Bachelor of Electrical Engineering, 2017

(3rd Year, *1st* Semester Supplementary).

Power System Planning and Design

Time: Three Hours **Full Marks:** 100

(50 marks for each part)
Use a separate Answer-Script for each Part

PART-I.

Answer ***any three*** questions from this part.
Two marks are reserved for neat and well organised answer

1. a) Obtain the relation between the sending end and receiving end voltages and currents of a transmission line of medium length using nominal π representation. Draw the equivalent circuit and vector diagram. 8

   b) Derive the expressions for the generalized constants of nominal T circuit of medium transmission line in terms of line parameters. 4

   c) A three phase 150 km long line has a resistance of 0.04 ohm/km/phase, a reactance of 0.25 ohm/km/phase and a capacitive admittance of $j2\times10^{-6}$ mho/km/phase. Calculate ABCD parameters using nominal T circuit for this line. 4

2. a) Calculate the phase to neutral capacitance per km of a single phase two wire overhead transmission line. Conductors are spaced 3m apart and 7.5m above the ground. Conductor radius is 0.35cm. Compare the results obtained by neglecting and considering the effect of earth. 8

   b) Discuss why ACSR conductors are preferred in transmission lines. 4

   c) Define voltage regulation and efficiency of a transmission line. 4

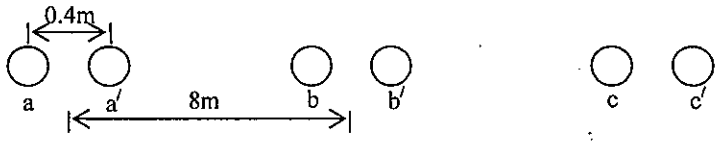
3. a) Explain what you understand by interference between power and communication lines. 4

   b) Show that transposition of communication lines reduces the interference between power and communication lines. 6

   c) Explain self GMD and Mutual GMD of transmission lines. 6

4. a) Show that the inductance per unit length of an overhead line due to internal flux linkages is constant and is independent of size of the conductor. 8

b) A three phase 440 kV multiconductor transmission line with phase sequence abc is shown in the figure below. Self GMD of each conductor is 0.9 cm. Find the inductance per phase per km if the lines are regularly transposed. 8



5. a) What is characteristic impedance of transmission line? What will be the ratio of incident voltage and reflected voltage magnitude at a distance x from receiving end if a transmission line is loaded with its characteristic impedance? 5

b) What do you understand by SIL of a transmission line? Explain why SIL is the ideal loading of any transmission line. 3

c) A 400kV, 700 km long line has series impedance $z = (0.01 + j\ 0.35)$ ohm/km/phase and shunt admittance $y = j\ 2.5 \times 10^{-6}$ mho/km/phase. Calculate (i) the characteristic impedance, (ii) the attenuation constant (iii) the phase shift constant (iv) SIL in the line. 8

Ref No:

Ex / EE/T/313/2017(S)

B. ELECTRICAL ENGINEERING EXAMINATION, 2017

(3rd year, 1st Semester, Supplementary)

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 Answer any Three (Two marks reserved for well organized answers)	Mark
6)	a)	Show that the sag in a transmission line supported on towers of equal height is given by the equation $\delta = \omega l^2/8H$, where the symbols have their usual meanings.	(8)
	b)	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 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 per meter = 0.844 kg.	(8)
7)	a)	Explain Sag template and the various curves marked on it.	(8)
	b)	According to Electricity Act 1956 calculate the clearance of the lowest conductor above ground for a 400 kV transmission line.	(2)
	c)	On what factors the configuration of transmission line depends on.	(6)
8)	a)	Explain the types of electrical failures in an insulator and how are they taken care of.	(8)
	b)	What are the advantages of using suspension insulators?	(4)
	c)	Briefly discuss ACSR and AAAC conductors and their advantages.	(4)
9)	a)	What are the desirable characteristics of conductor materials?	(6)
	b)	Explain Murray Loop Test and Varley loop test for locating faults in an underground cable.	(8)
	c)	Expand the following: (i) CERC (ii) XLPE (iii) PPL insulation (iv) IEGC	(2)

(please turn over)

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10)	Write short notes on any **two** of the following: (i) Primitive Tariff (ii) Economical improvement of power factor (iii) Losses occurring in an underground cable (iv) ABT Tariff (v) Market Guided Tariff.	(8×2)