5E1395

Roll No. _____

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B. Tech. V - Sem. (Main / Back) Exam., Feb.-March - 2021

PCC/PEC Electronics & Communication Engineering

5EC 4–05 Microwave Theory & Techniques

Time: 2 Hours **[To be converted as per scheme]**

Max. Marks: 82

Min. Marks: 29

Instructions to Candidates:

Attempt all ten questions from Part A, four questions out of eight questions from Part B and two questions out of seven from Part C.

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

(Answer should be given up to 25 words only) **[10×2=20]**

All questions are compulsory

Q.1 If the cutoff frequency of an air-filled waveguide is 20 GHz then what will be its cut off frequency after filling with a dielectric material of relative dielectric constant $\varepsilon_r = 16$?

Q.2 Write S – parameter units.

Q.3 Write two differences between MIC and MMIC.

Q.4 If cutoff frequency of TE_{11} mode is 5 GHz then find the operating frequency of TE_{02} mode.

Q.5 Draw the structure of an E – plane horn.

Q.6 Write the name of one dominant loss in waveguide.

Q.7 Define noise figure of a MW amplifier.

Q.8 Write the name of two MW devices which works on bulk and do not have any semiconductor junction.

Q.9 Why PIN diode speed is more than a normal PN junction? Give only the main reason.

Q.10 Write the name of two MW frequency bands used in military application.

PART – B

(Analytical/Problem solving questions) **[4×8=32]**

Attempt any four questions

Q.1 Draw the structure of a MW BJT (Heterojunction) and explain its model and working.

Q.2 Why TEM mode is not possible inside waveguide, support the reasons with Maxwell's equations. How TE and TM modes are excited in a rectangular waveguide?

Q.3 Explain any one scheme of MW power measurement when the MW power is less than 1 Watt.

Q.4 How differential negative mobility region achieved in MW devices? Draw the two valley diagram of a Gunn diode and explain its working.

Q.5 Draw the electric and magnetic field line distributions/pattern in –

(a) Microstrip line

(b) Co-planar line

Q.6 Design a power divider with matched terminations and operating at 10 GHz.

Q.7 Explain and write the s-parameter of a magic tee when it's all port are matched. What will be the effect on port mismatch and how S-parameter change with it?

Q.8 Draw the electric and magnetic field pattern inside a waveguide at –

(b) TM_{21}

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions) **[2×15=30]**

Attempt any two questions

Q.1 **Find all electric and magnetic fields expression for TM mode inside a rectangular waveguide with the help of Maxwell's equations.**

Q.2 **If the S parameter of a two port MW system is $S_{11} = 2 + j1$, $S_{21} = 4 + J1$, $S_{12} = 2+j1$ and $S_{22} = 0.6 + j2$. Find its gain, reflection and transmission constant.**

Q.3 **Explain the working of two hole directional coupler and design it for f = 5 GHz. Assume the waveguide is filled with $\varepsilon_r = 4$.**

Q.4 **Explain the impedance measurement technique used in MW system.**

Q.5 **Define the quality factor of a MW resonator and explain its –**

(a) Under coupling

(b) Over coupling

(c) Critical coupling conditions

Q.6 **Define EMI and EMC. Draw two scheme for obtain the MW system which is compatible with required EMI/EMC.**

Q.7 **How Klystron works? Draw the structure of a two cavity Klystron and explain the bunching phenomena in it.**
