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**Examination Session June-2022**

**(Fourth Semester)**

**MPHY-608**

**M.Sc. PHYSICS (MSCPHY)**

**[ Microwave Devices ]**

**Time : 2 Hours ]**

**[ Max. Marks : 40**

**Note :** This paper is of Forty (40) marks divided into two (02) Section A and B. Attempt the questions contained in these sections according to the detailed instructions given therein.

**SECTION—A**

**(Long-Answer-Type Questions)**

**Note :** Section 'A' contains five (05) long-answer-type questions of Ten (10) marks each. Learners are required to answer any two (02) questions only. 2×10=20

**MPHY-608/3**

**( 1 )**

**[P.T.O.]**

1. Define cut-off wavelength and cut-off frequency. What is the relation between  $\lambda_p$ ,  $\lambda_c$  and  $\lambda_0$  ? Also derive expression for  $v_p$  and  $v_g$ .
2. What are the characteristics of rectangular waveguides? Derive the field equations in a rectangular waveguide.
3. What are the properties of S-matrix ? Discuss about the scattering matrix of a two-port junction.
4. Explain the construction and operation of Tunnel diode and its volt-ampere characteristics. Also explain the applications of Tunnel diode.
5. What is directional coupler ? Derive expression for the scattering matrix of a directional coupler.

### SECTION—B

#### (Short-Answer-Type Questions)

**Note :** Section 'B' contains eight (08) short-answer-type questions of Five (05) marks each. Learners are required to answer any four (04) questions only.  $4 \times 5 = 20$

1. What are the characteristics of “Magic tee” ? Also derive the scattering matrix of Magic tee.
2. Describe the construction and working of a “Gyrator” and “Isolator”.
3. Explain the operating principle of IMPATT diode and its major disadvantages.
4. Explain parametric up/down converter.
5. Derive an expression for the S-matrix for a shunt element.
6. What is phase velocity ? Discuss about reflection in a parallel plane waveguide.
7. Discuss the propagation of TM waves in a rectangular waveguide.
8. Derive field equations in a circular waveguide.

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