

Transmission & Distribution of Electrical Power

Time : 3 Hours

Min. Passing Marks : 24

Maximum Marks : 80

Instruction to Candidates :

Attempt any five questions, selecting one question from each unit. All questions carry equal marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.)

Unit-I

1. (a) Explain the radial and ring main distribution system. [8]
 (b) A 3 phase ring distributor ABCD fed at A 11kV supplies balanced loads of 40A at 0.8pf lagging at B 50A, .707pf lagging at C and 30 A at 0.8pf lagging at D, the total load currents being referred to the supply voltage at A. The impedances per phase of the various sections are Section AB = $(1 - j2) \Omega$, section BC = $(2 + j3) \Omega$, section CD = $(1 + j1) \Omega$, section DA = $3 + j4) \Omega$. Calculate the currents in various sections and station bus bar voltages at B, C and D. [8]

OR

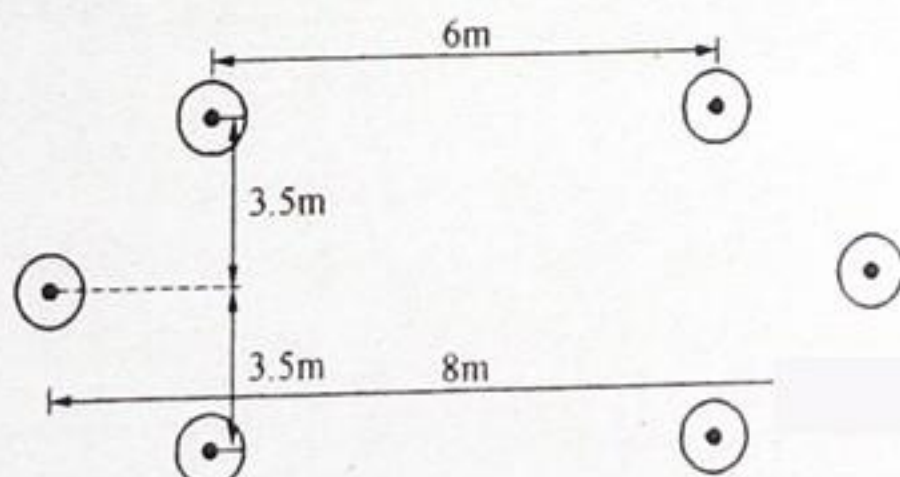
1. (a) Draw and explain the structure of electrical power system indicating the voltage level in each transmission levels. [8]
 (b) A two wire distribution system AB 600m long is fed at both ends at 220V. Loads of 20A, 40A, 50A and 30A are tapped at distances of 100m, 250m, 400 m and 500m from the end A respectively. If the area of cross - section of distributor conductor is 1 cm^2 . Find the minimum consumer voltage. Take $\rho = 1.78 \times 10^{-8} \Omega\text{m}$. [8]

Unit-II

2. (a) An overhead line has a span of 160m of stranded copper conductor between level supports. The sag is 3.96 meter at -5.50 C with 9.53 mm thick in ice coating and wind pressure of 40 Kgfm^2 of projected area. Calculate the temperature at which the sag will remain the same under conditions of no ice and no wind. The particulars of the conductor are as follows : [10]
 Size of conductor 7/3.45 mm. Area of cross section 64.5 mm^2
 weight of conductor 0.594 kgf/m . Modulus of elasticity 12700 Kgf/mm^2 . Coefficient of linear expansion $1.7 \times 10^{-5} / \text{C}$. Assume 1 ms of ice to weight 913.5 Kgf.
 (b) Derive an expression for sag of a line supported between two supports of same height. [6]

OR

2. (a) What is meant by disruptive critical voltage and visual critical voltage? State the effects of conductor size, spacing and condition of the surface of conductors on these voltages. [8]
 (b) Calculate the capacitance per phase of a three - phase double circuit line as shown in below Figure. The diameter of the conductor is 2.2cm. Assume that the line is completely transposed. [8]



Unit-III

3. (a) Explain about skin and proximity effects. [6]
 (b) Deduce an expression for capacitance of three phase transmission line with unsymmetrical spacing (Transposed conductors). [10]

OR

3. (a) Starting from first principles derive an expression for the sending end voltage and current of a long transmission line in terms of the line parameters and receiving end voltage and current. [10]
 (b) Derive the capacitance of a three - phase overhead line. [6]

Unit-IV

4. (a) A 50Hz three phase transmission line is 250km long. It has a total series impedance of $(20 + j60)$ ohms and a shunt admittance of 914×10^{-6} mhos. It delivers 50MW, 220kV with 0.85 power factor lagging. Find the [8]
 (i) Sending end voltage,
 (ii) Voltage regulation and
 (iii) Transmission efficiency by nominal-T method
 (b) Explain the various factors affecting the corona loss. [8]

OR

4. (a) Derive the expression for the voltage induced in communication lines due to the current in power lines. [8]
 (b) Estimate the corona loss for a three - phase, 110 Kv, 50 Hz, 150 Km - long transmission line consisting of three conductors each of 10mm diameter and spaced 2.5 m apart in a equilateral triangle formation. The temperature of air is 30°C and the atmospheric pressure is 750 mm of mercury. Assume the irregularity factor as 0.85. Ionization of air may be assumed to take place at a maximum voltage gradient of 30 Kv/cm . [8]

Unit-V

5. (a) Draw with neat sketches and explanation of pin and suspension type insulators. Compare their merits and demerits. [8]
 (b) Explain any two methods of grading of cables with necessary diagrams. [8]

OR

5. (a) A 3 phase overhead transmission line is being supported by three disc insulators. The potentials across top unit and middle unit are 9kV and 11kV respectively. Calculate : [8]
 (i) The ration of capacitance between pin and earth to the self - capacitance of each unit.
 (ii) The line voltage
 (iii) String Efficiency
 Diagrams explain constructional features of various types of cables. [8]