# PG Even Semester Examination, May 2025

## PHYSICS

(2nd Semester)

Course No.: PHYCC-554A

**(Electronics and Social State Physics)**

*Full Marks: 70*

*Pass Marks: 28*

*Time: 3 hours*

*The figures in the right margin indicate full marks for the question.*
*Answer any five questions selecting one from each unit.*

## ELECTRONICS

### UNIT-I

1. (a) Explain the formation of depletion layer in a pn-junction. 4

   (b) Describe the construction and working of solar cell. Show that $V_{oc} \propto 1_e$ for very weak light intesity in solar cell. 2+3+5=10

2. (a) Write three difference between BJT and FET. 3

   (b) Describe the working of n-channel enhancement MOSFET with a neat diagram. In what ways enhancement and depletion MOSFET differ? 6+3=9

   (c) Define threshold voltage. 2

## UNIT-II

3. (a) Draw the circuit diagram of non-inverting amplifier using OPAMP and derive the voltage gain expression. 2+4=6

   (b) Explain the concept of 'virtual ground' of OPAMP. 2

   (c) Define (i) input bias current (ii) input offset current, (iii) input offset voltage. 2+2+2=6

4. (a) Explain the use of OPAMP as (i) Comparator (ii) Logarithmic amplifier. 4+4=8

   (b) Signals applied to the inverting and non-inverting terminals of a differential amplifier are –0.40 mV and –0.42mV If the differential gain (Ad) and CMRR are 1200 and 55dB, respectively, calculate the output voltage ($V_0$). 5

   (c) What is CMRR? 1

## UNIT-III

5. (a) Distinguish between sequential and combinational logic. Give examples. 4

   (b) What is multiplexing and de-multiplexing? Explain working of a multiplexer and de-multiplexer using logic circuits and truth table. 2+8=10

6. (a) Discuss SR flip-flop, using NOR gate. What is 'race conditions' in SR flip-flop? 5+2=7

   (b) Discuss the action of four-bit serial-in serial-out shift registers. 7

# Solid State Physics

## UNIT-I

7. Define crystalline, polycrystalline and amorphous state of solid. Derive Bragg's law of crystal diffraction and explain the rotating crystal method used to determine crystal structure of solid. 3+3+8=14

8. (a) Discuss Ewald construction and derive Bragg's diffraction condition in terms of reciprocal lattice vector. 8

   (b) Electrons accelerated by 844 volts are reflected from a crystal. If reflection maximum occurs at a glancing angle of $58^0$, determine the interplanner spacing of the crystal. 6

## UNIT-II

9. (a) Discuss the Kronig-Penny model for linear lattice. How does it lead to formation of energy bands of solids. 8+2=10

   (b) Considering a 1-dimensional crystal show that the number of postive states in a band is equal to the number of unit cells. 4

10. Enumerate the properties of type-I and type-II superconductors. Derive London equations and discuss how superconducting states can be explained using the equations. 4+10=14

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