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Fifth Semester B.E. Degree Examination, January/February 2006
Electrical & Electronics Engineering
Electrical Power Transmission & Distribution

Time: 3 hrs.)

(Max.Marks : 100)

Note: Answer any FIVE full questions.

1. (a) Obtain the expression for sag in a freely suspended conductor when the supports are at equal levels. (8 Marks)
- (b) A transmission line conductor at a river crossing is supported from two towers of heights 50m and 80m above water level. The horizontal distance between the towers is 500m. If the tension in the conductor is 3000 kg, find the minimum clearance between the conductor and water. Weight of the conductor per meter is 0.844 kg. (7 Marks)
- (c) An overhead transmission line has a span of 200m between the supports. The supports are at same level. The cross sectional area of the conductor is 1.9cm^2 and ultimate strength is 5000kg/cm^2 . The specific gravity of the conductor material is 8.9gm/cm^3 . If the conductor is subjected to wind pressure of 1.5 kg/m length, calculate the sag for a factor of safety of 5. Also calculate vertical sag. (5 Marks)
2. (a) Show how the inductance of 3-phase transmission line with equilateral and symmetrical spacing between conductors can be calculated. (8 Marks)
- (b) The three conductors of a 3-phase line are arranged at the three corners of a triangle of sizes 2m, 2.5m and 4.5m. Calculate the inductance per km of the line when the conductors are regularly transposed. The diameter of each conductor is 1.24 cm. (7 Marks)
- (c) Calculate the loop inductance per km of a single phase transmission line consisting of 2 parallel conductors 1.5m apart and 1.5cm in diameter. Calculate also the reactance of the transmission line if operating at 50 Hz. (5 Marks)
3. (a) Derive the expression for capacitance of a 3-phase line with unsymmetrical spacing. (8 Marks)
- (b) In a 3-phase, 50 Hz, 66kV overhead transmission system, the conductors are placed in a horizontal plane at equal distances of 2m. The conductor diameter is 1.25cm. If the line length is 100km, calculate
 - i) Capacitance/phase
 - ii) Charging current/phase
 assuming complete transposition of the line. (7 Marks)
- (c) What is skin effect? Which are the factors influencing skin effect? (5 Marks)
4. (a) What are ABCD constants of a transmission line? Determine the same for a medium transmission line using nominal π -model. Hence prove $AD - BC = 1$. (10 Marks)
- (b) A 3-phase line delivers 3000 kW at a power factor of 0.8 lagging to a load. If the sending end voltage is 33 kV, determine :
 - i) Receiving end voltage
 - ii) Line current
 - iii) Transmission efficiency.
 The resistance and reactance of each conductor is 5Ω and 8Ω respectively. (10 Marks)

5. (a) Derive the expressions for sending end voltage and current of a medium transmission line (nominal T-model) in terms of Y , Z , V_R and I_R . (8 Marks)
- (b) A 3-phase, 50 Hz overhead transmission line delivers 10 MW at 0.8 p.f lagging at 66kV. The resistance and inductive reactance of the line per phase are 10Ω and 20Ω respectively, while capacitive admittance is 4×10^{-4} mho, calculate
- Sending end current
 - Sending end line to the voltage
 - Sending end power factor
 - Transmission efficiency.
- Use nominal T-method. (12 Marks)
6. (a) What is string efficiency in the context of suspension insulators? Explain methods of improving the same. (8 Marks)
- (b) A string of 8 units is used as a suspension insulator. The self capacitance is 10 times the pin to earth capacitance. How much percentage of the total voltage V across the string will be across the line unit? Use the standard empirical formula. (5 Marks)
- (c) A string of 4 insulators has a self capacitance equal to 10 times pin-to-earth capacitance. Find :
- Voltage distribution across various units as a percentage of total voltage across the string
 - String efficiency. (7 Marks)
7. (a) What is meant by grading of cables? Briefly explain various methods of grading. (7 Marks)
- (b) A single core cable has a conductor of diameter 2.5cm and a sheath of inside diameter 6 cm. Calculate the maximum stress. It is desired to reduce the maximum stress by using two intersheaths. Determine their best positions, the maximum stress and the voltages on each system. Voltage is 66 kV, 3-phase. (8 Marks)
- (c) A single core 66kV, 3-phase, 50Hz cable of 1.5 km length and of diameter 1cm, has an insulation thickness of 1.5cm. If PVC of relative permittivity 4.8 is used as dielectric, calculate the capacitance and charging current of the cable. (5 Marks)
8. Write short notes on any FOUR of the following :
- Stringing chart
 - Ferranti effect
 - Corona in transmission lines
 - Radial distribution system
 - Surge impedance loading
 - Thermal rating of cables.
- (4 × 5 = 20 Marks)

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