B.E. (ETCE) 2nd YEAR EXAMINATION, 2017
(2nd Semester)
TRANSMISSION LINES AND WAVEGUIDES

Time: Three hours | Full Marks 100

No. of question		Marks

Answer any *five* questions.
All questions carry equal marks.
Assume the values of physical constants as and when required.
Use of Smith Chart is allowed.

1. (a) Consider a cascade connection of infinite ideal lumped T-sections. If each of them represents an infinitesimal length of a uniform transmission line, obtain appropriate expressions for characteristic impedance and propagation constant of the line. 14
   (b) Differentiate between intrinsic impedance, characteristic impedance and wave impedance. 6

2. (a) Measurements are made at 5 kHz on a 0.5 km long line to show that the characteristic impedance to be $94\angle -23.2^\circ\ \Omega$ and the total attenuation to be 0.06 Np. The phase shift between input and output is found to be 8°. Find R,L,G and C per km for the line, the phase velocity on the line and the power lost on the line when the sending end power is 3W and the load is matched. 10
   (b) Derive the condition of distortionless transmission through a line and discuss the feasibility of constructing such a line. 10

3. (a) A high frequency coaxial cable operating at RF has the diameters of the two conductors as 2 mm and 10 mm. Find L and C per unit length of the cable and thence its characteristic impedance. 8
   (b) Recalculate the same after determining the field configurations along the cable and using them justifiably. Also plot the fields on a cross sectional plane. 12

4. (a) A high frequency lossless system operates at 700 MHz with a phase velocity of 2.1×10^8 m/s. In the system, two transmission lines having $R_0=70\ \Omega$ and l=43.5cm for one line (terminated by $j70\Omega$) and $R_0=90\ \Omega$ and l=21cm for the other (terminated by $j70\Omega$) are connected in shunt. The combination is used as load to line#3 having $R_0=50\ \Omega$ and l=1.25m. Find the VSWR on each line and input impedance to line#3. No derivation is necessary. 10
   (b) Discuss how unknown impedance can be measured at RF range of frequencies using a slotted line setup. 10

5. (a) Discuss the principle of operation and usage of a quarter wave transformer. 10
   (b) A line of $R_0=300\ \Omega$ is used to feed an antenna of impedance $73+j42\ \Omega$. For a frequency of 45 MHz, determine the length, termination and location nearest to the load of a shunt stub to provide an impedance match. 10

6. (a) Justify the fact that different waveguides are used for different microwave frequency bands. 4
   (b) Explain why pure TEM mode cannot be sustained for a signal propagating through a waveguide. 4
   (c) Prove that a rectangular waveguide must act as a high pass filter. 12

7. Suppose that the central conductor is withdrawn from the cable mentioned in Q.3. Will it still be able support propagation of a 500 MHz signal through it? Establish your answer rationally showing all derivations. 20

8.	(a)	Establish the mode of operation in a microstrip line.	8
	(b)	Discuss the concept of effective dielectric constant with respect to microstrips.	4
	(c)	How is the line wavelength related to effective dielectric constant.	2
	(d)	Between a normal microstrip and an inverted microstrip, which one can operate over higher frequency ranges? Justify your answer.	6