Graphic Era
HILL UNIVERSITY
Established by an Act of the State Legislature of Uttarakhand (Adhiniyam Sankhya 12 of 2011)
University under section 2(f) of UGC Act, 1956

End Term (Odd) Semester Examination November 2025

Roll no.............................

Name of the Course and semester: B.Tech. and Sem I
Name of the Paper: Engineering Physics
Paper Code: TPH 101

Time: 3 hour   **Maximum Marks:** 100

Note:

    (i)   All the questions are compulsory.
    (ii)   Answer any two sub questions from a, b and c in each main question.
    (iii)   Total marks for each question is 20 (twenty).
    (iv)   Each sub-question carries 10 marks.

Q1   **(2×10 = 20 Marks)**

a. Explain in detail the principle, construction, and working of Fresnel's biprism. Derive the expression for determining the distance between two virtual sources.   CO1

b. Describe the theory of diffraction grating and explain how it is used for the determination of wavelengths of light. With the help of a neatly labeled diagram, derive the condition and intensity for principal maxima.   CO1

c. Newton's rings are formed in reflected light of wavelength 6000 Å with a liquid between the plane and curved surfaces. If the diameter of the 6th bright ring is 3.1 mm and the radius of curvature of the curved surface is 100 cm, calculate the refractive index of the liquid.   CO1

Q2   **(2×10 = 20 Marks)**

a. Discuss the fundamental processes of laser action. Describe the principle, construction, and working of a He–Ne gas laser with a neat labeled diagram.   CO2

b. Discuss the following concepts in brief:
(i) Double refraction method
(ii) Retardation plates   CO2

c. A 5 % solution of cane sugar placed in tube of length 40 cm, causes the optical rotation of 20 °. How much length of 10 % solution of the same substance will cause 35° rotation?   CO2

Q3   **(2×10 = 20 Marks)**

a. Using the Lorentz transformation equations, derive the length contraction and time dilation formula.   CO3

b. Explain and derive the Einstein mass–energy equivalence relation ($E = mc^2$). Discuss the physical interpretation of the equation.   CO3

c. (i) What is the length of a metre stick moving parallel to its length when its mass is 3/2 times of its rest mass?
(ii) The mean life of a meason is 2×10^{-8} sec. Calculate the mean life of a meason moving with a velocity 0.8c.   CO3

Q4   **(2×10 = 20 Marks)**

a. Derive the energy eigenvalues and eigenfunctions for a particle trapped in a one-dimensional infinite potential box.   CO4

b. Discuss and compare the quantum computing with classical computing. Write the superposition state of three qubits.   CO4

c. Energy of the particle at absolute temperature T is of the order of kT. Calculate the CO4 wavelength of thermal neutrons at 27 °C. Given, the mass of neutron = 1.67×10^{-27} kg. Planck's constant h = = 6.6×10^{-34} joule-sec and the Boltzmann's constant k = = 1.376×10^{-23} J/degree.

Q5   **(2×10 = 20 Marks)**

a. Discuss in detail the properties and types of superconductors.   CO5

b. Derive the first and fourth of Maxwell's relations using the basic electromagnetic laws, CO5 and express them in their differential forms. Explain the physical interpretation of each relation.

c. Explain in detail the concept of nanomaterials, describing their definition, unique CO5 properties, and various types.