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2002 SCHEME

EE53

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

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

1 a. Explain clearly the various advantages of transmitting electrical energy at high voltages. **(05 Marks)**

b. Assuming that the overhead line hangs in the form of a catenary between two level supports, find an approximate expression for the sag at the centre. **(07 Marks)**

c. An ACSR transmission line is supported by two towers at the same level, whose details are as under:
Size of the conductor 54/4 mm Al, 7/4 mm steel.
Weight of the conductor = 1.8 kgf/m.
Ultimate tensile strength = 15000 kgf.
Factor of safety = 2
Span of the conductor = 400 m. Wind pressure = 100 kgf/m^2.
The wind load on the conductor is assumed to be acting on two-thirds of the exposed area. There is no ice covering on the conductor. Find the maximum sag and vertical sag. **(08 Marks)**

2 a. What is symmetrical three phase line? Derive an expression for the inductance of a symmetrical three phase line. **(08 Marks)**

b. Write a brief note on the transposition of transmission lines. **(04 Marks)**

c. A 11 kV, 50 Hz, 3-phase overhead transmission line conductors are placed in a horizontal plane as shown in figure Q2 (c). The diameter of each conductor is 2 cm. The length of the line is 200 km. Calculate i) Capacitance/phase ii) Charging current/phase. The line is completely transposed. **(08 Marks)**

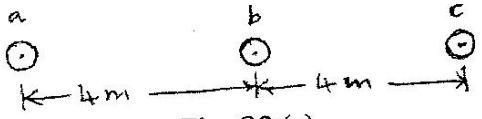

Fig. Q2 (c)

3 a. Derive an expression for the line to line capacitance and line to neutral capacitance of a single phase line. **(07 Marks)**

b. A double circuit three phase overhead line is as shown in figure Q3 (b). The radius of each conductor is 1.6 cm and the line is transposed. Find the inductance per phase per km of the transmission line. **(10 Marks)**

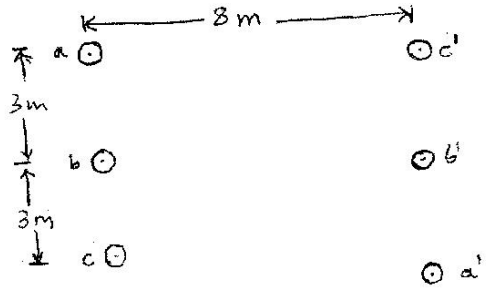

Fig. Q3 (b)

c. Distinguish between different types of transmission lines. **(03 Marks)**

4 a. Explain by means of a circuit diagram, how the performance of a medium transmission line is found using Nominal T method. Also draw the vector diagram. Explain also how the efficiency of transmission and regulation are calculated. **(10 Marks)**

b. A three-phase transmission line supplies a load of 8000 kW at 66 kV and 0.8 p.f lagging. The resistance and reactance of the line per phase are 8 Ω and 16 Ω respectively. The capacitive susceptance is 4×10^{-4} ℧. Calculate the sending end current, voltage, p.f., transmission efficiency and regulation using Nominal T method. **(10 Marks)**

5 a. List out the important properties required by the insulating materials used for overhead line insulators. **(05 Marks)**

b. Define string efficiency and explain how it can be improved using a guard ring. **(08 Marks)**

c. A five-unit suspension insulator is used for a three phase transmission line for each arm of the tower. The ratio of mutual capacitance to shunt capacitance is 10. Find the string efficiency of the insulator string. **(07 Marks)**

6 a. Explain with a neat sketch, the various components of an underground cable. **(06 Marks)**

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

c. The core diameter and the sheath diameter of a single core cable are 2 cm and 6 cm respectively. Find the maximum possible operating voltage. If the core is graded with two dielectrics of permittivities 5 and 3, find the operating voltage. The maximum permissible potential gradient for both the dielectrics is the same and is equal to 33 KV/cm. **(08 Marks)**

7 a. Define disruptive critical voltage and visual critical voltage. Derive expressions for the same. **(10 Marks)**

b. A 132 kV, 50 Hz, three phase symmetrical transmission line of standard conductors are spaced at 4 m and each conductor has a diameter of 2 cm. The surrounding air is at a temperature of 25°C and a pressure of 75 cm of Hg. The surface irregularity factor is 0.85. Find i) disruptive critical voltage ii) visual critical voltage for local corona and iii) visual critical voltage for general corona. The surface irregularity factors for visual local corona and visual general corona are 0.72 and 0.82 respectively. State whether under normal working conditions, corona discharge occurs or not. **(10 Marks)**

8 Write short notes on any four of the following:

a. Stringing charts.
b. Corona in transmission lines.
c. A, B, C, D constants.
d. Ring main distribution system.
e. Arcing horns and rings.
f. Charging current in a transmission line. **(20 Marks)**

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