

B.Tech III Year II Semester (R09) Supplementary Examinations May/June 2016

**MICROWAVE ENGINEERING**

(Electronics and Communication Engineering)

Time: 3 hours

Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

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- 1 Derive the expressions for the field components due to TE waves in rectangular waveguide.
- 2 An air filled resonant cavity with dimensions  $a = 5$  cm,  $b = 4$  cm and  $c = 10$  cm is made of copper ( $\sigma_c = 5.8 \times 10^7$  mhos/m). It is filled with a lossless material ( $\epsilon_r = 3$ ). Find the resonant frequency  $f_r$  and the quality factor for  $TE_{101}$  mode.
- 3 Draw the H-plane Tee diagram, equivalent circuit and field diagram and explain how power is coupled into port 3.
- 4 Show that the scattering matrix for shunt T-junction matched at arm 3 is given by:
$$[s] = \frac{1}{2} \begin{bmatrix} -1 & 1 & \sqrt{2} \\ 1 & -1 & \sqrt{2} \\ \sqrt{2} & \sqrt{2} & 0 \end{bmatrix}$$
- 5 (a) Discuss about the classification of linear beam tubes (O-type).  
(b) A reflex klystron operates at the peak mode of  $n = 2$  with beam voltage  $V_0 = 300$  V. Beam current  $I_0 = 20$  mA, signal voltage  $V_1 = 40$  V. Determine: (i) Input power in watts. (ii) Output power in watts. (iii) Efficiency.
- 6 (a) Explain how the oscillations are sustained in cavity magnetron with suitable sketches assuming that the  $\pi$ -mode oscillations already exist.  
(b) Explain how the same effect is obtained without strapping.
- 7 (a) Explain the principle of operation of IMPATT diode. Mention its performance characteristics.  
(b) List advantages of using Gunn diodes over IMPATT diodes.
- 8 (a) Draw the basic spectrum analyzer block diagram and explain how it works.  
(b) Compare the methods of impedance measurement using slotted line and reflectometer.

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