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<b>R-19</b>
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**Code: 19A463T**

III B.Tech. II Semester Supplementary Examinations April 2023

**Microwave Engineering**

(Electronics and Communication Engineering)

Max. Marks: 70

Time: 3 Hours

Answer any five full questions by choosing one question from each unit (5x14 = 70 Marks)

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<b>UNIT-I</b>
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1. Based on Maxwell's equations, derive the field equations and prove that TEM wave cannot exist in Rectangular Wave Guide? 14M

**OR**

2. a) List the various bands in microwave spectrum. Write the advantages and applications of microwaves 7M
- b) A rectangular waveguide with dimension of 3x2 cms operates in TM<sub>11</sub> mode at 10GHz. Determine the characteristic wave impedance. 7M

<b>UNIT-II</b>
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3. a) Derive expressions for Phase Velocity, Group Velocity, Guide Wavelength, and Wave Impedance in Circular Waveguides 7M
- b) Calculate resonant frequency for a circular waveguide resonator having dia of 6cm and length = 1.62 cm for the modes TM<sub>011</sub>, TE<sub>011</sub>, TE<sub>012</sub>. 7M

**OR**

4. a) Derive the Cut-off Wavelength in Circular Waveguide, Dominant and Degenerate Modes 7M
- b) In a circular cavity, its resonant frequency for TE<sub>101</sub> mode is 5 GHz, if d = 2 a. Find its dimensions. 7M

<b>UNIT-III</b>
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5. a) Derive the S- Parameters for E plane Tee. Assume that the T is lossless and reciprocal. 7M
- b) What is directional coupler? Explain the operation of 2-hole directional coupler with neat diagram. Give the expressions for Coupling Factor and for Directivity. 7M

**OR**

6. a) Derive the S- Parameters of Magic Tee and list the various applications of Magic Tee 7M
- b) In a magic tee the ports 1, 2, and 4 are having load such that the reflection coefficients in these arms are  $\Gamma_1 = 0.5$ ,  $\Gamma_2 = 0.6$ ,  $\Gamma_4 = 0.8$ . When we feed 10 W into fully matched port 3, find the reflected power in this arm 3 and the power outputs in remaining arms 7M

<b>UNIT-IV</b>
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7. With a neat sketch, explain the structure and principle of operation of TWT Amplifier 14M

**OR**

8. a) Explain output power and efficiency in reflex klystron. 7M
- b) With neat diagram explain the operation of helix TWT 7M

<b>UNIT-V</b>
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9. a) Explain the basic principle behind Gunn diode. 7M
- b) Explain the operation of IMPATT Diode 7M

**OR**

10. Using microwave test bench setup, Explain the measurement of  
i) Power ii) Q-factor 14M

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