

Write your Exam Roll No.)

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END TERM EXAMINATION

FIRST SEMESTER [B.TECH] DECEMBER 2025

Paper Code: BS-105

Time: 3 Hours

Subject: Applied Physics-I

Maximum Marks: 60

Note: Attempt all questions as directed. Internal choice is indicated.

Q1 Attempt any four of the following questions:

(Marks 4 x 5=20)

- (a) What do you understand by Carnot's theorem? Prove the necessary result.
- (b) Write Maxwell's equation in differential form. State physical interpretation of each equation.
- (c) Explain interference from parallel thin films for reflected light system. Calculate path difference.
- (d) What do you understand by population inversion? Explain why is it not achieved in two level laser system?
- (e) Show that work done for a perfect gas is $W = RT \log_e (V_f/V_i)$.
- (f) A plane EM wave travelling in +z direction in a dielectric medium with $\mu_r = 1$ and $\epsilon_r = 3$ has peak electric field intensity $E_0 = 6 \text{ V/m}$. Find (i) Speed of the wave, (ii) impedance of the medium and (iii) Peak magnetic field intensity
- (g) Define Malus law. Two Nicols have parallel directions so that the intensity of transmitted light is maximum. Through what angle must either Nicol be turned if intensity is to drop by one-fourth of its maximum value.
- (h) A clock is moving with a speed of $0.95c$ relative to an observer standing on the earth. If the speed is increased by 5% by what percentage does time dilation increases.

UNIT-I

Q2 (a) Differentiate between reversible and irreversible processes with example.

(3)

(b) What is Carnot engine? Explain Carnot cycle and derive the expression for the efficiency of the engine.

(7)

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OR

- Q3 (a) Prove that the entropy of an ideal gas remains constant in a reversible Process but increases in an irreversible process (3)
- (b) A Carnot engine whose low temperature reservoir is at 7°C has an efficiency of 40%. To increase the efficiency to 50% by how many degrees should the temperature of the source be increased? (3)
- (c) State zeroth law of thermodynamics with justified application. (4)

UNIT-II

- Q4 (a) Derive an equation of motion in differential form for a harmonic oscillator governed by sinusoidal force. (5)
- (b) What do you understand by skin depth. Find the skin depth at a frequency 1.6MHz in Al where $\sigma=38.2\text{MS/m}$ and $\mu=1$. (5)

OR

- Q5(a) Derive equation of continuity from Maxwell's equation. (5)
- (b) State and Prove work energy theorem. (5)

UNIT-III

- Q6 (a) Explain in detail how wavelength of monochromatic source can be determined using Newton Ring experiment. What will happen if white light is used in this experiment. (7)
- (b) Calculate minimum thickness of a half wave plate when sodium light is used for polarization with $\mu_o=1.57$ and $\mu_e=1.52$. (3)

OR

- Q7 (a) Deduce an expression of resultant intensity for Fraunhofer single slit diffraction. (7)

- (b) How many orders will be visible if the wavelength of an incident radiation is $5000\text{\AA}$, number of lines on the grating is 1000 per inch. (3)

UNIT-IV

- Q8 (a) Deduce the expression for mass energy equivalence. (5)
(b) Describe Michelson Morley experiment. (5)

OR

- Q9 (a) Explain working of Ruby laser with labelled energy level diagram. (5)
(b) What are the necessary conditions for laser. Calculate how many photons are required per second to produce laser beam of 1mW for light of wavelength $5000\text{\AA}$. (5)
