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Total Number of Pages : 02

B.Tech.  
PCEC4402

8<sup>th</sup> Semester Regular / Back Examination 2017-18

MICROWAVE ENGINEERING

BRANCH : AEIE, ECE, EIE, ETC, IEE

Time : 3 Hours

Max Marks : 70

Q.CODE : C243

Answer Question No.1 which is compulsory and any five from the rest.

The figures in the right hand margin indicate marks.

Answer all parts of a question at a place.

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

- Mention the applications of a quarter-wave transformer.
- Find VSWR and Reflection coefficient for an open circuited transmission line.
- What is Gunn Effect in a Gunn oscillator?
- What is the necessity of a matched load after a slotted section?
- Discuss the unitary & Zero property for a scattering matrix.
- What is the Bunching parameter in reflex klystron?
- What is stub? Why short circuited stub is preferred?
- What do you mean by slow wave structure and what is its significance?
- Why TEM mode is not possible inside the waveguide?
- What is rat-race directional coupler?

**Q2 a) An air filled circular waveguide has a radius of 1.5cm and isto carry energy at (5)**

a frequency of 10GHz. Find all TE and TMmodes for which transmission is possible.

**b) A 10-dB directional coupler has a directivity of 40dB. If theinput power at port (5)**

1 is 10mW what are power outputs at port2,3 and 4? Assume the coupler

(a) is lossless and (b) has aninsertion of 0.5dB.

**Q3 a) Derive the input impedance of an open circuited transmission line. What it is (5)**

equivalent to?

**b) A lossless co-axial cable is used to delay a pulse by 100ns. The inductance (5)**

and capacitance of the cable are  $0.2\mu\text{H}/\text{m}$  and  $60\text{pF}/\text{m}$  respectively. Calculate  
(i) characteristics impedance,  
(ii) phase constant  
(iii) input impedance

**Q4 a) Derive the cutoff wavelength of a rectangular waveguide from Maxwell's (5)**

equations. What are the assumptions made in this equation? What is the significance of a cutoff wavelength?

**b) How is frequency meter used in a microwave system? Explain the different (5)**

methods used for frequency measurement of a microwave signal.

**Q5 a) Explain the directional coupler with scattering matrix with proper conditions. (5)**

Discuss how the factors coupling, directivity and isolation affect the performance of the coupler? Find out the transmission loss.

**b) Briefly explain the amplification process of TWT with proper diagram. (5)**

**Q6 a)** Derive the following relationship in reflex klystron. **(5)**

Repeller voltage and Accelerating voltage  
Repeller voltage and frequency of operation.

**b)** Define the quality factor of a Rectangular cavity resonator. Discuss the factors affecting the quality factor. **(5)**

A rectangular waveguide cavity is made from copper ( $\sigma = 5.183 \times 10^7 \text{ s/m}$ ) with  $a=4.755 \text{ cm}$ ,  $b=2.215 \text{ cm}$ . The cavity is made from a dielectric of  $\epsilon_r= 2.25$  and  $\tan\delta = 0.0004$ . If the resonance is to occur at  $f=5 \text{ GHz}$ , find the required length  $d$  and the resulting  $Q$  for the  $l=1$  and  $l=2$  resonant modes.

**Q7** Discuss in brief with suitable diagram the working of a cavity Magnetron. Also establish the relation for minimum anode potential for a  $\pi$  mode of operation. **(10)**

**Q8 Write short answer on any TWO :** **(5 x 2)**

- a) LSA mode of operation for GUNN diode.
- b) Smith chart
- c) Scattering Matrix
- d) Quarter wave matching