

MICROWAVE AND RADAR ENGINEERING

Subject Code: - EE-302-F

Class: VI ECE

- Q1. What is the difference between TE and TM modes in rectangular waveguide? Explain with suitable field pattern
- Q2. A rectangular wave guide of cross-section 5cm X 2 cm is used to propagate TM_{11} mode at 10 GHz. Determine the cut-off wavelength and characteristic impedance
- Q3. Deduce the expression for cut off wavelength of a waveguide system. Explain the Physical Significance of cut-off wavelength
- Q4. What is the difference between waveguide and transmission lines? Explain how wave guide acts as high pass filter
- Q5. What is the directional coupler? Discuss the S parameter of directional coupler
- Q6. Explain the working of a two cavity Klystron by giving Applegate diagram
- Q7. What are cavity resonators? Derive the equation for resonant frequency for a rectangular Cavity resonator
- Q8. What are the ferrites? Explain the action of isolator using ferrites. Mention its typical application
- Q9. Describe with necessary block schematic for power measurement using calorimeter
- Q10. Calculate the SWR of transmission system operating at 10GHz. Assume TE_{10} wave transmission inside a wave guide of dimensions $a=4\text{cm}$, $b=2.5\text{cm}$. The distance measured between twice minimum power points = 1mm on a slot ted line
- Q11. Discuss briefly about parametric amplifier
- Q12. Explain the construction and working of a TRAPATT diode
- Q13. Derive simple Radar range Equation. Explain the factors that affect the maximum range of a radar
- Q14. Explain the function of A scope and PPI display in connection to Radar
- Q15. Explain the basic principles of a radar system. Give the limitation and application of a Radar
- Q16. Define Microwave and draw the wave spectrum
- Q17. What hampered the early development of microwave devices
- Q18. What are different types of wave guides
- Q19. What is the advantage of wave guide over transmission line

- Q20. Define Phase velocity, group velocity and derive the relation between them
- Q21. Show that TEM mode cannot propagate in a wave guide using Maxwell's equation
- Q22. Derive the expression for TM mode
- Q23. Explain the Advantages and disadvantages of circular wave guide
- Q24. What are application of circulator
- Q25. Write a note on phase shifter.
- Q26. Define Faraday rotation.
- Q27. Derive the equation of o/p power of klystron.
- Q28. How wave guides are different from normal two wire transmission line.
- Q29. Show that a TEM wave cannot propagate in a wave guide by making use of Maxwell's equation.

- Q30.** Derive the wave equation for a TM wave and obtain all field components in a rectangular wave guide.
- Q31.** Explain how a wave guide acts as a high pass filter
- Q32.** Deduce the expression for a cut-off wavelength of a waveguide system. Explain the physical significance of cut off wavelength.
- Q33.** Highlight the difference in propagation and general behavior between TE and TM mode in a rectangular waveguide.
- Q34.** Discuss in brief the various mode of wave guide .what are the dominant modes?
- Q35.** A rectangular wave guide is filled by dielectric material of $\epsilon_r=9$ and has the inside dimension of 7 cmX3.5 cm .It operates in dominant mode :
- Q36.** Determine the cut off frequency
- Q37.** Find the phase velocity in the guide at a frequency of 2 GHz
- Q38.** Find the guide wavelength at the same frequency
- Q39.** Explain in brief the excitation of modes in wave guide
- Q40.** Explain scattering parameter and give properties of S-matrix .derive the S- matrix for E-plane tee
- Q41.** Derive an expression for the efficiency of two cavity Klystron amplifier
- Q42.** Explain how a dielectric vane phase shifter provides variable phase shift
- Q43.** Write a note on IMPATT
- Q44.** Write a note on frequency measurement
- Q45.** Explain the operation of a varactor diode .discuss the construction details and give its application
- Q46.** Discuss the advantages and list the application of parametric amplifier
- Q47.** What is pulsed radar? What are the effects of transmitting along pulse ?Explain all the stages of pulsed radar
- Q48.** Obtain the S-matrix for a magic Tee and discuss its application as adjustable phase shifter
- Q49.** How does an isolator differ from an attenuator ?Explain the various types of ferrite isolators with suitable diagram
- Q50.** Briefly describe ,with the help of a sketch , the principle of operation of a cavity magnetron oscillator .What is the dominant mode of operation at the dominant mode
- Q51.** What is the limitation of conventional tubes at microwave frequencies? How these limitations can be overcome
- Q52.** With the aid of a suitable sketch, describe the construction and operation of PIN diode
- Q53.** Describe with necessary block schematic for power measurement using bolometer
- Q54.** Calculate the SWR of transmission system operating at 10 GHz .assume TE₁₀GHz .Assume TE₁₀ wave transmission inside a wave guide of dimension a- 4 cm, b=2.5 cm . The distance measured between twice minimum power point =1mm on a slotted line.

- Q55.** Find out an expression for maximum detectable range of a target by radar .mention the factors that affect the range equation of a radar?
- Q56.** What are PRF and pulse width? What is effect of increasing or decreasing either?
- Q57.** Sketch a Gunn diode construction and describe it briefly .What are some of the performance figure of which Gunn diode are capable
- Q58.** What is parametric amplifier? How is it different from a normal amplifier?
- Q59.** Write a note on Tunnel diode.
- Q60.** Write a short note on Microwave bridge.
- Q61.** Explain directivity and coupling factor of a directional coupler
- Q62.** Explain how bunching takes place in the klystron amplifier around the electron which passes the buncher cavity gap when the gap voltage is zero and becoming positive
- Q63.** What are the high frequency limitation of conventional tubes
- Q64.** Explain the operation of Reflex Klystron oscillator .Why is the transit time so important in this device
- Q65.** What is the Gunn Effect? Discuss the characteristics of Gunn diode
- Q66.** Explain operation ,construction and application of Tunnel diode
- Q67.** What is VSWR? How it can be measured
- Q68.** Define the pulse repetition frequency and range ambiguities.
- Q69.** Derive the basic radar range equation as governed by the minimum detectable signal.
How does the selection of threshold level affect the performance of a radar
- Q70.** Write a note on TWT
- Q71.** Write a short note on prediction of range performance
- Q72.** Describe the working of h-plane tee. A 20 mw signal is fed into one of the collinear port of a lossless H- plane tee junction .Calculate the power delivered through each port when other ports are terminated in matched load
- Q73.** Explain the working of Bathe –Hole directional coupler and determine the scattering parameters of 10 db directional coupler with the directivity of 30 db. Assume that its loss less and VSWR at each port is 1.0 under matched condition
- Q74.** Describe the operation of p-I-n diode at low frequencies And microwave frequencies
- Q75.** Derive Manley Rowe power relation for a parametric device
- Q76.** What is meant by blind speeds? Discuss a method to overcome this problem
- Q77.** How is the information provide by a radar echo with regard to the shape ,size range and velocity of the target
- Q78.** A rectangular guide of dimension $a=2$, $b=2.5$ cm is operated at frequency of 10^{10} Hz .A pulse modulated carrier of the above frequency is transmitted through the guide. How much pulse delay is introduced by a guide 100m long
- Q79.** Explain how a slotted line can be used to measure any unknown impedance at microwave frequencies
- Q80.** Describe a typical method for the measurement of microwave power in detail
- Q81.** In context with a cylindrical magnetron explain the following
- i) Resonant cavity
 - ii) Power output and efficiency

- Q82.** Give the physical interpretation for phase and group velocity in relation to speed of light
- Q83.** Write a short note on cross field amplifier
- Q84.** Explain with the help of a block diagram ,how frequency of an unknown microwave signal can be measured
- Q85.** A rectangular wave guide of cross section 5cmx2 cm is used to propagate TM_{11} mode at 10 GHz .Determine the cut- off wavelength and the character impedance
- Q86.** Find the resonant frequencies of first two lowest modes of an air –filled rectangular cavity of dimensions 5cm X 4 cm X 2.5 cm
- Q87.** Describe in detail the operation of two hole directional coupler. Calculate the coupling factor if the power in the primary wave guide is 72 mw and power delivered in directional coupler is 8mw
- Q88.** What is strapping in magnetron?
- Q89.** Explain the theory of negative resistance amplifier and transferred electronic devices?
- Q90.** What is re-entrant cavity?
- Q91.** What are the various ways of coupling energy to a resonator?
- Q92.** What is velocity modulation? How is it different from normal modulation?
- Q93.** Explain Doppler effect.
- Q94.** Give the working and the application of duplexer
- Q95.** Write a note on ferrite phase shifters.?
- Q96.** What is a cavity resonator?
- Q97.** Why convectional tubes cannot be used for frequency greater than 100 MHz?
- Q98.** Give two application of magic Tee?
- Q99.** Give two application of Gunn diode ?
- Q100.** Give two application of magnetron?