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. - 2015

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 suitable missing data if any.

UNIT - I

1 a. Obtain the conditions for the choice of working voltage for transmission. 6

b. Calculate the horizontal component of the tension and maximum sag for a span of 300 m if the maximum tension in the conductor be 3500 kg and weight of conductor is 700 kg/km. Determine also the location of the points on the conductor at which the sag will be half of the above value. 8

c. Explain the applications of the stringing chart (Kelvin's law). 6

2 a. Deduce the expression for sag in over head conductors at different levels. 10

b. An over head line with stranded copper conductors is supported on two poles 200 m apart having a difference in level of 10 m. The conductor diameter is 2 cm and weighs 2.3 kg/m length calculate the sag at the lower support under the conditions if wind provides a pressure 57.5 kg /m^2 of the projected area and factor of safety is 4. The maximum tensile strength of copper is 4,220 kg/cm^2. 10

UNIT - II

3 a. Derive the expression for the potential distribution over the suspended insulator of four units and obtain the expression for string efficiency. 8

b. In a string of three identical suspension insulator units supporting a transmission line conductor, if the self capacitance of each unit is denoted as C farads, the capacitance of each connector pin to ground can be taken as 0.1 C farads. Determine the voltage distribution across the string if the maximum permissible voltage / unit is given by 20 kV. Determine string efficiency. 8

c. Explain intersheath grading methods adopted in the underground cable to achieve the uniformity in the dielectric stress. 4

4 a. Derive the condition for most economical diameter of conductor from the basic principle. 8

b. A single core cable for use on 11 kV, 50 Hz system has conductor area of 0.645 cm^2 and the internal diameter of sheath is 2.18 cm. The permittivity of the dielectric used in the cable is 3.5. Find the maximum and minimum electrostatic stress in the cable. Find also the capacitance of the above cable / km length. Find the charging current. 8

Contd…2

c. What are the points to be considered during the failure of insulators? 4

UNIT - III

5 a. Derive the expression for inductance of a single phase two – wire line from the basics. 10

b. Calculate GMR of a $\frac{6}{3}$ mm A1, $\frac{1}{3}$ mm steel ACSR conductor. 6

c. What is Proximity effect? 4

6 a. Derive the conditions of effect of Earth on the capacitance of single phase over head line. 10

b. Calculate the capacitance of a 100 km long 3 – phase, 50 Hz overhead transmission line consisting of 3- conductors, each of diameter 2 cm and spaced 2.5 m at the corner of equilateral triangle. 5

c. A 3- phase 33 kV overhead sub – transmission line, 30 km long, has its conductor ACSR 15 mm diameter spaced at the corner of an equilateral triangle of 1.5 m side. Find the inductance per phase of the system. 5

UNIT - IV

7 a. What are ABCD constants of a transmission line? Determine the same for a medium transmission line using nominal π - method. Hence prove AD – BC = 1 10

b. A 50 Hz, 3- phase transmission line 30 km has a total series impedance of (40 + j 125) Ω and shunt admittance of 10^{-3} mho. The load is 50 MW at 220 kV with 0.8 lagging power factor. Find the sending end voltage, current and power factor (use nominale - π representation) 10

8 a. Find the following for a single circuit transmission line delivering a load of 50 MVA at 110 kV and p.f 0.8 lag,

i) Sending end voltage ii) Sending end current

iii) Sending end power iv) Efficiency of transmission. 10

$Given: A = D = 0.98\angle 3^{\circ}, B = 110\angle 75^{\circ}\ \Omega, C = 0.0005\angle 80^{\circ}$

b. Derive the ABCD expression of a medium transmission line assuming nominal T configurations. Draw the vector diagram. 10

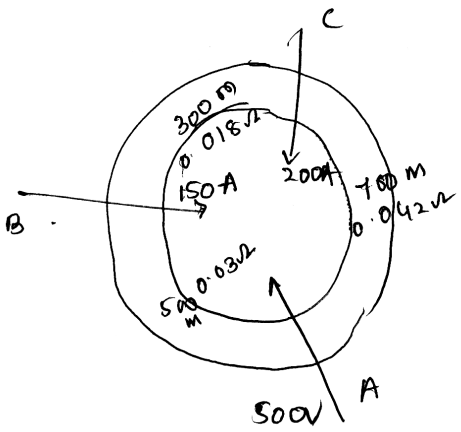
UNIT - V

9 a. What is Corona? Derive the expression for the disruptive critical voltage and visual critical voltage. 8

b. Write short notes on feeder, distributor and service mains. 6

c. In a dc ring main shown a voltage of 500 V is maintained at A. At B a load of 150 A is taken and at C a load of 200 A is taken. Find the voltages at B and C. The resistance of each conductor of the main is 0.03 Ω/1000 m. 6

Contd…3



10 a. What are the factors affecting the corona losses? Explain them briefly. 6

b. A 3 – phase, 220 kV, 50 Hz transmission line consists of 1.2 cm radius conductors spaced 2 m at the corners of an equilateral triangle. Calculate the disruptive critical voltage between the lines, irregularity factor = 0.96, temperature 20ºC, Barometric pressure 72.2 cm of mercury. Dielectric strength of air = 21.1 kV (rms/cm). 6

c. A 800mt distributor fed from both ends A & B is loaded uniformly at the rate of 1.2 A/m run, the resistance of each conductor being 0.05 Ω/km. Determine the minimum voltage and the point where it occurs if feeding points A and B are maintained at 255 V and 250 respectively. Find also the current supplied from feeding points A and B. 8

* * * *