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

III B.Tech II Semester Supplimentary Examinations, Apr/May 2008
MICROWAVE ENGINEERING
(Electronics & Communication Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Discuss the limitations of conventional tubes at microwave frequencies.
   (b) Explain the principle of operation of two cavity Klystron with neat diagrams. [6+10]

2. (a) A helix traveling wave tube is operated with a beam current of 300 mA, beam voltages of 5 KV and characteristic impedance of 20 Ohm. What length of the helix will be selected to give a output power gain of 50 dB at 10 GHz.
   (b) Explain how the amplification takes place in TWT. Compare its bandwidth with Klystron amplifier.. [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) Write short notes on "LSA mode in GUNN diode".
   (b) How is it possible to exhibit negative resistance characteristics in an IMPATT diode? [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) Explain the working of two hole directional coupler with a neat diagram.
   (b) Explain about E plane Tee junction with a neat sketch. Why it is called a series Tee? [8+8]

7. (a) Why 'Ferrites' are used in microwave passive devices? Explain.

(b) Scattering matrix is a unitary matrix. Prove this statement. [8+8]

8. (a) Explain VSWR measurement procedure in microwave laboratory with a suitable microwave bench setup.

(b) Calculate VSWR of a rectangular guide of 2.3cm x 1.0 cm operating at 8 GHz. The distance between twice minimum power points is 0.09 cm. [8+8]

⋆ ⋆ ⋆ ⋆ ⋆

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

III B.Tech II Semester Supplimentary Examinations, Apr/May 2008
MICROWAVE ENGINEERING
(Electronics & Communication Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Discuss the limitations of conventional tubes at microwave frequencies.
   (b) Explain the principle of operation of two cavity Klystron with neat diagrams. [6+10]

2. (a) With the aid of neat sketches, describe the construction and operation of TWT.
   (b) Starting with the assumption that there are three forward traveling waves in TWT, derive an expression for power gain of the tube. [6+10]

3. (a) A magnetron is operating in the Π mode and has the following specifications, N=10, f= 3MHz, a = 0.4cm, b= 0.9 cm, l = 2.5 cm, V_0 = 18 KV, B = 0.2 wb/m^2.
   Determine:
      i. the angular velocity of the electron.
      ii. The radius at which radial forces due to electric and magnetic fields are equal and opposite.
   (b) What are Hatree harmonics? Explain in detail. [8+8]

4. (a) Explain GUNN effect. Mention the type materials suitable for fabricating GUNN diodes.
   (b) Discuss the applications of parametric amplifier, in detail. [8+8]

5. (a) Distinguish between the properties of TEM mode of propagation and that of TE and TM type of propagation.
   (b) Write short notes on "Cavity resonators and its applications". [8+8]

6. (a) What is magic Tee? Describe the properties of magic Tee, giving its S-Matrix.
   (b) Show a wave-guide with cylindrical post and describe its behaviour. How can it be used, when it is inserted half way into the wave-guide? [10+6]

7. (a) Enumerate the properties of S parameters.
   (b) Formulate the S parameter matrix of a 4 port circulator. [8+8]

8. (a) Distinguish between slotted line and directional coupler methods of VSWR measurement.
   (b) Write short notes on "frequency meters". [8+8]

⋆ ⋆ ⋆ ⋆ ⋆

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

III B.Tech II Semester Supplimentary Examinations, Apr/May 2008
MICROWAVE ENGINEERING
(Electronics & Communication Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Explain how microwave engineering is different from low frequency electronic engineering.
   (b) Derive an expression for the power output and efficiency of a two cavity Klystron? What is the maximum efficiency that can be obtained? [8+8]

2. With a neat sketch explain the structure and the principle of operation of backward wave oscillator. Derive a simple expression for the oscillator frequency? Discuss its applications. [16]

3. (a) What is magnetron? How it is different in principle of operation from that of Backward wave oscillator.
   (b) What is meant by wheel spoke bunching. Explain in detail. [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. (a) Draw a neat sketch of magic T-junction. Imagine that a source is connected to arm 'P', and arm 'S' is match terminated. Arms 1 and 2 are terminated in reflection coefficients of 0.2 and 0.3 respectively. What is the VSWR seen by the source?
   (b) Draw the H-plane Tee junction and explain its properties. [8+8]

7. (a) Why 'Ferrites' are used in microwave passive devices? Explain.

(b) Scattering matrix is a unitary matrix. Prove this statement. [8+8]

8. (a) Explain VSWR measurement procedure in microwave laboratory with a suitable microwave bench setup.

(b) Calculate VSWR of a rectangular guide of 2.3cm x 1.0 cm operating at 8 GHz. The distance between twice minimum power points is 0.09 cm. [8+8]

⋆ ⋆ ⋆ ⋆ ⋆

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

III B.Tech II Semester Supplimentary Examinations, Apr/May 2008
MICROWAVE ENGINEERING
(Electronics & Communication Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Discuss in detail about lead inductance and inter electrode capacitance effects of conventional tubes at microwave frequencies.
   (b) What is electronic Admittance? Discuss its significance and the mode patterns of Reflex Klystron Oscillator. [8+8]

2. With a neat sketch explain the structure and the principle of operation of backward wave oscillator. Derive a simple expression for the oscillator frequency? Discuss its applications. [16]

3. (a) A magnetron is operating in the Π mode and has the following specifications, N=10, f= 3MHz, a = 0.4cm, b= 0.9 cm, l = 2.5 cm, V_0 = 18 KV, B = 0.2 wb/m^2.
   Determine:
      i. the angular velocity of the electron.
      ii. The radius at which radial forces due to electric and magnetic fields are equal and opposite.
   (b) What are Hatree harmonics? Explain in detail. [8+8]

4. (a) Explain the GUNN effect based on two valley model theory.
   (b) Write short notes on "TRAPATT diode". [8+8]

5. (a) What is a cavity resonator? Discuss the applications of cavity resonators.
   (b) Describe the method of designating the modes of transmission in rectangular waveguides. Why is transmission in the dominant mode most often used in waveguides? [8+8]

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. Explain the construction, operation and applications of the following microwave components.
   (a) Circulator
   (b) Gyrator. [8+8]

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]

⋆ ⋆ ⋆ ⋆ ⋆