

JK LAKSHMIPAT UNIVERSITY, JAIPUR
INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination November 2018

B. Tech. in Electrical Engineering, Semester V

Roll No.....

EE503: Transmission and Distribution of Electrical Power

Time: 3 hours

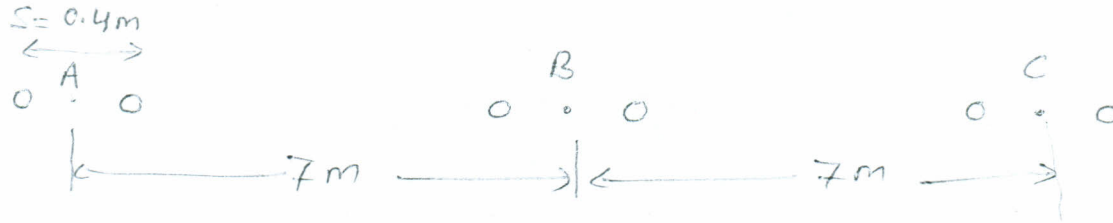
Max. Marks: 80

Instructions to students:

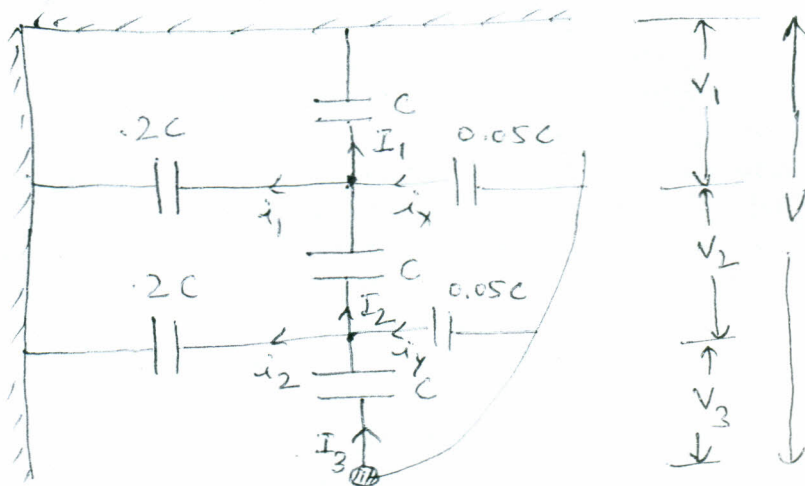
1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

- Q.1 Objective type multiple choice questions (10 questions @ 1 mark) 10**
- i. In a transmission system, the weight of copper used is proportional to:
(a) V^2 (b) V (c) $1/V^2$ (d) $1/V$
 - ii. In a dc 2-wire feeder, voltage drop per wire is 2.5 %, transmission efficiency of the feeder will be: (a) 97.5 % (b) 95 % (c) 93.75 % (d) 98.75 %
 - iii. ACSR is used for transmission of power in preference to copper conductors because
(a) It is lighter (b) It is more economical
(c) It has higher current carrying capacity (d) It can stand higher surge voltages
 - iv. The effect of corona is: (a) increased energy loss (b) increased reactance
(c) Increased inductance (d) all of the above.
 - v. Guard ring transmission line: (a) improves power factor (b) reduces earth capacitance of the lowest unit
(c) reduces transmission losses (d) improves regulation.
 - vi. Safety factor is the ratio of: (a) Working stress to breaking stress. (b) Breaking stress to working stress.
(c) $1 / \text{breaking stress}$. (d) $1 / \text{working stress}$.
 - vii. The regulation of a line at full load 0.8 pf lagging is 12 %. The regulation at full load 0.8 pf leading can be: (a) 24 % (b) 18 % (c) 12 % (d) 4 %
 - viii. Characteristics impedance of an overhead transmission line is usually in the range of:
(a) 100 to 200 ohm (b) 200 to 300 ohm (c) 1 to 100 ohm (d) 400 to 500 ohm
 - ix. The material commonly used for sheaths of underground cable is:
(a) Copper (b) lead (c) steel (d) rubber
 - x. Grading of cables: (a) reduces insulation cost and increases current rating (b) reduce insulation cost but decreases current rating
(c) increases both (d) none of the above
- Q.2 Short answer type questions (4 questions @ 2.5 marks) 10**
- i. What are the properties of insulating materials?
 - ii. What is meant by disruptive critical voltage?
 - iii. How inductance and capacitance of a transmission line are affected by the spacing between the conductors?
 - iv. What is power circle diagram?
- Q.3A Find the ratio of volume of copper required to transmit the power over a given distance by overhead system using (i) dc 2-wire system and (ii) 3-phase 3-wire ac system. 05**
- Q.3B Determine the best current density in A/mm^2 for a 3-phase overhead line if the line is in use for 2600 hours per year and if the conductor costs Rs. 3.0 per kg has a specific resistance of 1.73×10^{-8} ohm-m and weighs 6200 kg/m^3 . Cost of energy is 10 paise/unit. Interest and depreciation is 12 % of the conductor cost. 05**
- Q.4A What is corona? What are its effects and how is disruptive critical voltage estimated? 05**

- Q.4B Find the inductive reactance of a 3-phase bundled conductor line with 2-conductor per phase with spacing of 40 cm. phase to phase separation is 7 m in horizontal configuration. All conductors are ACSR with dia of 3.5 cm. 05



- Q.5A A conductor is composed of seven identical copper strands each having a radius r . Find the self GMD of the conductor. 05
- Q.5B A certain 3-phase equilateral transmission line has a total corona loss of 53 kW at 106 kV and a loss of 98 kW at 110.9 kV. What is the disruptive critical voltage between lines? What is the corona loss at 113 kV? 05
- Q.6A Explain why the voltage across the units of a string of suspension type insulators is not equal. Also define string efficiency. 05
- Q.6B Derive expressions for sag and tension in a power conductor strung between two supports at equal heights taking into account the wind and ice loading also. 05
- OR
- Q.6B Calculate the string efficiency for a string of three insulator units if the capacitance of each unit to earth and line be 20% and 5% of the self capacitance of the unit. 05



- Q.7 A transmission line conductor at a river crossing is supported from two towers at a height of 50 and 80 m above water level. The horizontal distance between the towers is 300 m. if the tension in the conductor is 2000 kg find the clearance between the conductor and water at a point midway between the towers. Weight of conductor/m = 0.844 kg. Derive the formula used. 10
- Q.8 Derive the expression for insulator resistance, capacitance and electric stress in a single core cable. Where is the stress maximum and minimum? 10
- OR
- Q.8 A single circuit transmission line delivering a load of 50 MVA at 110 kV and power factor of 0.8 lagging with parameters: $A = D = 0.98 \angle 3^\circ$, $B = 110 \angle 75^\circ \Omega$, $C = 0.0005 \angle 80^\circ \text{ mho}$. Then find (i) Sending end voltage (ii) Sending end current (iii) Sending end power (iv) transmission efficiency. 10