Code No: RR320404 **Set No. 1**

III B.Tech II Semester Regular Examinations, Apr/May 2007
MICROWAVE ENGINEERING
(Electronics & Communication Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Write short notes on "Two cavity Klystron oscillator".
   (b) Derive the expression for transadmittance of Reflex Klystron Oscillator and explain the condition of oscillation from admittance spiral.. [6+10]

2. (a) Draw a labeled schematic diagram of Helix TWT and explain the structural features. Show that output power gain of TWT is G=-9.54 + 47.3 CN db.
   (b) How are oscillators prevented in a TWT?. [10+6]

3. (a) Explain the growth of oscillations in a traveling wave magnetron.
   (b) Compare the features of rising Sun magnetron with cavity magnetron. [8+8]

4. (a) Discuss the principle of "MASER" and its applications.
   (b) Write short notes on "Parametric Amplifier". [8+8]

5. (a) A rectangular wave-guide has a cross section of 1.5 cm x 0.8 cm, σ=0, μ= μ_0 and $\in$= 4$\in_0$. The magnetic field component is given as
   $H_x = 2Sin\left(\frac{\pi x}{a}\right)\cos\left(\frac{3\pi y}{b}\right) Sin\left(\pi \times 10^{11} t - \beta z\right) A/m$
   Determine
      i. The mode of operation
      ii. The cut off frequency
      iii. The phase constant
      iv. The propagation constant
      v. The wave impedance.
   (b) Write short notes on "Rectangular resonant Cavity". [10+6]

6. Write short notes on the following.
   (a) Directional coupler.
   (b) Wave guide windows.
   (c) Flap attenuator. [5+5+6]

7. (a) Determine the S parameters for a 10dB directional coupler. The directivity is 30 dB. Assume that directional coupler is lossless and the VSWR at each port is 1.0 under matched conditions.
   (b) Explain the Faraday rotation in Ferrites in detail. [8+8]

8. Write short notes on:

(a) Tunable probes
(b) Matched loads
(c) Crystal detectors
(d) Use of isolators in measurements. [4x4x4x4]

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Code No: RR320404 **Set No. 2**

III B.Tech II Semester Regular Examinations, Apr/May 2007
MICROWAVE ENGINEERING
(Electronics & Communication Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Discuss the advantages of microwaves over low frequencies.
   (b) A two cavity Klystron amplifier has the following parameters. V_0 = 1200V, I_0 = 25mA, R_o = 30 KΩ, f= 10GHz, d= 1 mn, L = 4 cm, R_{sh} = 30Ω Calculate
      i. the input voltage for maximum output voltage
      ii. the Voltage gain in decibels
      iii. Efficiency.. [7+9]

2. (a) Distinguish between different types of slow wave structures. Why is a slow wave structure used in TWT?
   (b) Compare the performance characteristics applications and limitations of Klystron amplifiers, TWT amplifiers and parametric amplifiers.. [8+8]

3. (a) What is a cylindrical Multicavity Travelling wave magnetron oscillator? Explain.
   (b) Write short notes on "Hatree resonance condition" [8+8]

4. (a) Discuss in detail how negative resistance region appears in the characteristics of a GUNN diode.
   (b) What is transferred electron effect? Explain LSA diode along with its applications. [8+8]

5. (a) A rectangular wave-guide has a cross section of 1.5 cm x 0.8 cm, σ=0, μ= μ_0 and $\in$= 4$\in_0$. The magnetic field component is given as
   $H_x = 2Sin\left(\frac{\pi x}{a}\right)\cos\left(\frac{3\pi y}{b}\right) Sin\left(\pi \times 10^{11}t - \beta\, z\right) A/m$
   Determine
      i. The mode of operation
      ii. The cut off frequency
      iii. The phase constant
      iv. The propagation constant
      v. The wave impedance.
   (b) Write short notes on "Rectangular resonant Cavity". [10+6]

6. (a) Derive the expressions for coupling factor and directivity of a two hole directional coupler.

(b) What are the different types of matching elements normally used in wave guide system. Distinguish between magic Tee and rat race hybrid. [8+8]

7. (a) Derive the S matrix of a magic Tee.

   (b) Discuss the properties and applications of a Gyrator. [10+6]

8. (a) With a neat diagram, explain the construction of a slotted line.

   (b) Using slotted line, draw a typical microwave bench setup for measurement of unknown load and explain. [8+8]

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Code No: RR320404 **Set No. 3**

III B.Tech II Semester Regular Examinations, Apr/May 2007
MICROWAVE ENGINEERING
(Electronics & Communication Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Compare "Drift space bunching" and "Reflector bunching" with the help of Applegate diagrams.
   (b) A reflex Klystron operates at the peak of n=1 or $^3/_4$ mode. The dc power input is 40mW and ratio of V_1 to V_0 is 0.278.
      i. Determine the efficiency of the Reflex Klystron Oscillator
      ii. Find the total power output in mW.
      iii. If 20% of the power delivered by the electron beam is dissipated in the cavity walls, find the power delivered to the load.. [6+10]

2. (a) Draw a labeled schematic diagram of Helix TWT and explain the structural features. Show that output power gain of TWT is G=-9.54 + 47.3 CN db.
   (b) How are oscillators prevented in a TWT?. [10+6]

3. (a) Draw neatly the cross section of a 8 cavity magnetron and explain the mechanism of oscillations.
   (b) For a magnetron a= 0.6 m, b = 0.8m, N=16, B= 0.06T, f= 3 GHz and V_0 = 1.6 KV. Calculate the average drift velocity for electrons in the region between cathode and anode. [8+8]

4. (a) Describe a non-degenerate negative resistance parametric amplifier.
   (b) An N type Ga As GUNN diode has the following specification
   Threshold field: 3KV/m
   Applied field 3.5KV/m
   Device length 10 micrometers
   Doping Constant 10^{14} electron/ Cm^3
   Operating freq. 10 GHz
   Calculate the current density and (-Ve) electron mobility in the device, explaining the relations used. [6+10]

5. (a) Starting with the equation for the propagation constant of a mode in a rectangular wave guide, Derive the expression $\lambda = \frac{\lambda g \lambda c}{\sqrt{\lambda g^2 + \lambda c^2}}$
   Where λ_g is the guide wave length and λ_c is the cutoff wave length
   (b) An air filled rectangular wave guide has dimensions of 0.9" x 0.4" and is supporting TE_{10} mode at a frequency of 9800 MHz. Calculate the wave guide impedance. Calculate the percentage change in this impedance for a 10% increase in the operating frequency. [8+8]

6. Explain the construction, operation and applications of the following microwave components.
   (a) Directional couplers.
   (b) Wave guide Tees. [8+8]
7. (a) What are ferrite devices? Explain how Faraday rotation is utilized in the construction of a 4 port circulator.
   (b) What are the advantages of scattering matrix representation over impedance and admittance matrix representations? [10+6]
8. (a) What are the precautions to be taken while setting up microwave bench for measurement of various parameters.
   (b) How do you measure microwave power using a Bolometer. [8+8]

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Code No: RR320404 **Set No. 4**

III B.Tech II Semester Regular Examinations, Apr/May 2007
MICROWAVE ENGINEERING
(Electronics & Communication Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain clearly the different high frequency effects in electron tubes and show how these are eliminated in the design of a high frequency microwave tube.
   (b) The bunching grids of a Klystron amplifier are 2 mm apart. The beam voltage is 2KV and the drift space is 2.8 cm. Long. What must be the value of the RF voltage at the bunching grid to produce maximum fundamental components of the current at the catcher. Assume the operating frequency 2.8 GHz. On what factors does the bunching parameter depend upon?. [8+8]
2. (a) What is a slow wave structure? Explain and differentiate between different structures.
   (b) Explain the working principle of TWT amplifier.. [8+8]
3. (a) Describe how microwave frequencies are generated in a magnetron tube with neat sketches.
   (b) What is Π mode? What are the various modes that are possible in a magnetron. [8+8]
4. (a) Write short notes on "Parametric up converter".
   (b) What is a MASER? What does its name signify? What applications does it have? [8+8]
5. (a) A 6.0 GHz signal is to be propagated in the dominant mode in a rectangular waveguide. If its group velocity is to be 80% of the free space velocity of light, what must be the breadth of the waveguide? What impedance will it offer to this signal if it is correctly matched?
   (b) Derive the expression for the resonant frequency of a rectangular cavity resonator. [8+8]
6. (a) Explain the difference between
      i. E plane Tee
      ii. H- plane Tee

      Explain clearly why do you call them series and parallel Tee respectively.
   (b) Describe with a neat sketch a precision Attenuator, and Explain its operation [8+8]
7. (a) What are microwave ferrites? Explain the working of ferrite isolator.
   (b) Derive the S-matrix of a directional coupler in standard form. [8+8]

8. (a) With a neat diagram, explain the construction of a slotted line.
   (b) Using slotted line, draw a typical microwave bench setup for measurement of unknown load and explain. [8+8]

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