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E – 2478

Reg. No. : .....

Name : .....

**Eighth Semester B.Tech. Degree Examination, May 2018  
(2013 Scheme)  
13.805.6 : MICROWAVE DEVICES AND CIRCUITS (T)  
(Elective – V)**

Time : 3 Hours

Max. Marks : 100

**PART – A**

Answer **all** questions, **each** carry **2** marks.

1. Justify why  $TM_{10}$  and  $TM_{01}$  modes in rectangular waveguide do not exist.
2. Define Q factor of a resonator.
3. A certain microstrip line has the following parameters.  $\epsilon_r = 5.23$ ,  $h = 7$  mils,  $t = 2.8$  mils,  $w = 10$  mils. Calculate the characteristic impedance  $Z_0$  of the line.
4. Justify why diagonal elements in a directional coupler are zero. Also write the S matrix.
5. Define the working principle of stub matching.
6. Compare the three different physical structures of the transistor used in microwave.
7. List any two features of high mobility transistor.
8. Define Gunn effect.
9. List any four application of MASER.
10. List the properties of parametric up converter.

**PART – B**

Answer **any one** question from **each** Module, **each** carries **20** marks.

**Module – I**

11. Derive Helmholtz equation in rectangular coordinates. Derive the equation for electric fields and magnetic fields for TE modes in rectangular waveguides.

OR

12. Derive Helmholtz equation in circular coordinates. Derive the equation for electric fields and magnetic fields for TE modes in circular waveguides.

P.T.O.



### Module – II

13. Define Tee junction and write three characteristics of a three port junction. Explain the workings, S matrix of E plane tee.

OR

14. Explain the working of a two – hole and 4 port directional coupler. Write the S matrix of 4 port directional coupler.

### Module – III

15. Explain the physical structure, working of IMPATT diode. Derive the expression for power output and efficiency.

OR

16. a) Explain the physical structure, working of Hetero-junction transistor. 15
- b) A Ge-Ga As Hetero-junction transistor has electron affinity for Ge,  $X^1 = 4 \text{ eV}$  and for GaAs,  $X^2 = 4.07 \text{ eV}$ . Energy gap,  $E_g$  for Ge and Ga As are  $0.8 \text{ eV}$  and  $1.43 \text{ eV}$  respectively. Compute conduction band differential and valance band differential between Ge and GaAs. 5

### Module – IV

17. a) Derive and explain Manley-Rowe power relations for parametric amplifier. 10
- b) Describe the following terms of a negative resistance amplifier with suitable diagrams :
- i) Two valley model
- ii) High field domain. 10

OR

18. Explain the working principle of MASER in detailed with help of neat diagrams.
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