National Institute of Technology, Hamirpur (HP)

Name of Examination: B. Tech/DD End- Semester Examination (November-2022)

Department: **Electronics & Communication Engineering**   Semester: **5th**

Title of the Course: **Microwave Devices & Systems**   Course Code: **EC-314**

Time: **180 Minutes**   Maximum Marks: **50**

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Note:
    1. All the questions are compulsory.
    2. The Marks of each question is indicated against the question.

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Q. 1. A rectangular waveguide is filled by dielectric material $\varepsilon_r = 9$ and has inside   [3 Marks]
dimensions of 7×3.5 cm. It operates in the dominant TE_{10} mode.
(a) Determine the cutoff frequency
(b) Find the group velocity in the guide at a frequency of 2 GHz.
(c) Find the guided wavelength at the same frequency.

Q. 2. Derive necessary equation for *TE* modes in rectangular waveguide.   [6 Marks]

Q. 3. Write short notes on TWT.   [5 Marks]

Q. 4. A two cavity klystron is to give maximum power output at fundamental   [3 Marks]
frequency of 6 GHz. The accelerating voltage is 1000 volts and coupling coefficient
is unity. What is the optimal length of the drift space?

Q. 5. Derive S-matrix for E-Plane Tee.   [4 Marks]

Q. 6. A symmetric directional coupler has an infinite directivity and a forward   [5 Marks]
attenuation of **20 dB**. The coupler is used to monitor the power delivered to a load Z_l
as shown in figure. Bolometer 1 introduces a VSWR of 2.0 on arm 1, bolometer 2 is
matched to arm 2. If bolometer 1 reads **9 mW** and bolometer 2 read **3 mW**. Then
determine (a) power dissipated in the load Z_l and (b) VSWR on arm 3.
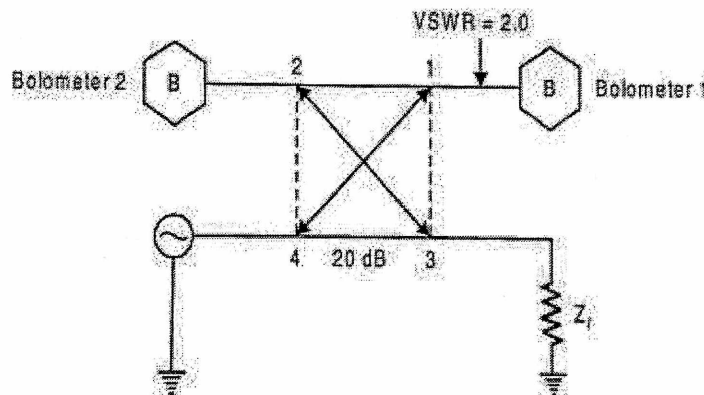
Q. 7. With suitable diagram, discuss modes of operation of Gunn Diode.   [4 Marks]

Q. 8. Write short notes on Tunnel Diode.   [5 Marks]

Q. 9. With suitable diagram plot field distribution and write dominant mode of   [6 Marks]
propagation of (a) microstrip line (b) parallel strip line and (c) coplanar strip line.

Q. 10. A microstrip line is made of copper conductor 0.254 mm wide on a G-10   [4 Marks]
fiberglass-epoxy board 0.20 mm in height. The relative dielectric constant of the board
material is $\varepsilon_r = 4.8$. The microstrip line 0.035 mm thick is to be used for 10 GHz.
Determine the characteristics impedance of microstrip line.

Q. 11. Write short notes on Measurement of Standing Wave Ratio.   [5 Marks]