CBCS SCHEME

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18EE43

Fourth Semester B.E. Degree Examination, Jan./Feb. 2023
Transmission and Distribution

Time: 3 hrs. Max. Marks: 100

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Explain with the help of a neat line diagram, the typical transmission and distribution system indicating standard voltages. **(07 Marks)**

b. A transmission line conductor crossing a river supported from two towers at heights 30 m and 80 m above the water level. The horizontal distance between the towers is 450 m. If the tension in the conductors is 1500 kg and weight of the conductor is 1.4 kg/m length, find the clearance of the conductor and water and clearance midway between the supports. **(07 Marks)**

c. Discuss any two methods to improve the string efficiency with neat sketch. **(06 Marks)**

OR

2 a. Derive an expression for sag of a line with neat sketch when supports are at equal and also define a sag. **(07 Marks)**

b. Each line of a 3-phase system is suspended by a string of 3-similar insulators. If the voltage across the line unit is 17.5 KV. Calculate the line to neutral voltage. Assume that the shunt capacitance between each insulator and earthed metal work of tower to be $\frac{1}{10}^{th}$ of the capacitance of the insulator itself. Also find the string efficiency. **(06 Marks)**

c. An overhead transmission line conductor having parabolic configuration weights 1.925 kg/m length. The area of cross-section of the conductor is 2.2 cm^2 and the ultimate strength is 8000 kg/cm^2. The supports are at 600 m apart having the 15 m difference of levels. Calculate sag from the taller of the two supports which must allowed so that the factor of safety is 5. Assume the ice loading of 1 kg/m run. **(07 Marks)**

Module-2

3 a. Derive an expression for the inductance of a single phase two wire line. **(06 Marks)**

b. A 3-phase, double circuit line is composed of 1.5 cm diameter. Conductors spaced vertically at a distance of 2m and spaced 6m apart as shown in Fig.Q3(b). Determine the inductance of the line per kilometer.

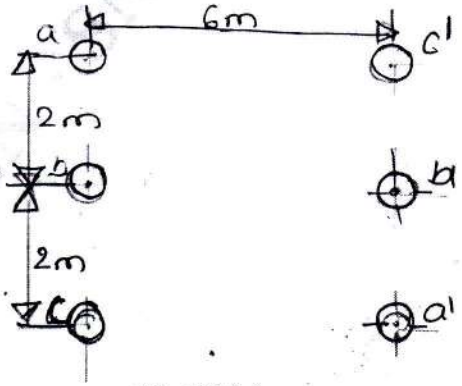

Fig.Q3(b) **(10 Marks)**

c. A single phase overhead line 32 km long consists of two parallel wires each 5 mm in diameter and 1.5 m apart. If the voltage is 50 KV at 50 Hz. Calculate the line capacitance/km and charging current with the line open circuited. **(04 Marks)**

OR

4 a. Derive an expression for the capacitance/phase of a 3-phase line with unsymmetrical spacing (single circuit) transposed. **(08 Marks)**

b. A 11 KV, 50 Hz, 3-ϕ overhead transmission line conductors are placed in a horizontal plane with spacing such that $D_{31} = 8$ m, $D_{12} = D_{23} = 4$ m. The diameter of each conductor is 2 cm. The length of line 200 km. Calculate capacitance/phase and charging current/phase. The line is completely transposed. **(06 Marks)**

c. Write a note on transposition of transmission lines. **(06 Marks)**

Module-3

5 a. Show how regulation and transmission efficiency are determined for medium transmission line using nominal T method with suitable vector diagram. **(07 Marks)**

b. A 100 km long, 3-ϕ, 50 Hz transmission line has following line constants:
Resistance/phase/km = 0.1 Ω
Reactance/phase/km = 0.5 Ω
Susceptance/phase/km = 10×10^{-6} S
If the line supplies load of 20 MW at 0.9 p.f. lagging at 66 KV at the receiving end, calculate by nominal π method,
(i) Sending end voltage, current and p.f.
(ii) Regulation
(iii) Transmission efficiency **(09 Marks)**

c. Write a note on Ferranti effect. **(04 Marks)**

OR

6 a. Develop the generalized circuit constants for :
(i) Short transmission line
(ii) Medium transmission line-nominal T method **(08 Marks)**

b. 3-ϕ, 50 Hz, 300 km long transmission line has following parameters:
Resistance = 0.15/km/phase, Reactance = 0.5 Ω/phase/km, Admittance = 3×10^{-6}/phase/km, by the nominal π model. Find ABCD constants of the line. **(06 Marks)**

c. A single phase transmission line supplies a load of 1 MW at 11 KV, 0.8 p.f. lagging. The resistance and reactance of the line are 5 Ω and 10 Ω respectively. Determine:
(i) Sending end voltage
(ii) Efficiency of transmission line
(iii) Percentage voltage regulation **(06 Marks)**

Module-4

7 a. Explain the phenomenon of corona in overhead transmission line. **(06 Marks)**

b. A 3-phase, 50 Hz, 110 KV line with 1 cm diameter conductors one constructed so that corona takes place if the line voltage exceeds 175 KV (rms). Determine the spacing between the conductors. Assume smooth conductors, air density factor is 1. If the value of potential gradient at which ionization occurs can be taken as 30 KV/cm. **(06 Marks)**

c. Define grading of cables. Explain capacitance grading. **(08 Marks)**

OR

8 a. Derive the expression for capacitance of a single core cable. **(08 Marks)**

b. A single core lead sheathed cable has a conductor diameter as 3 cm. The diameter of the cable being 9 cm. The cable is graded by using two dielectrics of relative permittivity 5 and 4 respectively, with corresponding safe working stresses of 30 KV/cm and 20 KV/cm. Calculate the radial thickness of each insulation and the safe working voltages of the cable. **(06 Marks)**

c. A 33 KV, 50 Hz, 3-ϕ underground cable 4 km long uses three single core cables. Each of the conductor has a diameter of 2.5 cm and the radial thickness of insulation is 0.5 cm. Determine:

(i) Capacitance of the cable/phase
(ii) Charging current
(iii) Total charging KVAR

The relative permittivity of insulation is 3. **(06 Marks)**

Module-5

9 a. Briefly explain radial and ring main system. **(08 Marks)**

b. What are the requirements of power distribution system? **(04 Marks)**

c. A single phase distributor AB is 500 m long and is fed at point A, and it is located as follows:

(i) 100 A at 0.8 p.f. lagging 200 m from A.
(ii) 150 A at 0.707 p.f. lagging at 500 m from A.

Total resistance and reactance of the distributor are 0.2 Ω and 0.1 Ω/km respectively. If the receiving end voltage is 400 V, find the sending end voltage and power factor. **(08 Marks)**

OR

10 a. Write a note on power quality. **(06 Marks)**

b. Define: (i) Reliability (ii) Availability (iii) Adequacy (iv) Security **(08 Marks)**

c. Write a note on limitation of distribution system. **(06 Marks)**

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