Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 41031

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2024.

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 × 2 = 20 marks)

1. Define proximity effect.

2. State the advantages of bundled conductor lines.

3. What is meant by short line?

4. Mention the effects of corona.

5. What are the materials used for making insulators?

6. Why high voltage lines are supported on steel towers and not on poles?

7. What are the different types of cables?

8. What should be the desirable characteristics of insulating materials used in cables?

9. Distinguish between radial and ring main distributor.

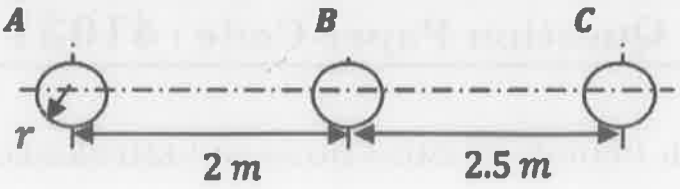
10. What is the need of a substation in the power system?

PART B — (5 × 13 = 65 marks)

11. (a) Derive the expression for inductance per phase of a three-phase line when the conductors are placed at the corners of an equilateral triangle.

Or

(b) A 3-phase, 50 Hz, 66 kV overhead line conductors are placed in a horizontal plane as shown in figure. The conductor diameter is 1.25 cm. If the line length is 100 km, calculate (i) Capacitance/phase (ii) charging current/phase assuming complete transposition of the line.



12. (a) A three-phase, 50 Hz over head transmission line 100 km long has the following constants:

Resistance/phase/km = 0.1 Ω

Inductive reactance/phase/km = 0.2 Ω

Capacitive susceptance/phase/km = 0.04×10^{-4} mho

Determine the transmission efficiency and regulation when supplying a load of 10,000 kW at 66 kV with p.f. of 0.8 lagging. Use nominal T method.

Or

(b) Calculate the corona characteristics of a 3-phase 220 kV, 50 Hz transmission line consisting of 1.5 cm radius conductor spaced 2 m apart in equilateral triangle formation. The temperature is 40° C and atmospheric pressure is 76 cm. Take m_o = 0.85 and m_v = 0.72 for local corona and 0.82 for general corona.

13. (a) Assuming that the shape of an overhead line suspended between two supports at equal level can be approximated by a parabola, deduce expressions for calculating sag and conductor length.

Or

(b) A string of four insulator units has ratio of shunt to mutual capacitance of 0.2. The line bus bar voltage is 285 kV. Find the voltage across all the units and string efficiency.

14. (a) Find the maximum working voltage of a 1-core lead sheathed cable joint with conductor 1 cm diameter and sheath 5 cm inside diameter. Two insulating materials are used: Inner – maximum working potential gradient 60 kV/cm, relative permittivity 4 ; Outer - maximum working potential gradient 40 kV/cm, relative permittivity 3.

Or

(b) Derive expressions for insulation resistance and capacitance of single-core cables.

15. (a) A 3-phase, 4-wire distributor supplies a balanced voltage of 400/230 V to a load consisting of 30 A at 0.866 lagging p.f. for R phase, 30 A at 0.866 leading p.f. for Y phase and 30 A at UPF for B phase. The resistance of each line conductor is $0.2\,\Omega$. The area of cross-section of neutral is half of any line conductor. Calculate the supply end voltage for R phase. The phase sequence is RYB.

Or

(b) Draw and describe the key diagram of a typical 66/11 kV sub-station.

PART C — ($1 \times 15 = 15$ marks)

16. (a) A symmetrical 132 kV line delivers a load of 40 MW at 0.8 lagging p.f. Calculate with the help of power circle diagram

(i) The sending end voltage (6)

(ii) The MVAR capacity of synchronous condenser needed if the sending end voltage is increased to 180 kV. (9)

The capacity of synchronous condenser needed at no load if the sending end and receiving end voltages are 132 kV respectively. Assume line constants are

$A = 0.9 \angle 25°$, $B = 100 \angle 70° \Omega$, $C = 0.0006 \angle 88°$.

Or

(b) An overhead line at a river crossing is supported from two towers of heights 30 m and 90 m above water level with a span of 300 m. The weight of the conductor is 1 kg/m and the working tension is 2000 kg. Determine the clearance between the conductor and the water level midway between the towers.

———————