BACHELOR OF ENGINEERING (ELECTRICAL ENGINEERING) 3RD YEAR 1ST SEMESTER - 2019

# POWER SYSTEM PLANNING AND DESIGN

Time: Three hours (**50** marks for this part) Full Marks: 100

**Use a separate Answer-Script for each part**

**PART -I**

**Answer any three questions**

**Two marks allotted for neat and to the point answers**

1) a) Discuss the features of ACSR conductor. (8)

b) A transmission line uses ACSR conductors. Each conductor has an effective diameter of 19.53 mm, weighs 844 kgf per km and has an ultimate tensile strength of 7950 kgf and with a 1.25 mm radial coating of ice and a horizontal wind pressure of 40 kgf/$m^2$ of projected area. The ground clearance is 6.7 m. One cubic metre of ice weighs 913.5 kgf. Calculate the height above the ground at which a conductor with span of 275 m must be supported in order that the total tension shall not exceed half the ultimate strength. (8)

2) a) Explain the power losses occur in cable. (10)

b) Determine the charging current per phase drawn by a cable with 3 cores and protected by a metal sheath when switched on to an 11 kV, 50 Hz supply. The capacitance between two cores with the third core connected to the sheath is measured to be 4.2 μF. (6)

3) a) Discuss Varley loop test with proper circuit diagram. (6)

b) What are the purposes of using sheath and armouring on cable? (6)

c) Discuss the features of XLPE cable insulation. (4)

4) a) What are the desirable characteristics of conductor material for a transmission line? (6)

b) By using catenary method derive an expression for sag of a line supported between two supports of the same height. (10)

5) a) Explain how the power factor of a consumer can be improved economically. (8)

b) Write a short note on Market guided tariff. (8)

*Ref No:*

**Ex/EE/5/T/312/2019**

**BACHELOR OF ENGINEERING (ELECTRICAL ENGINEERING) THIRD YEAR**

**FIRST SEMESTER - 2019**

**SUBJECT: - POWER SYSTEM PLANNING AND DESIGN**

Full Marks: 100

Time: Three hours (**50** marks for this part)

**Use a separate Answer-Script for each part**

| No. of Questions | | PART -II<br>Answer any Three<br>(Two marks reserved for well organized answers) | Marks |
|---|---|---|---|
| 6) | a) | What are the distributed parameters of a transmission line and why they are called so? | (4) |
| | b) | Derive the inductance per unit length of an overhead transmission line due to both internal and external flux on the line. | (12) |
| 7) | a) | Derive the expression for inductance of double circuit three phase transmission lines. | (8) |
| | b) | A three phase 50 Hz line consists of three conductors each of diameter 21 mm. the spacing between the conductors is as follows: A-B = 3 m, B-C = 5 m, C-A = 3.6 m. Find the inductance and inductive reactance per phase per km of the line. | (8) |
| 8) | a) | Derive the expression for capacitance of an overhead symmetrically spaced three phase line. | (8) |
| | b) | A two conductor, single phase line operates at 50 Hz. The diameter of each conductor is 2 cm and they are spaced 3 m apart. Calculate: (a) the capacitance of each conductor to neutral per km, (b) line-to-line capacitance, and (c) capacitive susceptance to neutral per km. | (8) |
| 9) | a) | Derive the $\pi$ equivalent and T equivalent representation of long transmission line. | (10) |
| | b) | A three phase 132 kV transmission line is connected to 150 MW load at a power factor of 0.85 lagging. The line constants of the medium transmission line are $Z = 96\angle 78°\ \Omega$ and $Y = 0.001\angle 90°$ S. The length of the line is 80 km. Using nominal T representation, calculate: the A, B, C and D constants of the line. | (6) |
| 10) | | Write short notes on:**(any two)**<br>i) Ferranti Effect.<br>ii) Effect of earth on transmission line capacitance.<br>iii)Incident voltage and reflected voltage of a long transmission line. | (2×8) |