CBCS SCHEME

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18EE43

Fourth Semester B.E. Degree Examination, Dec.2024/Jan.2025
Transmission and Distribution

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Prove that the volume of conductor required in a transmission system is inversely proportional to the square of voltage as well as power factor of the load. **(06 Marks)**

b. Mention the advantages and features of ACSR and AAAC. **(06 Marks)**

c. A transmission line conductors with diameter 19.5mm, weights 0.85 kg/mt, span is 275mt. The wind pressure is 39 kg/mt^2 of projected area with ice coating of 13 mm. The ultimate strength of conductor is 8000 kgs. Calculate the maximum sag, if the factor of safety is 2 and ice weight is 910 kg/mt^3. **(08 Marks)**

OR

2 a. With a neat diagram, explain feeders, distributor and service main of a distribution system. **(06 Marks)**

b. Derive the expression for the sag when the supports are at equal levels. **(07 Marks)**

c. A 33KV line is supported on a string of three similar insulators, the mutual capacitance of which across the units 9 times the shunt capacitance between the unit and earthed frame work. Compute the voltage across each insulator and string efficiency. **(07 Marks)**

Module-2

3 a. Derive an expression for the inductance fo a conductor due to internal and external flux. **(10 Marks)**

b. Find the inductance per phase per kilometer for the double circuit line whose conductors are at the corners of a regular hexagon of side 3 mts. Radius of the conductors 2.0 cm. **(10 Marks)**

OR

4 a. Develop an expression for the capacitance of a three phase line with unsymmetrical spaced line with transposed conductors. **(10 Marks)**

b. A 3-phase overhead transmission line has 100 kms length. The diameter is 0.75 cm. The conductors have been arranged in a horizontal plane with 4 mt distance between conductors. Calculate the line constants if the line is transposed. Assume $\rho = 1.73 \times 10^{-8}\ \Omega$ cm. **(10 Marks)**

Module-3

5 a. Mention the classification of transmission line based on the length and the operating voltages. **(04 Marks)**

b. Derive an expression for voltage regulation and efficiency of a short transmission line. Draw the vector diagram. **(08 Marks)**

c. A 3-phase, 50 Hz transmission line has resistance, inductance and capacitance per phase of 9.5 Ω, 0.1 H and 0.8 μF and delivers a load of 35 MW at 132 KV and 0.8 power factor lag. Determine the sending end voltage and current of the line using nominal – T method. **(08 Marks)**

OR

6 a. Derive an expression for sending end voltage and current for long transmission line using rigorous method. **(10 Marks)**

b. The ABCD constants of a three-phase transmission line are A = D = (0.936 + j0.016), B = (33.5 + j138)Ω and C = (–0.9280 + j901.223) × 10^{-6} mho. The load at the receiving and is 40 MW at 200 KV with power factor of 0.86 lagging. Find the magnitude of the sending end voltage, current, power and voltage regulation. Assume that the magnitude of the sending end voltage remains constant. **(10 Marks)**

Module-4

7 a. Explain the phenomenon of corona. What are the factors affecting corona? **(06 Marks)**

b. Sketch and label a cross-section of an insulated cable and explain the significance of the various layers. **(06 Marks)**

c. A single core lead sheathed cable is graded by using two dielectrics of relative permittivity 3.6(inner) and 2.5 (outer) the thickness of each being 1 cm. The core diameter is 1 cm, system voltage is 66 KV, 3-phase. Determine the maximum stress in the two dielectrics. **(08 Marks)**

OR

8 a. Derive an expression for critical disruptive voltage and visual critical voltage with reference to corona. **(06 Marks)**

b. Derive an expression for the insulation resistance of a single core cable. **(06 Marks)**

c. A 33 KV, 3-phase, 50 Hz UG cable line, 3.4 km long, uses three single – core cables. Each cable has a core diameter of 2.5 cm and the radial thickness of insulation is 0.5 cm. The relative permittivity of the dielectric is 3. Find maximum stress and total charging KVAR. **(08 Marks)**

Module-5

9 a. With distribution layout, explain 3-phase, 4-wire system of distribution of electrical power. **(06 Marks)**

b. Define failure rate. Mention different types of failure and explain. **(06 Marks)**

c. A 2-wire feeder ABC has a load of 120A at C and of 60A at B both at power factor 0.8 lag. The impedance AB is (0.04 + j0.08)Ω and that of BC is (0.08 + j0.12)Ω. If the voltage at the far end C is to be maintained at 400V, determine the voltage : i) at A ii) at B. **(08 Marks)**

OR

10 a. Explain the limitations of distribution system. **(08 Marks)**

b. A 3-phase ring distribution ABCD fed at A at 11 KV supplies balanced loads of 40 A at 0.8 p.f. lagging at B, 50 A at 0.707 p.f. lagging at C and 30 A at 0.8 p.f. lagging at D. The load currents are referenced to the supply voltage at A. The impedances of the various sections per phase are : Section AB = (1 + j2)Ω, Section BC = (2 + j3)Ω, Section CD = (2 + j1)Ω, Section DA = (3 + j4)Ω. Calculate the current in various sections and bus bar voltages at B, C and D. **(12 Marks)**

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