CBCS SCHEME

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BEE402

# Fourth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
## Transmission and Distribution

Time: 3 hrs. Max. Marks: 100

*Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.*
*2. M : Marks , L: Bloom's level , C: Course outcomes.*

| | | Module – 1 | M | L | C |
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| Q.1 | a. | With the help of single line diagram, explain the structure of electrical power system indicating standard voltages. | 06 | L2 | CO1 |
| | b. | Explain the effects of high voltage transmission based on the conductor volume, transmission efficiency and percentage line drop. | 06 | L2 | CO1 |
| | c. | The towers of height 95 m and 70 m respectively support a transmission line conductor at water crossing. The horizontal distance between the towers is 400 m. If the tension in the conductor is 1100 kg and its weight is 0.8 kg/m, calculate:<br>(i) Sag at lower support<br>(ii) Sag at upper support<br>(iii) Clearance of lowest point on the trajectory from water level.<br>Assume bases of towers are at water level. | 08 | L3 | CO1 |
| | | **OR** | | | |
| Q.2 | a. | Explain the different methods to equalize the potential across the string of suspension insulator. | 06 | L2 | CO1 |
| | b. | Write a short note on Bundled conductors. | 06 | L1 | CO1 |
| | c. | Each line of 3-phase system is suspended by a string of 3 similar insulators. If the voltage across the bottom most unit is 17.5 KV. Calculate the voltage across the insulator string. Also find the string efficiency. Assume that the earth capacitance is $1/8^{th}$ of mutual capacitance. | 08 | L3 | CO1 |
| | | **Module – 2** | | | |
| Q.3 | a. | Derive an expression for inductance of a single phase two wire line starting from fundamentals. | 08 | L3 | CO2 |
| | b. | Explain the terms (i) GMD and (ii) GMR with the help of suitable examples. | 06 | L1 | CO2 |
| | c. | The three conductors of a 3-phase line are arranged at the three corners of a triangle of sides 2 m, 2.5 m and 4.5 m. Calculate the inductance per km of the line when conductors are regularly transposed. The diameter of each conductor is 1.24 cm. | 06 | L3 | CO2 |
| | | **OR** | | | |
| Q.4 | a. | Derive an expression for capacitance of a 3-phase line with equilateral spacing. | 08 | L3 | CO2 |
| | b. | Compare single circuit and double circuit lines. | 05 | L2 | CO2 |
| | c. | A single-phase over head line 30 km long consists of two parallel wires each 5 mm in diameter and 1.5 m apart. If the line voltage is 50 KV, 50 Hz. Calculate the charging current with line open circuited. | 07 | L3 | CO2 |
| | | **Module – 3** | | | |
| Q.5 | a. | Briefly explain the purpose of overhead transmission line and how transmission lines are classified. | 06 | L2 | CO3 |
| | b. | Discuss the terms voltage regulation and transmission efficiency as applied to transmission line. | 04 | L2 | CO3 |

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| | c. | A three phase 50 Hz overhead transmission line 100 km long has following constants:<br>Resistance/ph/km = 0.1 Ω ; Reactance/ph/km = 0.2 Ω; susceptance/ph/km = $0.04 \times 10^{-4}$ siemens. Determine:<br>(i) Sending end current (ii) Sending end voltage<br>(iii) Sending end p.f. (iv) Transmission efficiency<br>When supplying a balanced load of 10,000 KW at 66 KV, 0.8 p.f. lagging. Use nominal T-method. | 10 | L3 | CO3 |
| | | **OR** | | | |
| Q.6 | a. | With the help of vector diagram, explain the nominal-π method for obtaining the performance of medium transmission line. | 08 | L3 | CO3 |
| | b. | What are A, B, C, D parameters? Briefly explain. | 04 | L2 | CO3 |
| | c. | A 3-phase transmission line is 400 km long and feeds a load of 450 MVA, 0.8 p.f. lagging at 345 KV. The ABCD constants are A = D = $0.8181\angle 1.3^{\circ}$ ; B = $172.2\angle 84.2^{\circ}$, C = $1.93\times10^{-3}\angle 90.4^{\circ}$ Ʊ. Calculate sending end current and percentage voltage drop at full load. | 08 | L3 | CO1 |
| | | **Module – 4** | | | |
| Q.7 | a. | Briefly explain the factors influencing the corona. | 06 | L2 | CO4 |
| | b. | Explain the terms with reference to corona:<br>(i) Critical disruptive voltage<br>(ii) Visual critical voltage<br>(iii) Corona power loss | 06 | L2 | CO4 |
| | c. | Determine the critical disruptive voltage and the visual critical voltage for a 3-phase, 132 KV, 50 Hz line situated in a temperature of 30°C and at a barometric pressure of 74 cm. The conductor diameter is 1.5 cm while the spacing between the conductors is 2.75 m. The surface irregularity factor is 0.9 while $m_u = 0.75$ and $m_0 = 0.9$. | 08 | L3 | CO4 |
| | | **OR** | | | |
| Q.8 | a. | With the help of cross sectional diagram, explain the construction of single core cable. | 06 | L2 | CO4 |
| | b. | Explain the inter sheath grading of cables. | 06 | L2 | CO4 |
| | c. | Single core, lead covered cable has a conductor diameter of 3 cm with insulation diameter of 8.5 cm. The cable is insulated with two dielectrics with permittivities 5 and 3 respectively. The maximum stress in the two dielectrics are 38 KV/cm and 26 KV/cm respectively. Calculate radial thickness of insulating layers and the working voltage of the cable. | 08 | L3 | CO4 |
| | | **Module – 5** | | | |
| Q.9 | a. | Explain the following terms with reference to distribution system:<br>(i) Radial feeder (ii) Parallel feeder<br>(iii) Loop feeder (iv) Interconnected network | 08 | L2 | CO5 |
| | b. | A single phase distributor 2 km long supplies a load of 120 A at 0.8 p.f lagging at its far end and a load of 80 A at 0.9 p.f. lagging at its mid point. Both power factors are referred to the voltage at the far end. The resistance and reactance per km (go and return) are 0.05 and 0.1 Ω respectively. If the voltage at the far end is maintained at 230 V, calculate:<br>(i) Voltage at the sending end<br>(ii) Phase angle between voltages at the two ends. | 12 | L3 | CO5 |
| | | **OR** | | | |
| Q.10 | a. | Define the terms:<br>(i) Reliability (ii) Availability (iii) Adequacy (iv) Security | 08 | L2 | CO5 |
| | b. | Explain with neat sketch different failure modes of bath tub curve. | 06 | L2 | CO5 |
| | c. | Write a short note on power quality. | 06 | L2 | CO5 |

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