

Duration: 3 Hours

Max. Marks: 100

PART - A (MCQ) (20 × 1 = 20 Marks)

Answer ALL Questions

	<i>Marks</i>	<i>K- Level</i>	<i>CO</i>
1. In a lossless network, the elements of the impedance matrix are predominantly _____. (a) resistive (b) reactive (c) inductive (d) capacitive	1	K1	CO1
2. The capacitor preferred at high frequency is (a) Electrolyte capacitor (b) mica capacitor (c) Air capacitor (d) glass capacitor	1	K1	CO1
3. The reflection coefficient of a matched load ideally should be for perfect matching. (a) Zero (b) Negative (c) Positive (d) Infinite	1	K1	CO1
4. The E-plane Tee is classified as a _____ junction. (a) voltage (b) shunt (c) parallel (d) series	1	K1	CO2
5. Isolators can be made by inserting a _____ along the axis of a rectangular waveguide. (a) resistor (b) capacitor (c) ferrite rod (d) transformer	1	K1	CO2
6. What is the primary purpose of movable shorts in microwave engineering? (a) Impedance tuning and adjustment (b) Power amplification (c) Signal modulation (d) Data transmission	1	K1	CO2
7. What is the purpose of velocity modulation in a two-cavity klystron? (a) To control the transit time of electrons (b) To generate an output RF signal (c) To amplify the input RF signal (d) To create a time-varying magnetic field	1	K1	CO3
8. Which of the following factors negatively affects the performance of vacuum tubes at high frequencies? (a) Transit-angle effects (b) Thermionic emission (c) Cathode heating (d) Anode voltage	1	K1	CO3
9. The main advantage of a TWT over a klystron for microwave amplification is (a) Lower cost (b) Smaller size (c) Higher power (d) Wider bandwidth	1	K1	CO3
10. Which parameter relates incident and reflected waves in microwave circuit analysis? (a) z parameter (b) y parameter (c) h parameter (d) s parameter	1	K1	CO4
11. What is the range of VSWR values? (a) Zero to one (b) One to ten (c) One to infinity (d) Zero to infinity	1	K1	CO4
12. What is the main principle behind the operation of a bolometer? (a) Voltage generation (b) Current amplification (c) Resistance variation with temperature (d) Inductive coupling	1	K1	CO4
13. At high frequencies the output power of IMPATT diode is..... (a) proportional to the frequency (b) inversely proportional to the frequency (c) inversely proportional to the square of frequency (d) proportional to the square of frequency	1	K1	CO5
14. IMPATT diode is a..... (a) negative resistance device (b) positive resistance device (c) zero resistance device (d) none of the mentioned	1	K1	CO5

15. Identify the phenomenon responsible for the negative resistance characteristic in Gunn diodes. 1 K1 CO5
 (a) Superconductivity (b) Avalanche breakdown
 (c) Quantum tunneling (d) Transferred Electron Effect (TEE)
16. The typical range for VSWR values in constant VSWR circles is between _____. 1 K1 CO5
 (a) 0.5 and 1.5 (b) 1.5 and 2.5 (c) 2.5 and 3.5 (d) 3.5 and 4.5
17. Which of the following is NOT a performance specification for an RF amplifier? 1 K1 CO6
 (a) Operating frequency and bandwidth (in Hz) (b) Output power (in dBm)
 (c) Power supply requirements (d) Magnetic permeability
18. In the high-frequency region, which type of filter shows a more rapid increase in insertion loss? 1 K1 CO6
 (a) Binomial filters (b) Butterworth filters
 (c) Maximally flat filters (d) Equal ripple filters
19. Determine the value of power at the load of an RF amplifier if transducer power gain (GT) is 5.042 and the available power is 0.0308 W. 1 K2 CO6
 (a) 0.0291 W (b) 0.987 W (c) 0.345 W (d) 0.155 W
20. In the high-frequency region, which type of filter shows a more rapid increase in insertion loss? 1 K1 CO6
 (a) Binomial filters (b) Butterworth filters
 (c) Maximally flat filters (d) Equal ripple filters

PART - B (10 × 2 = 20 Marks)

Answer ALL Questions

21. Define reciprocal and symmetrical networks. 2 K1 CO1
22. Illustrate the equivalent circuit of high frequency capacitor. 2 K1 CO1
23. Define coupling factor and directivity of a directional coupler. 2 K1 CO2
24. Identify the type of component with S-parameters of $S_{11} = S_{22} = 0, S_{21} \neq S_{12}$. 2 K1 CO2
25. Compare the important features of TWTA and Klystron amplifier. 2 K2 CO3
26. Define π mode of operation in magnetron. 2 K1 CO3
27. State the functions of Network analyser. 2 K1 CO4
28. Classify microwave powers with its range. 2 K1 CO4
29. Draw the physical structure of HEMT. 2 K1 CO5
30. State the conditions that are necessary and sufficient for unconditional stability. 2 K1 CO6

PART - C (6 × 10 = 60 Marks)

Answer ALL Questions

31. a) State and prove the properties of S-matrix. 10 K2 CO1
OR
 b) Illustrate the high frequency equivalent circuit of resistor, inductor and capacitor and explain. 10 K2 CO1
32. a) Examine the characteristics, applications and S-matrix of E-plane Tee junction in microwave Engineering. 10 K2 CO2
OR
 b) Explain the operation of rat-race junction and hence derive its S-parameters. 10 K2 CO2

33. a) A Two cavity klystron amplifier has the following parameters. 10 K2 CO3
- (a) Beam voltage $V_0 = 1000\text{V}$,
 - (b) DC beam resistance $R_0 = 35\text{ K}\Omega$,
 - (c) Beam current $I_0 = 25\text{ mA}$,
 - (d) Operating frequency $f = 3\text{ GHz}$
 - (e) Gap spacing in either cavity $(d) = 1\text{ mm}$
 - (f) Spacing between two cavities $L = 4\text{ cm}$
 - (g) Effective shunt impedance $R_{sh} = 30\text{ K}\Omega$.
- Estimate the input gap voltage, voltage gain and efficiency, DC transit angle, beam coupling coefficient.
- OR**
- b) Explain the operation of reflex klystron oscillator and derive the equation for bunching parameter with neat illustrations. 10 K2 CO3
34. a) Illustrate and explain the experimental set-up for dielectric constant measurement. 10 K2 CO4
- OR**
- b) Illustrate the impedance, wavelength and frequency measurement using slotted line method. 10 K2 CO4
35. a) Explain the operation, construction and characteristics of IMPATT diode. 10 K2 CO5
- OR**
- b) Explain the two-valley model theory with neat illustrations. 10 K2 CO5
36. a) Derive the expression for input and output stability circles. 10 K2 CO6
- OR**
- b) Derive the expressions for power gain, available gain and transducer gain a microwave amplifier using S-parameters. 10 K2 CO6