

R18

Code No: 152AE

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech I Year II Semester Examinations, February - 2025

APPLIED PHYSICS

(Common to EEE, CSE, IT, CSIT, ITE, CE(SE), CSE(CS), CSE(DS), CSE(N))

Time: 3 Hours

Max. Marks: 75

Note: i) Question paper consists of Part A, Part B.

ii) Part A is compulsory, which carries 25 marks. In Part A, answer all questions.

iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART - A

(25 Marks)

- 1.a) State Born's interpretation of the wave function and its physical meaning. [2]
- b) What are the key findings of the Davisson and Germer experiment? [3]
- c) What are the main differences between Zener and p-n junction diodes? [2]
- d) What is the significance of the Fermi level in semiconductors? [3]
- e) A solar cell has a short-circuit current of 25mA and an open-circuit voltage of 0.6V. If the maximum power output is 10mW, calculate the Fill Factor (FF) of the solar cell? [2]
- f) Write the working principle of avalanche photodiode. [3]
- g) List two major applications of the Carbon dioxide (CO₂) laser in industry. [2]
- h) A He-Ne laser operates at a wavelength of 632.8nm. Calculate the energy of a single photon emitted by this laser in electron volts. [3]
- i) A parallel-plate capacitor with a dielectric constant of 4.5 is filled with a dielectric material and has a plate area of 0.01m² and plate separation of 1mm. Calculate the capacitance of the capacitor. [2]
- j) A ferromagnetic material has a relative permeability of 500. If the material is placed in a magnetic field of 0.01T, calculate the magnetization? [3]

PART - B

(50 Marks)

- 2.a) State de-Broglie's hypothesis and derive the expression for the wavelength of a particle in motion.
- b) Describe the photoelectric effect and its significance in establishing the particle nature of light. [5+5]

OR

- 3.a) Derive Schrodinger's time-independent wave equation and discuss its significance in quantum mechanics.
- b) Explain the concept of black body radiation. [5+5]
- 4.a) How the Fermi level depends on carrier concentration and temperature in intrinsic and extrinsic semiconductors?
- b) Derive the expression for the diffusion current and drift current in semiconductors. [5+5]

OR

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- 5.a) Differentiate between NPN and PNP transistors.
b) What is the Hall effect? Derive the expression for Hall voltage. Write its applications. [5+5]

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- 6.a) Explain the differences between radiative and non-radiative recombination mechanisms in semiconductors.
b) Describe the structure and working principle of an LED. [5+5]

OR

- 7.a) Discuss the working principle and structure of a solar cell. Explain how its efficiency depends on material properties and device design.

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- b) Explain the structure and working principle of a PIN photodiode. [5+5]

- 8.a) Explain the interaction of radiation with matter, detailing the processes of absorption, spontaneous emission, and stimulated emission.

- b) Describe the principle and working of a laser. Explain the role of population inversion and pumping in laser operation. [5+5]

OR

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- 9.a) Discuss the construction, working, and applications of the He-Ne laser.

- b) How optical fibres are useful in fibre optic communication? [5+5]

- 10.a) Explain ferromagnetism and describe the formation of ferromagnetic domains.

- b) Discuss Maxwell's equations in integral form and their physical significance. [5+5]

OR

- 11.a) List the differences between ferroelectrics and piezoelectric materials.

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- b) Classify magnetic materials and discuss the properties with examples. [5+5]

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