Printed pages: 02 **Sub Code: NEC 601**

Paper Id: **131631** **Roll No:** | | | | | | | | | | |

B TECH
(SEM-VI) THEORY EXAMINATION 2017-18
MICROWAVE ENGINEERING

Time: 3 Hours ***Total Marks: 100***

Note: 1. Attempt all Sections.
2. Assume any missing data.

SECTION A

1. Attempt *all* questions in brief. **2 x10 = 20**

a. Why TEM mode cannot exist in Rectangular waveguide.
b. Differentiate dominant and degenerative mode in waveguide.
c. Define S Matrix.
d. Give the difference between Isolator and Circulator.
e. Give the drawbacks of klystron amplifiers.
f. What is backward wave oscillator (BWO)? State the applications of BWO.
g. State the conditions for an IMPATT diode to produce oscillations.
h. What is the effect of transit time?
i. Define VSWR.
j. What do you mean by slotted line?

SECTION B

2. Attempt any *three* of the following: **10 x 3 = 30**

a. What is a microwave cavity resonator? Explain it with suitable diagram and equivalent circuit. Where does it find applications?
b. What are S-parameters? Why are they used at microwave frequencies to describe multipoint network? Show that the scattering matrix of four port circular using magic tees is

$$[S] = \begin{bmatrix} 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}$$

c. Explain in detail about 2-cavity klystron amplifier.
d. Describe the operating principle and characteristics of Microwave Tunnel Diode and explain two of its applications.
e. What are the various methods for measuring frequency? Discuss them in detail.

SECTION C

3. Attempt any one parts of the following: **10 x 1 = 10**

a. Write down the advantages, disadvantages and application of a circular waveguide. A circular waveguide in a dominate mode at a frequency of 9 GHz have initial diameter of 5 cm. Calculate guide wavelength and cutoff wavelength.

b. Derive the field distribution of TE_{10} mode in rectangular waveguide and draw its field pattern. Show that TE_{01} and TM_{10} modes do not exist in rectangular waveguide.

4. Attempt any one parts of the following: **10 x 1 = 10**

a) Explain the construction and working of directional coupler. Derive expression for coupling factor and directivity. Compare single hole and double hole directional coupler.

b) (i) Explain the working and applications of circulator. Are they reciprocal or Non reciprocal device?
(ii) What is Faraday rotation? How it is used in designing microwave components?

5. Attempt any one parts of the following: **10 x 1 = 10**

a) Draw the schematic diagram of TWT amplifier and describe its principle of operation. Give the propagation characteristics of different waves generated in the amplifier

b) What are the limitations of conventional active devices at microwave frequency? Explain.

6. Attempt any one parts of the following: **10 x 1 = 10**

a) Explain IMPATT and TRAPATT diodes in detail and compare their performance.

b) Explain:

(i) Microwave bipolar junction Transistor.

(ii) Transferred electron devices.

7. Attempt any one parts of the following: **10 x 1 = 10**

a) What do you mean by insertion loss and attenuation? Discuss any one method for measurement of attenuation using microwave test bench.

b) Explain the working of frequency meter in detail. Discuss how we can measure the unknown Load with the help of microwave test bench.