B.E.Tel.E. 2nd YEAR EXAMINATION, 2018
(2nd Semester)

TRANSMISSION LINES AND WAVEGUIDES

Time: Three hours | Full Marks 100

No. of questions		Marks
	Answer *question no. 1* and any *four* from the rest. Values of universal physical constants may be assumed. Usage of Smith Chart is allowed.	
1.(a)	For a lumped symmetric two port network, determine the characteristic impedance in terms of the elements of its T-equivalent.	6
(b)	Show how this expression is modified for a distributed symmetric two port network.	4
(c)	Repeat the same for its image propagation constant.	10
2.(a)	A generator of 1 V 1KHz supplies power to a 100 km open wire line terminated in 200Ω resistance. The line parameters are: R=10.4 Ω/km L= .00367 h/km G= 0.8 X 10^{-4} S/km Calculate the efficiency of transmission i.e. ratio of power delivered to power supplied.	12
(b)	Establish that a telephone line is liable to suffer from heavy distortion.	8
3.(a)	Derive appropriate expressions for internal fields along an air filled coaxial RF cable in terms of its physical dimensions.	6
(b)	Hence evaluate its characteristic impedance.	6
(c)	Obtain relations for series inductance per unit length and shunt capacitance per unit length for the same cable and thus obtain its characteristic impedance. Show that both approaches lead to identical result.	8
4.(a)	Discuss the theory of quarter wave transformer and its usage.	6
(b)	How can such a transformer be designed for non-resistive loads?	2
(c)	Let us consider that the frequency range within which maximum refection coefficient is 5% as the operating band width of a quarter wave transformer designed to operate between a 50Ω line and a 100Ω load. Calculate its fractional band width.	12
5.(a)	A load has normalized admittance Y_R/G_0=1.25+j0.25. Find the length and location of a short circuited single stub tuner.	10
(b)	A 50Ω lossless slotted line is used to determine an unknown impedance. If the line is terminated in short circuit, adjacent minima are observed at 30cm and 10cm from the load end. With the load connected, VSWR is measured to be 3.2, minimum is at 13.2cm and the adjacent maximum is at 23.2cm from the load end. Find the unknown impedance.	10
6.(a)	Prove that a rectangular waveguide behaves essentially as a high pass filter.	10
(b)	Write a note on power loss in rectangular waveguides.	10

7.(a)	Show and explain a scheme of launching the dominant mode in a rectangular waveguide in one direction only.	8
(b)	Obtain the general solution of Helmholtz wave equation for application in circular waveguides.	12
8.(a)	Show the structure of a microstrip line along with the electric and magnetic field configurations along it with neat sketches.	6
(b)	Why cannot it support pure TEM mode of propagation? Justify the physical argument with formal proof.	6
(c)	Discuss the concept of effective dielectric constant and its limits in this context.	4
(d)	Suggest a planar transmission line structure where both series and shunt mounting of components is convenient.	4