B.E ELECTRICAL ENGINEERING THIRD YEAR FIRST SEM SUPPLE EXAMINATION, 2024

POWER SYSTEM PLANNING AND DESIGN

Time: Three hours | Full Marks: 100

(50 marks for this part)

Use a separate Answer-Script for each part

PART –I

Answer any five

		Marks
1.a)	What are the main function and characteristics of line supports?	6
b)	What is Stringing chart and why is it important?	4
2.a)	Derive an expression for sag of a line supported between two supports of the same height by catenary method.	8
b)	Calculate the clearance of the lowest conductor above ground for a 132 KV and 400 KV transmission line.	2
3.	Discuss the following: a) Electrical failure of insulators b) ACSR Conductor	5+5
4. a)	What are the advantages and disadvantages of underground cables over overhead conductors?	4
b)	Calculate the sag of a transmission line conductor consisting of hard drawn copper 120 mm^2 cross section, the conductor used has 37 strands each of diameter 2.11 mm having weight of 1118 kg/km and has a span of 200 m at level support. The conductor has an ultimate tensile stress of 42.2kg/mm^2 and allowable tension should not exceed 1/4th of ultimate strength. Consider ice coating of 10mm and density of ice as 0.915gm/cc.	6
5.	Show that in a single core cable, $\frac{g_{max}}{g_{min}} = \frac{R}{r}$ where g_{max} and g_{min} are the maximum and minimum potential gradients and r and R are the core radius and overall sheath radius respectively. Find out the condition for most economical size of cable.	10

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6.a) Discuss Murray Loop Test to locate short circuit fault for an underground cable with necessary circuit diagram. 6

b) Discuss the advantages of using XLPE insulation over the other cable insulation materials. 4

7.a) What are the criteria for suggesting tariff? 6

b) Explain generation guided guided tariff. 4

8.a) Explain load factor and availability factor. 4

b) The average demand of an industrial estate for the last four years is given below. Using the method of linear regression estimate the prospective demands for 2024 and 2025. 6

Year	2020	2021	2022	2023
Demand (MW)	120	136	152	166

Ref. No.: Ex/EE/PC/B/T/312/2024(S)

B.E. ELECTRICAL ENGINEERING THIRD YEAR FIRST SEMESTER
SUPPLEMENTARY EXAM 2024

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(50 marks for each part)
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PART II
Figures in the margin indicate full marks

Group-A
Answer any three of the following questions

1. A three phase four wire, 50Hz, 10km long untransposed line has four wires (1cm dia) spaced horizontally 2m apart in a plane. The wires in order are carrying currents I_a, I_b and I_c. The currents are (–30 + j50) A, (–25 + j55) A and (55 – j105) A. Determine (a) flux linkages of the neutral and voltage induced in the neutral wire, (b) the voltage drop in each of three phase wires. (10)

2. A three phase 200 km long line has a line has a resistance of 0.05 ohm/km/phase, a reactance of 0.4 ohm/km/phase and a capacitive admittance of $j0.5\times10^{-4}$ mho/km/phase. Calculate series and shunt parameters of the nominal-π and equivalent-π circuit for the above line. Which of these two circuits is a more faithful representation of the line? Justify your answer. (10)

3. Derive the expression for inductance and capacitance of a three phase transmission line with symmetrically spaced conductors of radius 'r' cm. Distance between any of the two conductors is 'D' m. (10)

4. (a) Derive expression for the G.M.R of a stranded conductor consisting of seven identical strands. Each strand has 20cm diameter. (4)

(b) Calculate the phase to neutral capacitance per km of a single phase two wire overhead transmission line. Conductors are spaced 3m apart horizontally and 7.5m above the ground. Conductor radius is 0.35cm. Compare the result obtained by neglecting and considering the effect of earth. (6)

5. Derive expression for the inductance of three phase double circuit line. Assume that the line is evenly transposed. (10)

Group-B

Answer any two of the following questions

6. What is characteristic impedance of transmission line? Determine its value for single phase two wire overhead transmission line consisting of solid conductors of circular cross section. What do you mean by SIL of a transmission line? (10)

7. Show that voltage and current at any point of a long transmission line can be resolved into two traveling waves in opposite direction. (10)

8. A three phase 250 km long transmission line has a line has a resistance of 0.05 ohm/km/phase, a reactance of 0.4 ohm/km/phase and a capacitive admittance of $j0.5\times10^{-4}$ mho/km/phase. Calculate ABCD parameter of the line using nominal-π model. Calculate the sending end voltage, line loss if the above line delivers at receiving end a load of 20 MW at 33 kV and at 0.8 lagging power factor. (5+5)