AGJ 1st half (h)-Con-Cod 80
Con. 3738-12.

TE | ETRXI VI (Rev) 17/5/12
MDC
GN-7196

(3 Hours) [Total Marks : 100

N.B. : (1) Question No. **1** is **compulsory**.
    (2) Attempt any **four** questions out of the remaining **six** questions.
    (3) Assume any **suitable** data wherever **required**. Justify the **same**.

Q1. (a) What are O-type and M-type devices in microwave?   20
  (b) Compare IMPATT and TRAPATT diodes.
  (c) What are slow wave structures? For what purpose are the slow-wave structures used in microwave devices?
  (d) What do you understand by the following terms:-
    1. Cut off frequency   2. Degenerate mode 3.phase velocity   4. Group velocity 5.Dominant mode.

Q2. (a) Derive the field equations for TE modes in rectangular waveguide.   10
  (b) Prove that TE10 is the dominant mode of propagation in a rectangular   5
    waveguide.
  (c) A TE11 mode is propagating through a circular waveguide. The radius of the   5
    guide is 5 cm, and the guide contains an air dielectric.
    a. Determine the cutoff frequency.
    b. Determine the wavelength λg in the guide for an operating frequency of 3GHz.
    c. Determine the wave impedance Zg in the guide.

Q3. (a) Draw a neat diagram of Klystron amplifier and explain the bunching process   10
    with Applegate diagram. Derive the equation of velocity modulation.
  (b) A Reflex Klystron operates under the following conditions: 6
        V0 = 600V   L=1mm
        Rsh = 15KΩ fr = 9GHz
    The tube is oscillating at Fr at the peak of the n= 2 mode. Assume that the transit time through the gap and beam loading can be neglected.
    a. Find the value of the repeller voltage Vr
    b. Find the direct current necessary to give a microwave gap voltage of 200V
    c. What is the electronic efficiency under this condition?

  (c) Explain excitation of modes in rectangular waveguides.

Q4. (a) What are cross field devices? Explain the working of cylindrical magnetron   10
    oscillator and π mode of operation.
  (b) An X-band pulsed cylindrical magnetron has the following parameters:
    Anode voltage: V0 = 26kV
    Beam current : I0 = 27A
    Magnetic flux density: B0 = 0.336Wb/m2
    Radius of cathode cylinder: a =5 cm
    Radius of vane edge to centre: b = 10cm   10
    Compute:
        a. The cyclotron angular frequency
        b. The cutoff voltage for a fixed B
        c. The cutoff magnetic flux density for a fixed V0.

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Q5. (a) Explain Gunn effect with the Two-valley model of Gunn diode. What are the   10
criteria that the semiconductor must satisfy in order to exhibit negative
resistance?

(b) Explain the working of microwave circulators.   5

(c) Why is Hybrid Tee called as the magic Tee? Derive the S-matrix of the E-H   5
plane Tee.

Q6. (a) Draw and explain Two-Hole directional coupler. Define coupling factor,   10
Directivity and Isolation Derive the S matrix for the same.

(b) For a rectangular waveguide, which propagates in the dominant mode at a   10
frequency of 5 GHz, find 'a' and 'b'? The cutoff frequency of which is 0.8 of the
signal frequency and the ratio of the guide height to width is 2. Also determine:-
1. Phase velocity
2. Group velocity
3. Guide wavelength

Q7. Write short note on any **four**:-   20

(a) Measurement of VSWR in microwave.
(b) Travelling Wave Tube.
(c) Microwave transistors.
(d) Cavity resonators.
(e) Limitations of conventional tubes at microwave frequencies.