DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

QUESTION BANK

SUBJECT CODE : EC2403 **SEM / YEAR : VII / IV**
SUBJECT NAME : RF & MICROWAVE ENGINEERING

UNIT – I
BASIC MICROWAVE COMPONENTS

PART- A (2 marks)

1. State Faraday's rotation law.
2. State the properties of S matrix.
3. What are the reasons that low frequency parameters cannot be Measured in microwaves?
4. State the two parameters that describe a directional coupler? Define them.
5. State TEE junction theorems.
6. What is S matrix and write the S matrix of N port network?
7. What is meant by hybrid coupler?
8. Compare z parameters and ABCD parameters with S-parameters.
9. What are hybrid rings?
10. List the parameters that determine the performance of a directional coupler.
11. Explain the action of a rat-race junction.
12. Why are waveguide bends and twists constructed so that the direction of propagated energy is
gradually changed?

PART – B

1. a A three port circulator has an insertion loss of 1db, isolation of 20 db, VSWR =1.2 when all ports are matched terminated. Find S matrix and output power at port 2and 3 for an input power of 100mw at port **(6)**
b. Explain the principle of operation of magic Tee and derive the S matrix of Magic Tee. **(10)**
2. From the first principles derive the S matrix parameters of Directional coupler. **(16)**
3. a) Is it possible to match all the 3 ports of a lossless reciprocal microwave component? Prove the same**. (10)**
b) Explain with diagrams waveguide corner,bends,twists. **(6)**
4. a) What is an isolator? Write down S parameters. **(4)**
b)A signal of power 32mw is fed into one of the collinear ports of a lossless H plane tee. Determine the powers in the remaining ports when other ports are terminated by means of matched load. **(12)**
5. With relevant equations , explain the properties of S-matrix with corresponding proof**. (16)**

UNIT II
TRANSFERRED ELECTRON DEVICES & AVALANCHE TRANSIT TIME DEVICES

PART- A (2 marks)

1.Define GUNN effect.
2. What is the necessary condition for an IMPATT to produce oscillations?
3. List the differences between microwave transistor and TED devices.
4. What are the advantages and disadvantages of parametric amplifier?
5. What is meant by avalanche transit time device?
6. Discuss the applications of PIN diode.
7. What is a parametric amplifier? How is it different from a normal amplifier?
8. What is the theory of a negative resistance amplifier?
9. Explain how a tunnel diode can be used as a amplifier.
10.List the several donation formation modes of a Gunn diode.
11.State the performance characteristics of IMPATT and TRAPATT diode.
12. An IMPATT diode has a drift length of 2 μm. Determine the operating frequency of IMPATT
diode if the drift velocity for Si is 107 cms/sec

PART- B

1. a) Derive the Manley Rowe power relation. **(12)**
b) Use the above relation to find the power gain of an up and down converter. **(4)**
2. a) Using RWH theory , explain two valley model of GaAs. **(8)**
b) Explain different types of modes. **(8)**
3. Explain the working principle of IMPATT diode and derive the power output and efficiency? **(16)**
4. Explain the working principle of TRAPATT diode and derive the power output and efficiency? **(16)**
5. Explain the working principle and modes of microwave bipolar transistor **(16)**
6. Explain the working principle and operation of microwave FET. **(16)**

UNIT III
MICROWAVE LINEAR BEAM TUBES & MICROWAVE CROSSED FIELD TUBES

PART- A (2 marks)

1. Draw the electronic admittance diagram of reflex klystron.
2. State the differences between TWT and klystron?
3. Can a two cavity klystron amplifier be used an oscillator? If yes, how?
4. What is the purpose of slow wave structures in TWT?
5. What is meant by frequency pushing and frequency pulling?.
6. What is velocity modulation?
7. What are the limitations of conventional tubes at microwave frequencies?Explain how these

limitations can be overcome.
8. What are the performance characteristics of a Klystron amplifier?
9. How is bunching achieved in a cavity magnetron?
10. What are cross field deices?
11. How is tuning achieved in reflex klystron oscillators?
12. What is strapping in magnetron? How is the same effect obtained without strapping?

PART- B

1. With neat circuit diagrams and relevant equations, explain the velocity modulation process and bunching in a klystron amplifier?. **(16)**
2. Explain in detail about multicavity klystron amplifiers. **(16)**
3. Derive the equation for power output and efficiency of two cavities and four cavity klystron amplifiers. **(16)**
4. With neat diagrams and relevant equations, explain about helix traveling wave tube. **(16)**
5. With neat diagrams and relevant equations, explain about cylindrical and coaxial magnetron. **(16)**
6. Discuss in detail about tunable magnetron and also explain in brief regarding Ricke diagram. **(16)**

UNIT IV
STRIP LINES AND MONOLITHIC MICROWAVE INTEGRATED CIRCUITS

PART- A (2 marks)

1. What are the advantages of microstrip line over strip line?
2. What are the advantages of MMIC over discrete circuit?
3. What are the properties of dielectric materials?
4. What are the losses in strip lines?
5. List the various MMIC fabrication techniques.
6. Microstrip line is also called an open strip line.Comment on this.
7. Why is it difficult to establish microstrip short circuits?
8. What are the design considerations for a microstrip line?
9. Why are propagating modes along the strip lines are non-TEM and not pure TEM modes?
10.How are waveguides different from normal two – wire transmission lines?
11.Give the physical interpretation for phase and group velocity in relation to speed of light.

PART- B

1. Explain in detail about microstrip lines and derive the expression for characteristic impedance of microstrip lines **(16)**

2. Discuss in detail about the various losses in microstrip lines. **(16)**
3. Explain the different types of microstrip lines and give a brief note of their characteristics. **(16)**
4. Write a brief note on the different types of materials and list their characteristics, **(16)**
5. Discuss in detail about the fabrication techniques of MMIC circuits. **(16)**

UNIT V
MICROWAVE MEASUREMENTS

PART- A (2 marks)

1. What is Bolometer? Give two examples?
2. A wave guide load is used to absorb power of 2W., reflected power is 3mW.Find magnitude of VSWR.
3. Why reflex klystron is a square wave 1kHz PAM while microwave measurements are done using VSWR?
4. What are the sources of error in return loss measurement using a waveguide reflectometer and klystron source?
5. What is meant by duty cycle?
6. How are microwave measurements different from low frequency measurements?
7. List the various techniques of measuring unknown frequency of a microwave generator.
8. How can you extend the range of power measurement?
9. Describe how an ordinary voltmeter can be calibrated to VSWR directly.What are the drawbacks of such a VSWR meter?
10. List any two methods of measuring impedance of a terminating load in a microwave system.
11. Explain the concept of double minimum method of measuring VSWR.

PART- B

1. Explain in detail the measurement of VSWR through return loss measurements. **(16)**
2. Discuss in detail the power measurement using microwave devices. **(16)**
3. Write a brief note on insertion loss and attenuation measurements. **(16)**
4. Explain in detail about the dielectric constant measurement of a solid using waveguide. **(16)**
5. Discuss in detail the impedance measurement using microwave devices. **(16)**