Ex/EE/T/313/2018

B.E ELECTRICAL ENGINEERING THIRD YEAR FIRST SEMESTER EXAMINATION, 2018

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)	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)
	b)	What are the main function and characteristics of line supports?	(8)
2)	a)	For an insulated cable, prove that $\frac{g_{max}}{g_{min}} = \frac{R}{r}$ where g_{max} and g_{min} are the maximum and minimum stress of the cable and r and R are the radius of conductor and internal radius of sheath respectively. Also derive the expression for the most economical size of cable.	(8)
	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 3.7 μF.	(8)
3)	a)	In a test for a fault to earth on a 520 m length of cable having a resistance of 1.1 Ω per 1000m, the faulty cable is looped with a sound cable of the same length but having a resistance of 2.29 Ω per 1000 m. The resistances of the other two arms of the testing network at the balance are in the ratio of 2.7:1. Calculate the distance to fault from the testing end of the cable.	(8)
	b)	What are the advantages of toughened glass over porcelain insulators?	(4)
	c)	Discuss the features of ACSR conductor.	(4)

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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 demands for 2018 and 2019. If the data for 2013 is not available, estimate the demand for the same two years by using the same method	(8)
	b)	Why it is preferable to have higher load factor in a power plant?	(4)
	c)	Explain primitive tariff.	(4)
5)		Write short notes on: **(any two)** (i) Sag and tension changes of a transmission line with changes in temperature and loading. (ii) Sheath and armouring in cables. (iii) Market guided tariff. (iv) Vibration in transmission line and their preventions.	(8 x 2)

Year	2013	2014	2015	2016	2017
Demand (MW)	80	86	90	92	97

Ref: Ex/EE/T/313/2018

Bachelor of Electrical Engineering, 2018

(3rd Year, 1st Semester).

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-II

Answer ***any three*** questions from this part.

Two marks are reserved for neat and well organised answer

1. (a) Determine the equivalent ABCD parameters of two transmission lines when they are connected in i) cascade and ii) parallel. 6

(b) What do you understand by performance of a transmission line? 2

(c) Determine the efficiency and voltage regulation of a three phase, 100 km, 50 Hz transmission line delivering 20 MW at a p.f. of 0.8 lagging and 66 kV to a balanced load. The conductors have resistance of 0.1 ohm per km, 1.5 cm outside diameter, spaced equilaterally 2 m between centers. Use nominal T method. 8

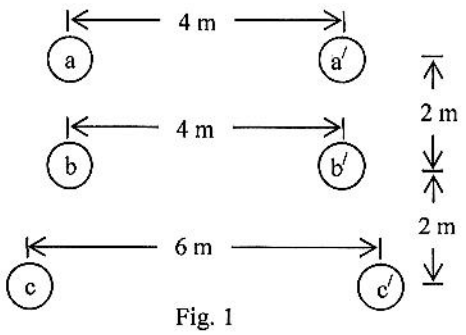
2. (a) 

Fig. 1

A three phase double circuit line consisting of solid conductors has the configuration as shown in Fig. 1. Radius of each conductor is 1 cm. Find the inductance per phase per km of line length. The lines are regularly transposed. 8

(b) Show that transposition of power line is not sufficient to reduce the interference between power and communication lines. Transposition of communication lines is also required to reduce the interference. 6

(c) What do you understand by equivalent delta spacing of transmission line? 2

3. (a) Explain the meaning of self GMD and mutual GMD with the help of a suitable example. 6

(b) Discuss how transposition helps in equalizing the capacitances in an asymmetrically spaced three phase overhead transmission line. 10

[Turn over

4. (a) Derive the suitable expression to obtain the variation in voltage and current distribution over a long line. Explain the significance of characteristic impedance loading in connection with long lines. 10

(b) Derive the expressions for series and shunt parameters of equivalent-T model of a transmission line. 6

5. (a) Distinguish between nominal model and equivalent model of a transmission line? Discuss the significance of these models in performance calculation of power transmission lines. 4

(b) Derive the expressions for the ABCD parameters of a medium transmission line in terms of line parameters considering nominal pi model. 5

(c) A three phase 50 Hz transmission line is 500 km long. The voltage at sending end in 220KV. The line parameters are r = 0.1 ohm/km /phase, x = 0.5 ohm/km/phase and y = 2.5×10^{-6} mho/km/phase. Calculate the sending end current and receiving end voltage when the line is at no load. 7