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Question Paper Code : 91033

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2025.

Fourth Semester

Electrical and Electronics Engineering

EE 3401 — TRANSMISSION AND DISTRIBUTION

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Why the concept of self GMD is not applicable for capacitance calculation?
2. Define skin effect.
3. Give the range of surge impedance value for an Overhead transmission line and an underground cable.
4. What is Corona?
5. What is stringing chart and write its significance.
6. List the desirable properties of good insulators.
7. What is 3 core belted cable?
8. Classify the types of cables used for three phase supply.
9. What are the limitations of Kelvin's law?
10. What is FACTS devices and give its objectives.

PART B — ($5 \times 13 = 65$ marks)

11. (a) Derive an expression for capacitance of a three phase unsymmetrically spaced overhead line.

Or

- (b) (i) Derive the expression for inductance of a single phase two wire line. (6)
- (ii) Calculate the loop inductance per km of a single phase transmission line consisting of two parallel conductors 1.5m apart and 1.5 cm in diameter. Calculate also the reactance of the transmission line if it is operating at a frequency of 50 Hz. (7)
12. (a) (i) Draw the phasor diagram of a short transmission line and derive an expression for voltage regulation and transmission efficiency. (7)
- (ii) Analysis and derive an expression for sending end current and voltage of a long transmission line. (6)

Or

- (b) A 3 phase line delivers 3000 kW at a p.f 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 5 ohm and 8 ohm respectively.
13. (a) A transmission line has a span of 265 m between level supports. The conductor has an effective diameter of 1.96 cm and weights 0.865 kg/m. Its ultimate strength is 8060 kg. If the conductor has an ice coating of 1.27 cm and is subjected to a wind pressure of 3.9 gm/cm² of projected area, calculate the sag for a safety factor of 2, weight of 1 cc of ice is 0.91 gm.

Or

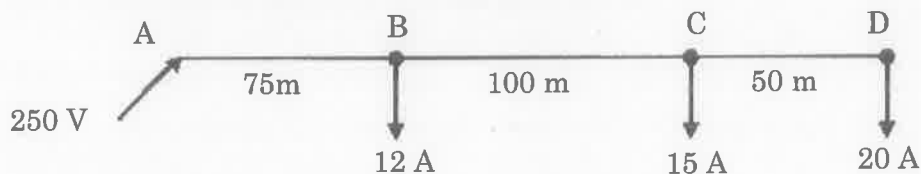
- (b) (i) Define string efficiency. Explain the methods of improving string efficiency. (6)
- (ii) Explain with neat figure the construction of suspension type insulator. Also describe the causes of failure of insulator. (7)
14. (a) (i) Explain the general construction of an underground cable with a neat sketch. (7)
- (ii) Calculate the capacitance and charging current of a single core cable used on a 3 phase, 66 kV systems. The cable is 1 km long having a core diameter of 10 cm and an impregnated paper insulation of thickness 7 cm. The relative permittivity of the insulation may be taken as 4 and the supply at 50 Hz. (6)

Or

- (b) (i) Compare the merits and demerits of underground system versus overhead system. (5)
- (ii) What is Grading of Cable? Explain in detail about the grading of cables. (8)

15. (a) (i) The load distribution on a two-wire D.C. distributor is shown in the following Figure. The cross-sectional area of each is 0.27 cm^2 . The end A is supplied at 250 V. Resistivity of the wire is $\rho = 1.78 \mu\Omega\text{-cm}$. Calculate.

- (1) The current in each section of the conductor. (2)
- (2) The two-core resistance of each section. (2)
- (3) The voltage at each tapping point. (2)



- (ii) What is a sub-station? Illustrate any one type of sub-stations with a suitable diagram. (7)

Or

- (b) Discuss in detail the advantages, disadvantages and applications of HVDC transmission system.

PART C — ($1 \times 15 = 15$ marks)

16. (a) A 3-phase 50 Hz transmission line 100 km long delivers 20 MW at 0.9 p.f lagging and at 110 kV. The resistance and reactance of the line per phase per km are 0.2Ω and 0.4Ω respectively while capacitance admittance is $2.5 \times 10^{-6} \text{ mho/km/phase}$. Calculate: (i) The current and voltage at the sending end (ii). Efficiency of transmission. Use nominal T method.

Or

- (b) (i) In a 33 KVA overhead line, there are three units in the string of insulators. If the capacitance between each insulator pin and earth is 11% of self-capacitance of each insulator, find (1) The distribution of voltage over 3 insulators and (2) String efficiency. (7)
- (ii) Derive an expression for the sag of a transmission line supported by towers of different heights at the ends. (8)

