Seat No. : _____

NI-140

November-2025

M.Sc., Sem.-III

PHY-504 : Physics

(Microwaves and Thin Film Technology)

Time : 2:30 Hours] **[Max. Marks : 70**

Instructions : (1) Attempt **all** questions.
(2) Symbols and terminology have their usual meanings.

1. (A) Draw the schematic figure of Reflex Klystron. Explain the working of Reflex Klystron and the bunching process using Applegate diagram. **7**

1. (B) Obtain a relation of Repeller voltage with accelerating voltage for the Reflex Klystron. Hence obtain an expression for the change in frequency due to the change in Repeller voltage. **7**

OR

1. (A) Explain the working of Cavity Magnetron drawing necessary figure. **7**

1. (B) Discuss the working of Cylindrical Magnetron to obtain an expression for the cut off magnetic field in terms of Hull's cutoff voltage. **7**

2. (A) Define 'S' parameters of a two-port microwave network. Obtain the scattering matrix for H-plane tee junction. **7**

2. (B) What is Magic tee ? Describe it's working and obtain the scattering matrix for the Magic tee. **7**

OR

2. (A) Write short notes on : (i) power meter and (ii) Microwave circulator. **7**

2. (B) Explain the working of microwave frequency meter. **7**

3. (A) What is sputtering ? Explain DC and RF sputtering in detail. **7**

3. (B) Write the names of vacuum pumps and draw neat diagram of diffusion pump and explain it in detail. **7**

OR

3. (A) Explain the principle and working of Pirani gauge. **7**

3. (B) Write various growth stages of thin films and the growth of continuous thin film on a substrate. **7**

4. (A) With diagram discuss Scanning Electron Microscope (SEM) in detail, also write its merit and demerit. **7**

4. (B) Explain the concept and working of Auger Electron Spectroscopy(AES) with necessary diagram. **7**

OR

4. (A) With diagram, explain the Transmission Electron Microscope (TEM). **7**

4. (B) Explain X- ray diffraction technique with necessary diagram. **7**

5. Answer the following : (any **seven**) **14**

(1) In TWT axial electric field due to RF signal travels with phase velocity of v_p = _____ × v_c (Take, diameter of TWT = 0.58 cm, and pitch = 0.1 cm)

(2) _____ does not have an attenuator hence oscillations occur due to reflections from an imperfectly terminated collector end of the helix.

(3) Mention three types of magnetrons.

(4) Perfectly matched junction represents that the value of scattering parameter Sii for the junction is _____.

(5) Why do we call E-plane Tee a 3-dB splitter ?

(6) Draw the schematic diagram of rat race coupler.

(7) Write various degrees of vacuums are _____.

(8) State the advantages of PVD.

(9) State the advantages of root pump over rotary pump.

(10) Write full form of LEED and RHEED.

(11) Write three applications of XRD.

(12) Write advantage and disadvantage of AES.

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Seat No. : _____

NI-140

November-2025

M.Sc., Sem.-III

PHY-504 : Physics

(Electronics Communication-I)

(Old)

Time : 2:30 Hours] **[Max. Marks : 70**

1. (A) Explain the construction and working of a Smith chart. Show how it can be used to determine reflection co-efficient, impedance, and admittance. **7**

1. (B) (1) With help of a circuit diagram describe primary transmission line parameters. **7**

(2) A coaxial cable having an inner diameter of 0.025 mm and using an insulator with dielectric constant of 2.56 is to have a characteristic impedance of 2000 W. What must be outer conductor diameter ? Assume high frequency transmission. What do you infer from this example ?

OR

1. (A) Derive expressions for attenuation constant, phase constant, and characteristic impedance for a lossy transmission line. **7**

1. (B) Discuss the effect of generator and load mismatches on the efficiency of power transfer in transmission lines. Derive expressions for reflection at both ends of the line. **7**

2. (A) Discuss basic antenna parameters such as radiation pattern, radiation resistance, directivity and gain briefly. **7**

2. (B) Explain the construction and working principle of a half-wave dipole antenna. Derive its radiation resistance and radiation pattern. **7**

OR

2. (A) Explain why the Yagi antenna is widely used for TV and VHF/UHF communication systems. **7**

2. (B) Describe the construction, working, and advantages of a parabolic reflector antenna. **7**

3. (A) Explain the theory of amplitude modulation. Derive the expression for an AM wave and show that it contains the carrier and two sidebands. **7**

3. (B) Discuss the advantages and applications of single sideband modulation. **7**

OR

3. (A) Compare the Foster-Seeley discriminator and ratio detector in terms of operation and noise performance. **7**

3. (B) Explain the phasing method of SSB generation. Derive the necessary phase relationships for suppressing unwanted sideband. **7**

4. (A) Explain the principle of Pulse Amplitude Modulation (PAM) with waveforms and discuss its advantages and disadvantages. **7**

4. (B) Explain Continuous Phase Frequency Shift Keying (CPFSK) and discuss its advantages over conventional Frequency Shift Keying (FSK). **7**

OR

4. (A) Compare analog modulation and digital modulation techniques with examples. **7**

4. (B) Explain the block diagram of a PCM system and describe the function of each block. **7**

5. Answer in brief Any **Seven** questions from the following : (Each question is of **two** marks.) **14**

(i) What assumptions are made in the lumped element model of a transmission line ?

(ii) What type of electromagnetic mode exists in a transmission line ?

(iii) What is a quarter-wave transformer ?

(iv) Differentiate between directional and omnidirectional antennas.

(v) The ratio of power radiated in a given direction to the power that would be radiated by an isotropic antenna for the same input power is called _____. (radiation resistance, directivity, gain, beam efficiency)

(vi) Log-periodic antennas have repeating electrical properties over logarithmic frequency intervals. (TRUE or FALSE)

(vii) Define modulation. Why is it necessary in communication systems ?

(viii) Give two advantages and disadvantages of FM over AM.

(ix) Explain why is SSB transmission more efficient than AM.

(x) Define bit-timing recovery.

(xi) State any two methods to reduce bit error rate.

(xii) In digital modulation, noise immunity is _____ than in analog modulation. (lower, higher, same, zero)