

**B.Tech. – VIEP – ELECTRONICS AND  
COMMUNICATION ENGINEERING  
(BTECVI)**

**00103 Term-End Examination**

**June, 2018**

**BIEL-016 : MICROWAVE AND RADAR ENGINEERING**

*Time : 3 hours*

*Maximum Marks : 70*

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*Note : Attempt any seven questions. All questions carry equal marks. Use of scientific calculator is allowed. Make suitable assumptions if required.*

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1. (a) What are degenerate modes ? Explain why TEM mode cannot exist in metallic waveguides. 5
- (b) What is a microstrip line ? How does its characteristic impedance change with width to height ratio ? 5
2. Derive the field expressions for a rectangular cavity resonator with necessary field diagrams. 10

3. (a) Draw and explain the working principle of directional couplers. 5
- (b) A rectangular cavity resonator has dimensions  $a = 7.5$  cm,  $b = 4$  cm and  $c = 16$  cm. Calculate the resonant frequency in  $TE_{101}$  mode and cut-off wave number. 5
4. (a) Describe the self-balancing bridge technique for power measurement. 5
- (b) What are the limitations of conventional active devices at microwave frequencies ? 5
5. (a) Why is VSWR (voltage standing wave ratio) measurement is one of the most important measurements ? List out the various other parameter measurements. 5
- (b) A slotted line is used to measure the frequency and it was found that the distance between the nulls is 1.85 cm. Given the guide dimensions as  $3$  cm  $\times$   $1.5$  cm, calculate the frequency. 5
6. (a) What is velocity modulation ? Explain how velocity modulation is utilised in a Klystron amplifier. 5
- (b) Draw the cross-sectional diagram of a magnetron and derive the expression for cut-off voltage. 5

7. Describe the construction and working principle of a two cavity Klystron amplifier. Also write down its performance characteristics and applications. 10
8. (a) Explain the working principle of a tunnel diode with its volt-ampere characteristics. 5
- (b) An IMPATT diode has the specification as  $C_D = 0.5 \text{ pF}$ ,  $L_P = 0.5 \text{ nH}$  and  $C_P$  is negligible. If the breakdown voltage is  $110 \text{ V}$ , bias current =  $100 \text{ mA}$ ; peak RF current =  $0.9 \text{ A}$ ; load =  $2 \Omega$ ,  $L = 4.8 \mu\text{m}$ ,  $V_d = 10^7 \text{ cm/sec}$ , find the resonant frequency of packaged diode, efficiency and operating frequency. 5
9. (a) Derive the simplified version of radar range equation in terms of minimum detectable signal to noise ratio,  $(S/N)_{\min}$ . 5
- (b) Draw the functional block diagram of MTI radar system and explain its operation. 5
10. Write short notes on any *two* of the following :  $2 \times 5 = 10$
- (a) Radar Displays
- (b) Excitation of Waveguides
- (c) Radar Clutter