USN

Fifth Semester B.E./B.Tech. Degree Examination, June/July 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. Explain typical line diagram of transmission and distribution scheme indicating voltage level used at different stages. **(06 Marks)**
   b. Deduce an approximate expression for sag in overhead lines when support are at unequal level. **(06 Marks)**
   c. Each line of a phase system is suspended by a string of 3 similar insulator, 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 earth is $1/8^{th}$ of the capacitance of the insulator itself. Also find the string efficiency. **(08 Marks)**

OR

2 a. Enumerate the advantages of HVDC over HVAC transmission. **(06 Marks)**
   b. With suitable expression, explain the advantage of high transmission voltage. **(06 Marks)**
   c. The tower of height 30 m and 90 m respectively support a transmission line conductor at water crossing. The horizontal distance between the tower is 500 m if the tension in the conductor is 1600 kg. Find the minimum clearance of the conductor and water and clearance mid way between the support, weight of conductor is 1.5 kg/met, base of the tower can be considered to be at water level. **(08 Marks)**

Module-2

3 a. Derive an expression for inductance per phase of a 3 phase overhead transmission line when conductors are symmetrically placed. **(08 Marks)**
   b. Explain the concept of i) Self GMD ii) Mutual GMD. **(06 Marks)**
   c. A 3 phase 50 Hz, 66KV overhead line conductor are placed in a horizontal plane as shown in Fig.Q.3(c). The conductor diameter is 1.25 cm. If the line length is 100 km calculate i) Capacitance per phase ii) Charging current per phase assuming complete transposition of the line **(06 Marks)**
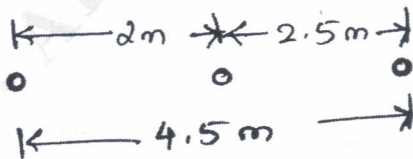

Fig.Q.3(c)

OR

4 a. Derive an expression for capacitance of a 3 phase line with unsymmetrical spacing but transposed. **(10 Marks)**

b. Fig.Q.4(b) shows the spacing of a double circuit 3 phase overhead line. The phase sequence is ABC and the line is completely transposed the conductor radius in 1:3 cm. Find the inductance per phase per kilometer. **(10 Marks)**
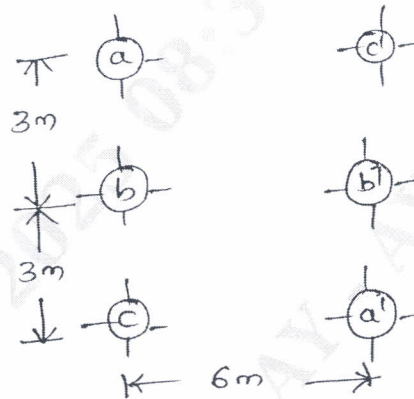

Fig.Q.4(b)

Module-3

5 a. Derive an expression for A, B, C, D constant of a medium transmission line using nominal π method of analysis. Show that $AD - BC = 1$. **(10 Marks)**

b. A 3 phase 50 Hz overhead transmission line 100 km long has following constant resistance/km/phase = $0.1\ \Omega$, inductive reactance / km / phase = $0.2\ \Omega$, capacitive susceptance / km / phase = 0.04×10^{-4} s.

Determine : i) Sending end current   ii) Sending end voltage   iii) Sending end power factor iv) Transmission efficiency when supplying a balance load of 10.000 kW at 66 kV pf 0.8 lagging. Use nominal T methods. **(10 Marks)**

OR

6 a. Derive an expression for voltage regulation and transmission efficiency of a single phase short transmission line with the help of vector diagram. **(10 Marks)**

b. An overhead 3 phase transmission line delivers 5000 kW at 22 kV at 0.8 pf lagging. The resistance and reactance of each conductor is $4\ \Omega$ and $6\ \Omega$ respectively. Determine: i) Sending end voltage   ii) Percentage regulation   iii) Transmission efficiency. **(10 Marks)**

Module-4

7 a. What is Corona? State and explain with the expression for disruptive critical voltage and visual critical voltage. **(10 Marks)**

b. What is grading of cable? Briefly explain inter sheath grading. **(10 Marks)**

OR

8 a. Derive an expression for insulation resistance of single core cable. **(10 Marks)**

b. Calculate the capacitance and charging current of a single core cable used on a 3 phase, 66 kV system. The cable is 1 km long having a core diameter of 10 cm and an impregnated paper insulation of thickness of 7 cm. The relative permittivity of the insulation may be taken as 4 and the supply at 50 Hz. **(10 Marks)**

Module-5

9 a. Explain radial distribution system. State its merits and demerits. **(10 Marks)**

   b. A single phase ac distribution AB 300 meter long is fed from end A and is waded under.
       i)   100 A at 0.707 pf lagging 200 m from point A
       ii) 200 A at 0.8 pf lagging 300 m from point A

       The load resistance and reactance of the distribution is 0.2 Ω and 0.1 Ω per kilometer. Calculate the total voltage drop in the distribution. The load power factor refers to the voltage at the far end. **(10 Marks)**

OR

10 a. What is power quality? Explain various power quality problems. **(06 Marks)**

   b. Define reliability. Write a short note on Bath tub curve. **(06 Marks)**

   c. Non reactive loads of 10 kW, 8 kW and 5 kW are connected between the neutral and the red, yellow and blue phase respectively of a 3 phase 4 wire system. The line voltage is 400 V. Calculate current in each line. **(08 Marks)**

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