Code No.: EC702PC | R20 | H.T.No. | | | 8 | R | | | | | | |

# CMR ENGINEERING COLLEGE: : HYDERABAD
## UGC AUTONOMOUS
## IV–B.TECH–I–Semester End Examinations (Regular) - November- 2023
## MICROWAVE ENGINEERING
## (ECE)

**[Time: 3 Hours]** **[Max. Marks: 70]**

**Note:** This question paper contains two parts A and B.
Part A is compulsory which carries 20 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

**PART-A** **(20 Marks)**

1. a) Determine the group velocity and phase velocity for a dominant mode propagating through a waveguide of breadth 10cms at frequency 2.5GHz. [2M]
   b) List out the advantages of micro-strip line over rectangular wave guide. [2M]
   c) Calculate the attenuation of a rotary Vane attenuator if the angle of rotation is 34 degrees. [2M]
   d) Explain about Gyrator. [2M]
   e) What are most important microwave tubes at the linear-beam tubes (O type) [2M]
   f) Write the characteristics of a two-cavity klystron amplifier [2M]
   g) Explain resonant modes in magnetron. [2M]
   h) Distinguish between O – type tubes and M – type tubes [2M]
   i) Explain the principle of H Plane Tee. [2M]
   j) Define Voltage standing wave ratio [2M]

**PART-B** **(50 Marks)**

2. What are Microwave spectrum bands? Explain briefly the Applications of Microwaves at various frequency bands. [10M]

**OR**

3. Derive the Characteristic impedance of a Micro Strip Lines. [10M]

4. Describe the working of a Rotary Vane Attenuator, with neat schematic. [10M]

**OR**

5. Explain the principle of working of a E-plane Tee junction with neat sketches. [10M]

6.a) Explain with neat sketches the working of Two cavity Klystron. [7M]
   b) A two-cavity amplifier klystron has the following parameters: Beam voltage: Beam current: Frequency: Gap spacing in either cavity: Vo=900V Io= 30 mA f = 8 GHz d = 1 mm Spacing between centers of cavities: l = 4cm Effective shunt impedance: R,h = 40 kfl [3M]
   Determine:
   i. The electron velocity
   ii. The de electron transit time
   iii. The input voltage for maximum output voltage
   iv. The voltage gain in decibels

**OR**

7. Draw the equivalent circuit of reflex klystron & explain its working with neat sketches. [10M]

8.a) Explain the working of a Magnetron with neat sketches. [7M]

b) An X-band pulsed cylindrical magnetron has the following operating parameters: [3M]
Anode voltage: Vo = 26 kV ,Beam current: Io = 27 A ,Magnetic flux density: Bo = 0.336 Wb/m2 ,Radius of cathode cylinder: a = 5 cm Radius of vane edge to center: b = 10 cm
Compute:
i. The cyclotron angular frequency
ii. The cutoff voltage for a fixed Bo
iii. The cutoff magnetic flux density for a fixed Vo

**OR**

9. Discuss in detail the principle of operation of GUNN diode [10M]

10. Explain the principle of working of H-Plane Tee Junction with neat sketches. [10M]

**OR**

11. How do you measure microwave power using a Bolometer. [10M]

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