Graphic Era
HILL UNIVERSITY
Established by an Act of the State Legislature of Uttarakhand (Adhiniyam Sankhya 12 of 2011)
University under section 2(f) of UGC Act, 1956

End Term (Even) Semester Examination May-June 2025

Roll no...............................

Name of the Program and semester: B-Tech ECE, VI Semester
Name of the Course: *Microwave Engineering*
Course Code: TEC-601

Time: 3 hour   Maximum Marks: 100

Note:
   (i)   All the questions are compulsory.
   (ii) Answer any two sub questions from a, b and c in each main question.
   (iii) Total marks for each question is 20 (twenty).
   (iv) Each sub-question carries 10 marks.

Q1.   CO1 (2X10=20 Marks)
a. Explain TM modes propagation in a circular wave guide.
b. A hollow rectangular wave guide has dimensions a=4 cm and b=2 cm. Calculate the amount of attenuation if the frequency is 3 GHz.
c. A hollow air-filled rectangular waveguide has dimensions a = 3.5 cm, b = 1.8 cm. The frequency of the impressed signal is 6 GHz. Identify all the possible modes of propagation. Also, calculate the phase velocity and wave impedance for the dominant mode.

Q2.   CO3 (2X10=20 Marks)
a. Explain tunneling when different bias potentials are applied to a tunnel diode. Show the negative resistance region and discuss its significance to design microwave sources.
b. Draw and explain the schematic of a two-cavity klystron oscillator. How bunching of electrons occur ?
c. Draw the schematic of a TWT device and discuss its working principle.

Q3.   CO2 (2X10=20 Marks)
a. Draw and explain the block diagram of a directional coupler. Write down the properties and all the parameters associated with a directional coupler.
b. Draw and explain Magic TEE. Write down its S-matrix and all the properties.
c. Write scattering matrix of ideal isolator. In an isolator the isolation is 25dB and insertion loss is 3dB. Find its scattering parameter.

Q4.   CO4 (2X10=20 Marks)
a. Explain spectrum analyzer with the help of a block diagram.
b. Explain the mechanism of S-Parameter measurements for a 3-port microwave network.
c. A 100W power source is connected to the input of directional coupler with C= 15dB, D=25dB and insertion loss of 0.5dB. Find the output powers at the through, coupled and isolated ports. Assume all ports to be matched.

Q5.   CO5, CO6 (2X10=20 Marks)
a. Discuss the step-by-step process for a Low-pass prototype filter design.
b. Write short notes on:
   i.   RFID
   ii. MMIC
c. Explain filter implementation technique using Richard transformation.