



(Pages : 2)

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Reg. No. :

Name :

**Seventh Semester B.Tech. Degree Examination, November 2015
(2008 Scheme)**

08.703 : MICROWAVE ENGINEERING (T)

Time : 3 Hours

PART – A



Max. Marks : 100

Answer **all** questions :

1. List the limitations of vacuum tubes at microwave frequencies.
2. The cut off wavelength for a circular air filled waveguide for dominant mode is 10 cm. Find the required cross sectional area and the required frequencies that can be used for this mode of propagation.
3. What are re-entrant cavities ? Mention their importance. Where they are used ?
4. Draw the apple gate diagram of a two cavity klystron. Mention its importance.
5. Describe the negative resistance phenomenon of gunn effect diodes.
6. List the properties of high field domain in GaAs diode.
7. Calculate the pinch off voltage of the GaAs MESFET with a channel height $0.01 \mu\text{m}$ and electron concentration $8 \times 10^{17} \text{cm}^{-3}$. The relative dielectric constant is 13.10.
8. Discuss Faraday rotation in ferrites.
9. List the advantages of microwave communication system.
10. Describe diversity reception in microwave communication. **(10×4=40 Marks)**

PART – B

Answer **any two** questions from **each** Module.

Module – I

11. a) Explain the construction and working of a klystron oscillator. **5**
b) Describe an expression for round trip transit time in the repeller region. **5**
12. a) Write notes on the quality factor of a cavity resonator.
b) Derive Q of a rectangular cavity resonator. **10**
13. a) Describe the importance of helical structure in TWTs. **4**
b) A TWT operates under the following parameters.
Beam voltage $V_0 = 2.5 \text{KV}$
Beam current $I_0 = 50 \text{mA}$
Characteristic impedance of helix $Z_0 = 6.75 \Omega$

P.T.O.



Circuit length $N = 45$

Frequency $f = 8 \text{ GHz}$

Determine the following :

- 1) Gain Parameter
- 2) Output power gain in dB
- 3) All four propagation constants.

6

Module – II

14. Explain the structure and working of microwave heterojunction bipolar transistor. Obtain its high frequency equivalent circuit. 10
15. An X-band cylindrical magnetron has the following parameters.
- Anode voltage $V_0 = 32 \text{ KV}$
 Beam current $I_0 = 84 \text{ A}$
 Magnetic flux density $\beta_0 = 0.01 \text{ Wb/m}^2$
 Radius of cathode cylinder $a = 6 \text{ cm}$
 Radius of vane edge centre $b = 12 \text{ cm}$
 Operating frequency $f = 9 \times 10^9 \text{ Hz}$
 Resonator conductance $G_r = 2 \times 10^{-4} \text{ mho}$
 Loaded conductance $G_l = 2.5 \times 10^{-5} \text{ mho}$
 Vane capacitance $C = 2.5 \text{ pF}$
- Determine :**
- a) Hall cut off voltage.
 - b) Cut off voltage for a fixed B_0 .
 - c) Cut off magnetic flux density for a fixed V_0 .
 - d) The unloaded quality factor.
 - e) The loaded quality factor. 10
16. a) Explain the construction and working of PIN diode. 7
 b) Briefly describe some of its applications. 3

Module – III

17. Derive the scattering matrix of a 4 port directional coupler. 10
18. Write short notes about the following :
- a) Microwave bends
 - b) Microwave twists. (5×2=10)
19. Explain about the repeaters used in the microwave communication system. 10