Fifth Semester B.E. Degree Examination, June-July 2009
Transmission and Distribution

3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions choosing at least two questions from each part.***

Part A

a. Explain with the help of line diagram a typical transmission and distribution system scheme indicating the standard voltages. **(06 Marks)**

b. Discuss how the optimal value of transmission voltage for any particular use can be selected. **(04 Marks)**

c. Derive the expression for sag in overhead transmission line conductor with supports at same levels. State also the effects of wind and ice coating on the sag. **(10 Marks)**

a. The towers of heights 30 m and 90 m respectively support a transmission line conductor at a river crossing. The horizontal distance between the towers is 500 m. If the tension in the conductor is 1600 kg find the minimum clearance of the conductor and water and also clearance midway between the supports. Weight of conductor is 1.5 kg/m. Assume the conductor takes the shape of parabolic curve. **(08 Marks)**

b. What is corona? Derive expressions for the disruptive critical voltage and visual critical voltage. **(08 Marks)**

c. A 132 kV, 3-φ line with 1.956 cm dia conductors is built so that corona takes place if the line voltage exceeds 210 KVrms. If the value of potential gradient at which ionization occurs can be taken as 30 kV/cm, find the spacing between the conductors. **(04 Marks)**

a. List out the mechanical and electrical characteristics required for a good insulator use in high voltage transmission lines. **(04 Marks)**

b. Define string efficiency. How the string efficiency can be improved? Explain any two suitable methods. **(08 Marks)**

c. Each of the three insulators of a string has self capacitance 'C' Farad. Capacitance of connecting metal work to earth is 0.25 C and 0.1 C to line. Calculate the voltage across each insulator as a percentage of line voltage to earth. Also find string efficiency. **(08 Marks)**

a. State the advantages of using Under Ground (UG) cables for power distribution. **(04 Marks)**

b. A single core cable 1 km long has a core dia of 0.5 cm and under sheath dia of 2 cm. The relative permitivity of insulating material is 3.5. The power factor on open circuit is 0.5 and the supply voltage is 11 kV, 50 Hz. Determine

i) Capacitance of cable.
ii) Charging current (I_C).
iii) Dielectric loss/ph.
iv) Equivalent insulation resistance. Given, $\rho = 4.5 \times 10^{14}\ \Omega.cm$. **(08 Marks)**

c. Prove that the inductance of a 1-φ, 2-wire line with composite conductors can be calculated and hence explain / define the terms self and mutual GMDs. **(08 Marks)**

Part B

a. Obtain the expression for capacitance of a 3-φ line with unsymmetrical spacing. Assume the lines are transposed. **(08 Marks)**

5 b. Three conductors of a 3 φ line are arranged in horizontal plane, 6 m apart. The dia of each conductor is 1.24 cm. Find the capacitance of 100 km long line in μF. **(04 Marks)**

c. Find the inductance/ph/km of a double circuit 3-φ line shown in figure Q5 (c). The conductors are transposed and are of radius 0.75 cm each. The phase sequence is abc. **(08 Marks)**

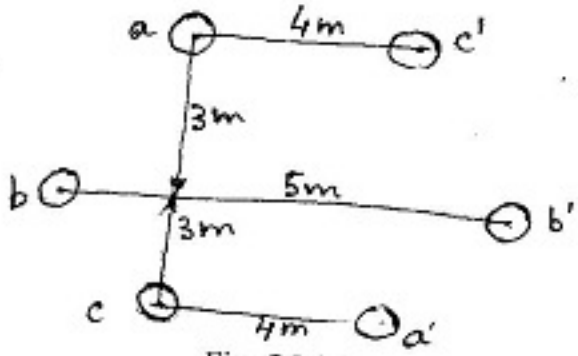

Fig. Q5 (c)

6 a. Explain how the transmission lines are classified based on voltage and their length. **(04 Marks)**

b. Derive the expressions for generalized A, B, C, D constants of a long transmission line by rigorous method of analysis. **(08 Marks)**

c. A 220 kV, 3-φ overhead transmission line has an impedance/ph of (20+5100) Ω and admittance of J0.001 ℧. Using nominal π-model, determine the sending end voltage and current when the current at the receiving end is 300 A at 0.9 pf lag. **(08 Marks)**

7 a. What are the necessary requirements of a good distribution system, explain. **(04 Marks)**

b. A dc 2-w distributor AB is 450 m long and is fed from both ends at 250 V is loaded as shown in figure Q7 (b). The resistance of each conductor is 0.05 Ω/km. Find the point of minimum potential and its potential. **(08 Marks)**

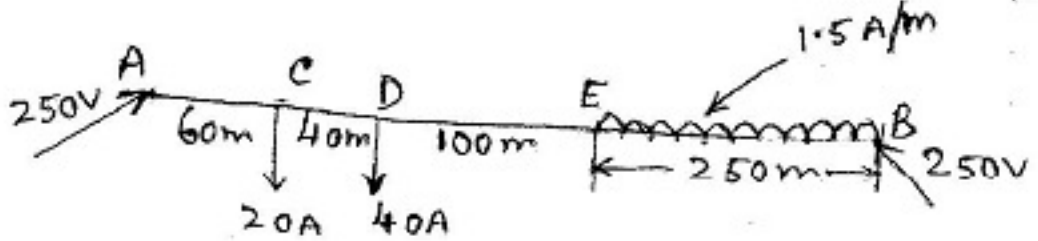

Fig. Q7 (b)

c. A 1-φ distributor has loop resistance of 0.3 Ω and a reactance of 0.4 Ω. The far end of the distributor has a load current of 80 A and 0.8 pf lag with reference to 220 V. The mid point of the distributor has a load current of 50 A at 0.707 pf lag with reference to voltage at mid point. Calculate the sending end voltage and pf. **(08 Marks)**

8 Write short notes on the following:

a. Feeders, distributors and service mains.

b. Stringing chart and its application.

c. Skin effect and proximity effect.

d. Advantages and disadvantages of corona.