Dr Amit Bage

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Roll No.....

National Institute of Technology, Hamirpur (HP)

Name of Examination: B. Tech/DD End- Semester Examination (November-2023)

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

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

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

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

Q. 1.

(a) The guided wavelength for a frequency of 20,000 MHz is 6 cm, when the dominant mode is propagated in an air-filled rectangular waveguide. Find the breadth of the guide? [2.5 Marks]

(b) An air filled circular waveguide is to have dimensions such that $f_c = 0.6f$ for TE_{11} mode and is to be operated at a frequency of 4 GHz. Determine the diameter of the waveguide. [2.5 Marks]

Q. 2.

(a) By means of Applegate diagram explain the operation of a reflex klystron. [5 Marks]

(b) With the aid of a schematic diagram, describe the travelling wave tube amplifier. [5 Marks]

Q. 3.

(a) Derive the S-matrix of a magic tee and discuss different input-output relations. [5 Marks]

(b) Find the S matrix for a three-port port circulator with an insertion loss of 0.5 dB, an isolation of 15 dB, and a VSWR of 1.5. [5 Marks]

Q. 4.

(a) Explain the Gunn effect using the two-valley theory. Also, explain several modes of operation of Gunn diode. [5 Marks]

(b) Explain the working mechanism & V-I characteristics of a tunnel diode. [5 Marks]

Q.5. A microstrip line is made of a copper conductor its dimensions are as follows: 0.362 mm in width on a G-10 fiber glass-epoxy board which is 0.30 mm in height. The relative dielectric constant of the board material measured at 30 GHz is 5.2. The microstrip line of 0.028 mm thickness is used for 15 GHz. Assume the conductivity of copper is 5.96×10^7 ℧/ cm. Determine the parameters given below: (i) Characteristic impedance Z_0 of the microstrip line (ii) Surface resistivity R_s of the copper conductor (iii) Conductor attenuation constant α_c
(iv) Quality factors Q_c [5 Marks]

Q. 6.

(a) Discuss methods for the measurement of low and high microwave power. [5 Marks]

(b) Explain the method of measurement of wavelength and frequency. [5 Marks]

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