

TEC-601

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B.Tech. (VI - Sem.)

Even Semester Examination - 2016

MICROWAVE TECHNIQUES**[Time : 3 Hours]****[Maximum Marks : 100]****Note:** Attempt all questions.

1. Attempt any Four parts:- (5x4=20)

(a) Drive an expression for propagation of TM wave in rectangular waveguide.

(b) Explain with neat and clean diagram the working of Strip line and Microstrip line.

(c) A TE_{11} is propagating through a Circular Wave Guide. The radius of the guide is 5 cm. determine:(i) f_c

(ii) Guide wavelength for a frequency of 3 GHz

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(1)

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(iii) wave impedance.

- (d) Write short note on power transmission and power loss in rectangular waveguide.
- (e) What are the advantages of microwaves over low frequency waves?
- (f) The terminating load of UHF transmission line with characteristics impedance $Z_0 = 50 \Omega$, working at 300 MHz is $(50 + j 50) \Omega$. Calculate the VSWR and reflection coefficient.

2. Attempt any Four parts:- (5x4=20)

- (a) Explain attenuation in circular waveguide.
- (b) With the help of Maxwell's equations prove that the TEM wave cannot propagate in a waveguide.
- (c) Drive an expression for the propagation of TE wave in rectangular cavity resonator.
- (d) A cavity resonator with dimensions $a= 2$ cm, $b= 1$ cm is excited by TE_{101} mode of 20 GHz. Calculate the length of the cavity.
- (e) Write note on quality factor of a cavity resonator.
- (f) A circular wave guide has a radius of 3 cm and is used as a resonator for TM_{011} mode at 10 GHz by placing two perfectly conducting plates at

its two ends. Determine minimum distance between two end plates.

3. Attempt any Two parts:- (10x2=20)

(a) With the help of scattering matrix explain why a hybrid E-H plane tee is referred to as a Magic Tee?

(b) What are the properties of scattering matrix? Explain the working of a two-hole Directional Coupler. Drive its scattering matrix.

(c) Explain the concept of Faraday rotation. Explain the operation of any one microwave component that makes use of Faraday rotation.

4. Attempt any Two parts:- (10x2=20)

(a) Compare the power ratio and RF Substitution methods of measuring Attenuation provided by a microwave component.

(b) Explain frequency pulling and frequency pushing as related to a magnetron. A normal circular magnetron has the following parameters:

Inner radius = $R_i = 0.15$ m

Outer Radius $R_o = 0.45$ m

Magnetic Flux Density $B_0 = 1.2 \text{ mWb/m}^2$

Calculate :

- (i) cut-off voltage.
- (ii) cut-off magnetic flux density if beam voltage is 6000 V.
- (c) Explain the methods for the measurement of medium microwave power, high microwave power and impedance.

5. Attempt any Two parts:- (10x2=20)

- (a) What are the high frequency limitations of conventional tubes? Explain how these limitations are overcome with the use of microwave tubes?
- (b) What is velocity modulation? How is it different from normal modulation? Explain how velocity modulation is utilized in Klystron amplifier?
- (c) Differentiate between a klystron and reflex klystron. A two cavity Klystron amplifier has the following specifications;

Beam Voltage = 900 V

Beam Current = 30 mA

Frequency = 8 GHz

Gap Spacing in each cavity = 1 mm

Spacing between centers of cavities = 4 Cm

Effective Shunt impedance = $R_{sh} = 40 \text{ k}\Omega$

Calculate:

- (i) The electron velocity.
- (ii) dc transit time.
- (iii) Maximum Input voltage.
- (iv) Voltage gain.

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