Code No: R1931021 **R19** **SET - 1**

III B. Tech I Semester Supplementary Examinations, June/July-2022

POWER SYSTEMS-II

(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions **ONE** Question from **Each unit**
All Questions Carry Equal Marks
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UNIT-I

1. a) What is bundled conductor and why is it used. [5M]
   b) Calculate the inductance and reactance of each phase of a three-phase 50Hz overhead high-tension line (HTL) which has conductors of 2.5cm diameter. The distance between the three-phases are (i) 5cm between a and b, (ii) 4m between b and c and (iii) 3m between c and a as shown in Figure 1. Assume that the phase conductors are transposed regularly. [10M]

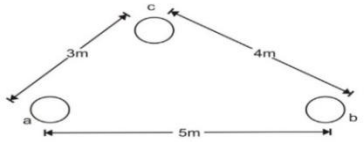

Figure 1

(OR)

2. a) What do you understand transposition in overhead lines? Explain why transposition is done in such a line. [8M]
   b) Calculate the capacitance per phase of a three-phase three-wire transposed system when the conductors are arranged at the corners of a triangle with sides measuring 1.0 m, 1.5 m, and 2.0 m. Diameter of each conductor is 1.2 cm. [7M]

UNIT-II

3. a) What is the purpose of an overhead transmission line? How are these lines classified? [6M]
   b) A three phase transmission line is 140 km long. The resistance per phase is 0.04 ohms per km and the inductance per phase is 0.95 mH per km. The shunt capacitance is 0.0105 μF per km. The receiving end load is 90 MVA with 0.85 power factor lagging at 110 kV. Determine the voltage, powers at the sending end, voltage regulation and efficiency by using nominal - π model. [9M]

(OR)

4. a) What is an equivalent π circuit of a long line? Derive an expression for parameters of this circuit in terms of line parameters. [7M]
   b) A three-phase, 50 Hz and 250 km long line whose resistance per km is 0.015 Ω and inductance per km is 0.8 mH and capacitance per km is 0.01 μF. Determine the network constants of a long transmission line while neglecting the conductance of the line. [8M]

UNIT-III

5. a) Derive the travelling wave equations in a lossless transmission line. [8M]
   b) A step wave of 110 kV travels through a line having a surge impedance of 350 Ω. The line is terminated by an inductance of 5000 μH. Find the voltage across the inductance and reflected voltage wave. [7M]

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(OR)

6. a) Explain the importance of surge impedance. [6M]
   b) An overhead line with inductance and capacitance per km length of 1.3 mH and 0.09 μF respectively is connected in series with an ungrounded cable having inductance and capacitance of 0.2 mH/km and 0.3 μF/km, respectively. Calculate the values of reflected and refracted (transmitted) waves of voltage and current at the junction due to a voltage surge of 100 kV travelling to the junction [9M]
      (i) along the line towards the cable, and
      (ii) along the cable towards the line.

UNIT-IV

7. a) Explain the phenomena of corona and derive an expression for disruptive critical voltage. [7M]
   b) The line constants of a three-phase long line are: A = $0.85\angle 2.3^0$; B = $180\angle 75^0$; C = $0.0014\angle 90^0$. Determine the sending-end voltage, the current and power factor when the open-circuit voltage at receiving end of the line is 220 kV. Also calculate the charging current. [8M]

(OR)

8. a) What are the disadvantages of corona? Explain how the corona considerations affect the design of a line? [8M]
   b) A certain 3-phase equilateral transmission line has a total corona loss of 60 kW at 110 kV and a loss of 80 kW at 120 kV. What is the disruptive critical voltage? What is the corona loss at 132 kV? [7M]

UNIT-V

9. a) What is a sag template? Explain how this is useful for the location of towers and the stringing of power conductors. [7M]
   b) A transmission line conductor consists of a hard drawn copper 240mm^2 cross-section and has a span of 160 m between level supports. The conductor has an ultimate tensile stress of 42.2 kg/mm^2 and allowable tension is not to exceed $\frac{1}{5}$th of ultimate tensile strength. Determine: [8M]
      (i) the sag,
      (ii) the sag with a wind pressure of 1.35kg/m and an ice coating of 1.0 cm thickness,
      (iii) the vertical sag. Take the specific gravity of hard drawn copper as 8.9 gm/cc and the weight of ice as 915 kg/m^3.

(OR)

10. a) Show that in a string of suspension insulators, the disc nearest to the conductor has the highest voltage across it. [8M]
    b) An insulator string has three units each having a safe working voltage of 13 kV. The ratio of self-capacitance of unit to shunt capacitance to each is 8:1. Calculate the maximum safe working voltage of string and string efficiency. [7M]

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