Registration no: | | | | | | | | | | |

Total Number of Pages: 03 **B.Tech**
PCEC4402

8th Semester Regular / Back Examination 2015-16
MICROWAVE ENGINEERING
Branch: AEIE, ECE, EIE, ETC, IEE
Time: 3 Hours
Max Marks: 70
Q.CODE: W130

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1 Answer the following questions: **(2 x 10)**

a) Write the expression for the attenuation constant (α) phase constant (β), characteristic impedance (Z_o) and phase velocity (V_p) for the Low lossless transmission line.

b) What is a stub? Why short circuited stub is always preferred?

c) Let Z_{sc} be the input impedance of a length of coaxial line when one end is short-circuited, and let Z_{oc} be the input impedance of the line when one end is open-circuited. Derive an expression for the characteristic impedance of the cable in terms of Z_{sc} and Z_{oc}.

d) The conduction current density in a lossy dielectric is given as Jc = 0.02 $\sin(10^9 t)$ A/m^2 . Find the displacement current density if $\sigma = 10^3$ mho/m, ε_r = 6.5 and $\varepsilon_o = 8.854 \times 10^{-12}$.

e) What is frequency pulling and frequency pushing in magnetrons?

f) Differentiate between Gunn diode and P-N junction?

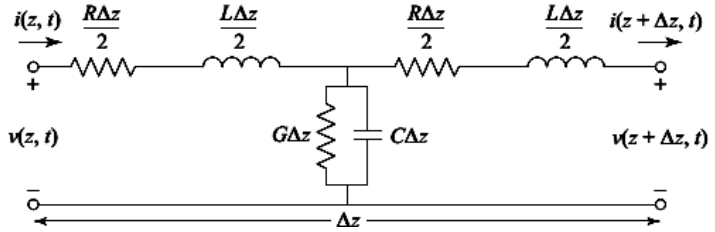
g) What do you mean by slow wave structure? What is its significance?

h) Define scattering matrix parameters of two port network?

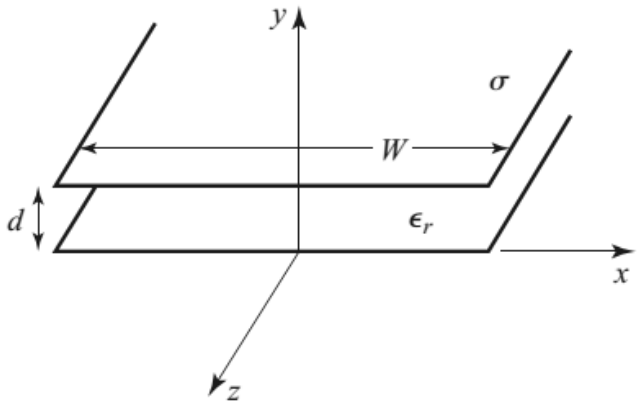
i) What do you mean by evanescent mode, dominant mode, degenerate mode and overmoded in waveguide?

j) What is external quality factor in terms of unloaded quality factor? How the coupling factor deals with the SWR?

Q2 **a)** Show that the T -model of a transmission line shown in the figure also yields the telegrapher equations. **(5)**



b) For the parallel plate line shown in the accompanying figure, derive the R, L, G, and C parameters. Assume W>>d. **(5)**



Q3 **a)** A certain transmission line has characteristic impedance 75 + j0.01Ω and is terminated in a line impedance of 70 + j50Ω. Calculate; **(5)**

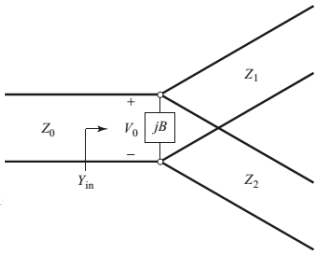
(i) Reflection coefficient
(ii) SWR
(iii) Transmission coefficient
(iv) Insertion loss

b) A lossless line of characteristic impedance R_o= 50 Ω is to be matched to a load $z_L = \frac{50}{[2+j(2+\sqrt{3})]}\Omega$ by means of lossless short circuited stub. The characteristic impedance of the stub is 100Ω. Find the stub position (near to load) and length so that match is obtained. **(5)**

Q4 Derive cyclotron angular frequency, cut off magnetic flux density, cut off voltage of cylindrical magnetron (use appropriate assumption). Hence find those parameters, when it has inner radius 5cm, outer radius 10 cm, beam current 30A, Magnetic flux density is 0.34 Wb/m^2 and beam / dc voltage is 30 KV. **(10)**

Q5 **a)** Prove that it is not possible to construct the three port network lossless, reciprocal and matched at all the ports? **(5)**

b) A lossless T-junction power shown in figure divider has a source impedance of 50Ω. Find the output characteristic impedances so that the output powers are in a 2:1 ratio. Compute the reflection coefficients seen looking into the output ports. **(5)**



Q6 **a)** A Travelling Wave Tube (TWT) has the following characteristics: Beam voltage V_O = 3KV, Beam current I_O = 30 mA, Frequency f = 10 GHz, Circuit Length N = 50 in wavelength, Characteristics impedance Z_o=10Ω. Determine: (i) gain parameter (C) (ii) The output power gain (A_p) in decibel and all four propagation constants. **(5)**

b) A reflex klystron operates with the beam voltage (Vo) 600V, the shunt resistance (R_{sh}) l5KΩ, the resonant frequency (f_r) 9 GHz and the distance of repeller space from anode (*L)* I mm. The tube is oscillating at *fr* at the peak of *then* = 2 mode or 1 3/4 mode. Assume that the transit time through the gap and beam loading can be neglected. **(5)**

(i). Find the value of the repeller voltage.

(ii). Find the direct current necessary to give a microwave gap voltage of 200 V.

(iii) What is the electronic efficiency under this condition?

Q7 **a)** What do you mean by rectangular wave guide? How fields vary in the wave guide? Derive the field components of the rectangular wave guide in terms of E_z and H_z,, the components in the direction of propagation by taking boundary conditions? **(5)**

b) In an air-filled rectangular wave guide with a = 2.286 cm and b = 1.016cm, the y- component of the TE mode is given by. **(5)**

$$E_y = \sin\left(\frac{2\pi}{a}x\right)\cos\left(\frac{3\pi}{a}y\right)\sin\left(10\pi\times10^{10}t-\beta z\right) \quad V/m$$

Find (i) operating mode (ii) The propagation constant and (iii) Intrinsic impedance.

Q8 Write short notes on any two: **(5 x 2)**

a) Two valley theory of Gunn diode

b) Microwave filter by using image parameter method

c) Hazards of Electromagnetic radiation

d) Two-hole Directional coupler