

B.E ELECTRICAL ENGINEERING THIRD YEAR FIRST SEMESTER
EXAMINATION, 2019

SUB: 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 - I Answer any Three (Two marks reserved for well organized answers)		Marks
1)	a)	What is Stringing chart and why is it important?	(6)
	b)	What are the factors that affect sag?	(4)
	c)	A transmission line conductor at a river crossing is supported from two towers at height of 50 and 80 meters above water level. The horizontal distance between the towers is 300 meters. If the breaking strength of the conductor is 4000 kg, find the clearance between the conductor and water at a point midway between the towers. Consider the weight of conductor 0.844 kg/m and a factor of safety of 2. Assume that the conductor takes the shape of parabolic curve.	(6)
2)	a)	Discuss the causes for failure of insulators in case of overhead transmission system.	(7)
	b)	Discuss the features of All Aluminum Conductors.	(6)
	c)	Calculate the clearance of the lowest conductor above ground for a 132 kV and 400 kV transmission line.	(3)
3)	a)	Why cable capacitance is higher than that of an overhead line?	(3)
	b)	What are the different types of faults that occur in a cable? How are they identified?	(8)
	c)	In a three phase three core cable, the capacitances are measured and found to be as follows: (i) Between one conductor and the other two connected together to the sheath = 4.8 μ F (ii) Between three cores bunched together and the sheath = 7.2 μ F Calculate the charging current when the cable is connected to an 11kV, 50Hz supply.	(5)
4)	a)	The average demand of an industrial estate for the last five years is given below. Using the method of linear regression estimate the prospective	(8)

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	demands for 2019 and 2020. If the data for 2014 is not available, estimate the demand for the same two years by using the same method.					
	Year	2014	2015	2016	2017	2018
	Demand (MW)	100	122	145	166	190
	b)	Explain why consumers having poor load factor should pay more.				(4)
	c)	Explain generation guided tariffs.				(4)
5)	a)	What are the advantages and disadvantages of underground cables over overhead conductors?				(6)
	b)	What are the criteria for suggesting tariff?				(8)
	c)	Expand the following terms: ACSR, XLPE, ABT (with respect to tariff), CERC.				(2)

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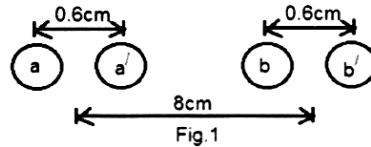
Part-II

Answer *any three* questions from this part.

Two marks are reserved for neat and well organised answer

1. a) Show that line to neutral capacitance of bundled conductor lines is more than single conductor lines. 6
- b) A three phase 180 km long line has a resistance of 0.04 ohm/km/phase, a reactance of 0.2 ohm/ km/ phase and a capacitive admittance of $j0.6 \times 10^{-5}$ mho/ km/ phase. Calculate ABCD parameters using nominal-T circuit for this line. 10
Using ABCD parameters obtained above calculate the sending end voltage, current and **voltage regulation** if the line delivers a load of 40 MW at 132 kV and at 0.95 lagging power factor at receiving end.
2. a) Write down the expression for the magnetic flux linkage of a solid round conductor, considering flux upto a distance d. Hence derive an expression for the flux linkage of any conductor in a group of several conductors carrying net current zero. 6
- b) A 50Hz, 500 km long line has series impedance $z = (0.02 + j 0.4)$ ohm/ km/ phase and shunt admittance $y = j 1.5 \times 10^{-6}$ mho/ km/ phase. Calculate the ABCD constants of the line. 10
3. a) Calculate the inductance of a single phase double circuit transmission line shown in Fig.1. 8
Conductors a and a' form the main path while b and b' in parallel form the return path. Each conductor diameter is 1 cm.

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- b) Discuss the following terms in the context of overhead transmission line: (i) attenuation constant, (ii) phase shift constant, (iii) distributed parameter and (iv) characteristic impedance. 8
4. a) What do you understand by double circuit line? 2
- b) Derive the expression for inductance of an asymmetrically spaced three phase overhead double circuit transmission line. 8
- c) Show how the electrostatic effect raises the potential of communication lines when power and communication lines run in close proximity. 6
5. a) Transposition of power transmission line is sufficient to prevent electromagnetic interference in telephone lines. – Justify or correct the statement with relevant mathematical derivation. 6
- b) A three phase 400 km long line has a line has a resistance of 0.04 ohm/ km/ phase, a reactance of 0.4 ohm/ km/ phase and a capacitive admittance of $j 5 \times 10^{-5}$ 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