



24518

V Semester B.Sc. Examination, November/December 2017
(New-Syllabus)
PHYSICS
Paper – VI (5.2) : Statistical Physics, Quantum-Mechanics and
Electronics – I

Time : 3 Hours

Max. Marks : 80

Instruction : Write answers to Section – A questions in the **first two pages only**.

SECTION – A

I. Answer the following, **each** of 1 mark. **(15×1=15)**

- 1) What is phase space ?
- 2) What is Stirling's approximation ?
- 3) Can matter wave travel faster than light ? Justify your answer.
- 4) Write the expression for zero point energy of a quantum mechanical oscillator.
- 5) Name two particles involved in the compton scattering.
- 6) Define ensemble.
- 7) Write the expression for energy of a particle in one dimensional box.
- 8) What is avalanche break down ?
- 9) What is the resistance of an ideal PN-junction when it is reverse biased ?
- 10) What is π -section filter ?
- 11) What is liquid crystal ?
- 12) In a transistor $I_B = 60\mu A$, $I_C = 1.75$ mA, calculate the current gain (β).
- 13) Draw the circuit symbol of LED.
- 14) What is meant by thermal runaway ?
- 15) On what factor colour of LED depends ?

P.T.O.



SECTION – B

II. Answer **any five** of the following, **each** of 5 marks. (5×5=25)

- 16) Compare Maxwell-Boltzmann and Fermi-Dirac statistics.
- 17) Illustrate the Heisenberg's uncertainty principle by gamma-ray microscope.
- 18) Describe time independent Schrödinger's wave equation.
- 19) Derive an expression for electrical conductivity of semiconductor.
- 20) Explain how zener diode works as a voltage regulator.
- 21) Explain the working principle of solar cell and its applications.
- 22) With diagram, explain the working of JFET.

SECTION – C

III. Answer **any four** of the following, **each** of 10 marks. (4×10=40)

- 23) a) State and prove Boltzman equipartition theorem.
b) Write a note on Gibb's paradox. (7+3)
- 24) a) What is compton effect ? Derive an expression for compton shift.
b) A monochromatic beam of X-rays of wavelength 0.2 nm is incident on a carbon block and gets scattered. If the scattered beam is observed at right angles to the incident beam, find the Compton Shift.
Given : Mass of electron = 9.11×10^{-31} Kg
Planck's constant = 6.62×10^{-34} JS
Velocity of light = 3×10^8 m/s. (7+3)
- 25) a) Obtain an expression for energy of a linear harmonic oscillator using Schrödinger wave equation.
b) What is the lowest energy in MeV that a neutron can have if it is confined to move along the edge of an impermeable box of length 10^{-14} m. Mass of neutron = 1.67×10^{-27} kg. (7+3)



- 26) a) What is Hall effect ? Obtain the expression for Hall-coefficient in terms of charge carrier density.
- b) A Germanium plate of thickness 2 mm, breadth 10 mm and length 200 mm is placed in a magnetic field of 0.6 web/m^2 acting perpendicular to its thickness. If 0.02 A current flows along its length, Calculate the Hall voltage if the Hall-coefficient is $3.76 \times 10^{-4} \text{ m}^3/\text{coulomb}$. (7+3)
- 27) a) Explain the working of a centretrapped full wave rectifier and obtain the expression for efficiency and ripple factor of the rectifier.
- b) Compare the merits and demerits of LED and LCD. (5+5)
- 28) a) Explain the working of a npn transistor as an amplifier in CE configuration.
- b) What is dc load line of a transistor ? Explain with the help of diagram how the dc load line can be drawn and how the operating point can be located. (5+5)
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