

510705

Roll No. _____

Total No. of Pages: **3**

510705

B. Tech. V - Sem. (Main/Back) Exam., (Academic Session 2021- 2022)
Electronics & Communication Engineering
5EC4 – 05 Microwave Theory and Techniques

Time: 3 Hours

Maximum Marks: 120
Min. Passing Marks:

Instructions to Candidates:

Part – A: Short answer questions (up to 25 words) 10×2 marks = 20 marks.
All ten questions are compulsory.

Part – B: Analytical/Problem solving questions 5×8 marks = 40 marks.
Candidates have to answer **five** questions out of seven.

Part – C: Descriptive/Analytical/Problem Solving questions 4×15 marks = 60 marks.
Candidates have to answer **four** questions out of five.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

*Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)*

1. NIL

2. NIL

PART – A

6

- Q.1 What are the advantages and disadvantages of microwave signals? [2]
Q.2 Define TE and TM modes. [2]
Q.3 Define dominant mode in waveguide. [2]
Q.4 List properties of scattering matrix. [2]
Q.5 Explain velocity modulation. [2]

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- Q.6 Explain Hartree condition. [2]
- Q.7 What is directivity and antenna gain? [2]
- Q.8 Explain image impedance. [2]
- Q.9 A pulse radar operating at 10 GHz has an antenna with a gain of 28 dB and a transmitter power of 2kW (pulse power). If it is desired to detect a target with a cross section of 12m^2 , and the minimum detectable signal is -90 dBm, what is the maximum range of the radar? [2]
- Q.10 Describe microwave imaging. [2]

PART – B

- Q.1 Derive the field components for TE mode in a rectangular waveguide. [8]
- Q.2 Derive scattering matrix for E-plane Tee, H-plane Tee, Magic Tee and Circulator. [8]
- Q.3 Explain the working of a magnetron and derive the equations of Hull cut off voltage and magnetic field. [8]
- Q.4 Design a three section binomial transformer to match a 100Ω load to a 50Ω line. The maximum VSWR that can be tolerated is 1.1. Calculate the obtained bandwidth. [8]
- Q.5 What is low VSWR? Explain the method of measuring very high VSWR? [8]
- Q.6 With reference to microstrip line discuss the following characteristics - [8]
- (a) Effective dielectric constant
 - (b) Characteristic impedance
 - (c) Losses in microstrip line
 - (d) Electric and magnetic field lines
- Q.7 Explain the working of basic RADAR with the help of a block diagram. [8]

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PART – C

Q.1 A two-port network is known to have the following scattering matrix –

$$[S] = \begin{bmatrix} 0.15\angle 0^\circ & 0.85\angle -45^\circ \\ 0.85\angle 45^\circ & 0.2\angle 0^\circ \end{bmatrix}$$

Determine, if the network is reciprocal and lossless. If port 2 is terminated with a matched load, what is the return loss seen at port 1? If port 2 is terminated with a short circuit, what is the return loss seen at port 1? [15]

Q.2 Describe the physical structure, negative resistance, power output and efficiency of IMPATT diodes. [15]

Q.3 (a) Draw circuit diagrams of impedance and admittance inverters along with their operation circuit diagram. [3]

(b) Their implementation as quarter-wave transformers. [3]

(c) Their implementation using transmission lines and reactive elements. [3]

(d) Their implementation using capacitor networks. Kindly mention the required equations. [3]

(e) Draw the circuit diagrams of the four Kuroda Identities. [3]

Q.4 With block diagrams explain the operation of spectrum analyzer and network analyzer. [15]

Q.5 (a) Describe the process involved in MMICs fabrication. [5]

(b) Write down the medical and civil applications with suitable diagram of microwaves. [5]

(c) Write short notes on [5]

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