5E3127

Roll No. _____ [Total No. of Pages : 4

5E3127

B.Tech. Vth Semester (Main/Back) Examination, Dec.2010/Jan.2011
Electrical Engineering
5EE5 Transmission & Distribution of Electrical Power
(Common with EX)

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 24

Instructions to Candidates:

*Attempt any **five** questions. All questions carry **equal** marks.*

1. a) What is meant by the terms feeder, distribution and service mains. Why the distribution by a.c consider superior to that by d.c? **(8)**

   b) A 2-Conductor cable one km in length is required to supply a constant load of 200 A throughout the year. The cost of the cable is Rs. (100a+40) per meter where *a* is the area of the cross-section of the conductor in cm^2. The cost of energy is 10 P per K wh and interest and depreciation charges amount to 10%. Specific resistivity of copper is $1.85\ \mu\ \Omega - cm$. Find the cross-section area 'a'? **(8)**

OR

   a) A 3-phase 4 wire system is used for lighting. Compare the amount of copper required with that needed for a 2 wire direct current system with the same lamp voltage. Assume the same losses and balanced load. The neutral is one half the *x* - section of one of the respective outers. **(8)**

   b) Prove that the volume of conductor required in a transmission system is inversely proportional to the square of the voltage as well as power factor of the load. State the conditions under which this statement is true? **(8)**

2. a) Deduce an approximate expression for calculating Sag in overhead line with conductors suspended between level supports. Show also how the effects of wind and ice can be taken into account when making calculations for Sag? **(8)**

   b) A transmission line has a span of 150 m between level supports. The *x*-sectional area of the conductor is 1.25 cm^2 and weighs 100 kg per 100m. If the breaking stress is 4220 kg/cm^2. Calculate the factor of safety if the Sag of the line is 3.5m. Assume a maximum wind pressure of 100 kg per sq. metre. **(8)**

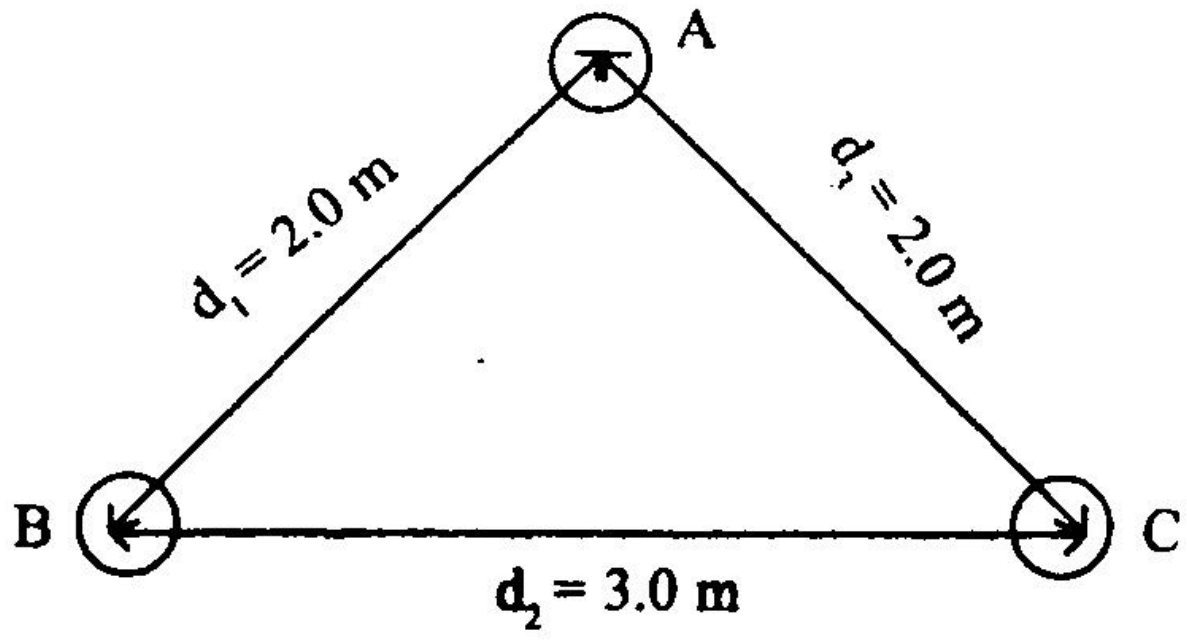
OR

a) Explain the necessity and the method of preparing "stringing charts" for overhead transmission lines. **(8)**

b) An over head transmission line at a river crossing is supported from two towers at heights of 25 m and 75 m above the water level. The horizontal distance between the towers is 250m. If the required clearance between the conductor and the water mid way between the towers is 45 metres and if both of the towers are on the same side of the point of maximum Sag of the parabolic configuration, find the stringing tension in the conductor. The weight of the conductor is 0.70 Kg/m. **(8)**

3. a) Prove that the inductance of a group of parallel wires carrying current can be represented in term of their geometric distances. Explain the meaning of the term 'Self g.m.d' and 'mutual g.m.d'. **(8)**

b) A single 3-phase line operated at 50 Hz is arranged as follows (fig - 1). The conductor diameter is 0.6 cm. Find the inductance and capacitance per km. The line is regularly transposed. **(8)**



OR

a) Show that when the effect of the earth is considered, the capacitance of a two-wire transmission line is given by $C_{ab} = \frac{\Pi K}{ln \frac{D}{r\sqrt{1+\frac{D^2}{4h^2}}}}$ F/m line to line

Where K = permittivity of the medium

D = Spacing between conductors

h = height of conductor above ground

r = radius of each conductor.

If the effect of earth is neglected, how would the capacitance be affected? **(8)**

b) An 11 KV three phase transmission line has a resistance of 1.5 Ω and reactance of 4 Ω per phase. Calculate the percentage regulation and efficiency of the line when total load of 5, 000 KVA at 0.8 lagging power factor is supplied at 11 KV at the distant end. **(8)**

4. a) Find the values of A, B, C, D in the following approximate methods in terms of Z and Y.

i) Nominal π - method

ii) Nominal T - method. **(8)**

b) Determine the corona characteristics of a 3 - phase line 160 m long. Conductor diameter 1.036 cm, 2.44 m delta spacing, air temperature 26.67° C, altitude 2440 m, corresponding to an approximate barometric pressure of 73.15 cm, operating voltage 110 KV at 50 Hz. **(8)**

OR

a) A 220 KV, 3 phase, 300 km long transmission line delivers a load of 100 MW at 0.85 p.f. lagging. The line has a total impedance of $Z = (40 + j\,125)\Omega$ and a total shunt admittance $Y = j\,0.001$ ℧. Find sending end voltage, current, power factor and efficiency of the line. Use nominal T representation for the line.**(8)**

b) Find the critical disruptive voltage and the critical voltages for local and general corona on a 3 - phase overhead transmission line, consisting of three stranded copper conductors spaced 2.5 m apart at the corners of an equilateral triangle. Air temperature and pressure are 21°C and 73.6 cm Hg respectively. The conductor dia, irregularity factor and surface factors are 10.4 mm, 0.85, 0.7 and 0.8 respectively. **(8)**

5. a) A string of eight suspension insulators is to be fitted with a grading ring. If the pin to earth capacitances are all equal to C, find the values of line to pin capacitances that would give a uniform voltage distribution over the string.**(8)**

b) A single core lead covered cable is to be designed for 66 KV to earth. Its conductor radius is 0.5 cm and its three insulating materials A, B and C have relative permittivities of 4, 2.5 and 4.0 with maximum permissible stresses of 50, 30 and 40 KV/cm respectively. Determine the minimum internal diameter of the lead sheath. Discuss the arrangement of the insulating materials. **(8)**

OR

a) A 3-phase transmission line is supported by a 3-unit suspension insulator string. The voltage across the line unit is 20 KV and that across the adjacent unit is 15 KV. Determine

i) Ratio of mutual to ground capacitance and

ii) System line voltage. Determine the string efficiency. **(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 stresses in the cable. **(8)**