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Register Number:……..

B.E DEGREE EXAMINATIONS: NOV/DEC 2014

(Regulation 2009)

Seventh Semester

ELECTRONICS AND COMMUNICATION ENGINEERING

ECE121: Microwave Engineering

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. If the matched isolator has insertion loss of 0.5 dB, then its corresponding S parameter value is……

   a) $S_{12} = 0.944$ b) $S_{21} = 0.944$

   c) $S_{11} = 0$ d) $S_{22} = 1$

2. The following is one of the non reciprocal devices.

   a) Isolator b) Attenuator

   c) Waveguide tee d) Hybrid ring

3. The voltage gain of two cavity klystron amplifier with $G_m = 25 \times 10^{-4}$ & $R_{sh} = 30k\Omega$ is…

   a) 75 b) 100

   c) 30 d) 33

4. The cyclotron angular frequency of cylindrical Magnetron with magnetic flux density 0.336 wb/m^2 is……

   a) 3.91 x10^{10} rad b) 5.91 x10^{10} rad

   c) 10 x10^{10} rad d) 12 x10^{10} rad

5. In a GaAs diode, if the drift velocity of electrons is 2 x 10^7 cm/s & length of active region is 10 x 10^{-4} cm then the natural frequency of oscillation is…

   a) 10GHz b) 20GHz

   c) 200GHz d) 1MHz

6. A parametric amplifier has an input and output frequency of 2.25GHz and is pumped at 4.5GHz.It is a……amplifier.

   a) negative resistance b) up converter

c) down converter d) degenerate

7. The selection of a substrate material depends on

a) circuit dissipation b) type of circuit

c) circuit function d) all the above

8. The characteristic impedance of coplanar stripline with an average power of 250mW and a peak current of 100mA is……..

a) 46 Ω b) 50Ω

c) 60 Ω d) 377 Ω

9. In a microwave measurement setup, zero reflection takes place when Z_L is equal to

a) Z_0 Ω b) ∞ Ω

c) 0Ω d) 50Ω

10. The following is not one of the frequency measurement methods at microwave frequency range.

a) Wavemeter method b) Slotted line method

c) Down conversion method d) Cavity perturbation method

PART B (10 x 2 = 20 Marks)

11. Sketch waveguide bends& twists.
12. What is Hybrid ring? Draw its schematic structure.
13. Can a two cavity klystron amplifier be used an oscillator? If yes, how?
14. Why magnetron is called as crossed field device? Mention its applications.
15. What are the various modes of operation of Gunn diode?
16. What is Tunneling effect?
17. What is shielded strip line? & Write its characteristic impedance Z_0 expression.
18. List the advantages of MMIC over discrete circuits.
19. List the different types of Impedance measurement methods?
20. How are microwave measurements different from low frequency measurements?

PART C (5 x 14 = 70 Marks)

21. a) i) 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. (7)

ii) Derive the scattering matrix of an ideal, symmetrical, lossless H plane Tee junction. (7)

(OR)

b) i) From the first principles, derive the S matrix parameters of directional coupler. (10)

State the TWO PARAMETERS that describe a directional coupler & define them .

ii) Is it possible to match all the 3 ports of a lossless reciprocal microwave component? Prove the same. (4)

22. a) i) Describe with neat sketch the construction details & principle of operation of a Reflex klystron tube. Derive expressions for Velocity modulation. (10)

ii) A reflex klystron is operated at 10GHz with dc beam voltage 300V,repeller space 0.1 cm for 1 ¾ mode. Calculate RF power output and repeller voltage for a beam current of 20mA. (4)

(OR)

b) i) With neat diagrams and relevant equations, explain the principle of Helix Traveling Wave Tube. Derive its gain expression. (10)

ii) For a TWT,I_0 =300mA,V_0=5kV, and the impedance of helix is 30 Ω. Find the length of the helix that will give a gain of 60dB at 9GHz. (4)

23. a) i) Explain the construction, working principle of IMPATT diode and derive the power output and efficiency. Mention its applications. (10)

ii) Compare ATTD & TED devices. (4)

(OR)

b) i) What are the advantages of parametric up converter over negative resistance parametric amplifier? (2)

ii) Derive the Manley-Rowe power relations of a Parametric Amplifier. Show how it can be applied to find the gain of up converter and down converter. (12)

24. a) i) Explain various losses in micro stripline & quality factor Q of micro stripline. (8)

ii) A gold parallel stripline has the following parameters: (6)

Relative dielectric constant of polyethylene ε_{rd} = 2.25

Strip width w= 25mm

Separation distance d= 5mm

Calculate the 1.Characteristic impedance of the stripline.

2. Stripline Capacitance

3. Stripline Inductance

4. Phase velocity

(OR)

b) Explain MMIC fabrication techniques in detail with one example.

25. a) i) Describe in detail with block diagram the measurement of low VSWR and high VSWR through slotted line method. (12)

ii) A wave guide load is used to absorb power of 2W. Reflected power is 3mW. Find the magnitude of VSWR. (2)

(OR)

b) Describe how the power of a microwave generator can be measured using bolometer & calorimeter techniques.

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