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**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 x 10 = 20**
- Why TEM mode cannot exist in Rectangular waveguide.
  - Differentiate dominant and degenerative mode in waveguide.
  - Define S Matrix.
  - Give the difference between Isolator and Circulator.
  - Give the drawbacks of klystron amplifiers.
  - What is backward wave oscillator (BWO)? State the applications of BWO.
  - State the conditions for an IMPATT diode to produce oscillations.
  - What is the effect of transit time?
  - Define VSWR.
  - What do you mean by slotted line?

**SECTION B**

2. Attempt any *three* of the following: **10 x 3 = 30**
- What is a microwave cavity resonator? Explain it with suitable diagram and equivalent circuit. Where does it find applications?
  - 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

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

- Explain in detail about 2-cavity klystron amplifier.
- Describe the operating principle and characteristics of Microwave Tunnel Diode and explain two of its applications.
- 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<sub>10</sub> mode in rectangular waveguide and draw its field pattern. Show that TE<sub>01</sub> and TM<sub>10</sub> 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.