 3.95 mt.

   c. Explain the flash over tests to be carried on Insulators. 6

3 a. What are the different methods for improving efficiency and explain any two methods. 7

   b. A string of suspension insulators consists of 4 units. The capacitance between each link pin and earth is one tenth of the self capacitance of each unit. The voltage between the tine conductor and the earth is 100 kV. Find the voltage distribution across each unit and string efficiency. 7

   c. Find the disruption critical voltage for a transmission line having conductor spacing of 1 m, conductor radius 1 cm. Barometric pressure 76 cm of Hg, Temperature 40ºC. Air breakdown potential gradient (at 76 cm of Hg and at 25ºC) is 21.2 kV (rms)/cm. Surface factor is 0.85. 6

4 a Derive an expression capacitance of a single core cable. 7

   b. Explain the term grading of cables and what are the practical problems in grading the cables. 5

Contd... 2

c. A single core cable 1km long has conductor diameter 2 of 1 cm and a diameter under the sheath 2.5 cm. The relative permittivity is 3.5, power factor on open circuit is 0.03. Calculate ; 8

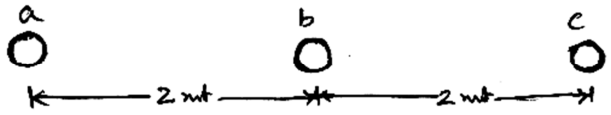
(i) Capacitance of the cable (ii) its insulation resistance

(iii) charging current (iv) The dielectric loss when the cable is connected to 6600 V at 50 Hz bus bars.

PART - B

5 a. Derive the expression for inductance of a 3 phase transmission line with unsymmetrical spacing. 10

b. A 3 phase, 50 Hz, 66 kV overhead line conductors are placed in a horizontal plane as shown in figure. The conductor diameter is 1.25 cm, if the line length is 100 km, calculate the capacitance per phase and charging current per phase. Assume complete transportation of the line. 6



c. Explain Ferranti effect. 4

6 a. Derive the ABCD constants of a medium transmission line assuming nominal Π configuration and draw the vector diagram. 10

b. A 3 phase transmission line is 400 km long. The voltage at the receiving end is 220 kV. The parameters of the line are R = 0.12 Ω/km, Reactance X_L= 0.5 Ω/km and admittance $Y = 3.4\times10^{-6}\underline{|90^{o}}\ /km$. Find the sending end voltage and current on no load. 10

7 a. Derive the relationship between the power at the receiving end and load angle (P_r V_s δ) 10

b. A 3 phase transmission line has the following constants (line to neutral) Resistance = 10 Ω, inductive reactance = 20 Ω, Capacitive susceptance = $4x10^{-4}$. Using nominal T method, calculate sending end voltage, line current, power factor and efficiency of transmission when supplying a balanced load of 10 MW at 66 kV at 0.8 pf lagging. 10

8 a. What are the different type of DC distribution explain any two types. 10

b. A single phase two wire feeder of 1200 m long supplies a load of 50 A at 0.8 pf lag, 40 A at 0.6 pf lag and 60 A at 0.707 pf lag at a distance of 500 m, 1000 m and 1200 m respectively from the feeding point. The resistance and reactance of the feeder per 100 m length are 0.01 Ω and 0.05 Ω respectively. If the voltage at the farend of the feeder is maintained at 220 V then calculate the voltages. 10

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