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PRANVEER SINGH INSTITUTE OF TECHNOLOGY KANPUR

Pre-University

Session 2023-24

Odd Semester

B. Tech.-I Semester

Engineering Physics (BAS 101)

CO Number	Course Outcome
CO1	To **Define (L1-Remember)** and **Describe** basic knowledge of Engineering physics.
CO2	To **Discuss (L2- Understand)** various complex problems of Engineering Physics and **Calculate** several numerical problems.
CO3	To **Demonstrate (L3-Apply)** fundamentals of Quantum mechanics and Wave optics, **Construct** mathematical expressions like one dimensional Schrodinger's wave equation and its application, Maxwell's equations (differential and integral form) Interference in thin films, Applications of Newton's rings, intensity distribution in N-slits diffraction grating, various aspects of optical fibre, laser, superconductivity and nano science.
CO4	To **Illustrate and distinguish (L4-Analyze)** various physical phenomenon closely associated with each other.

Time: 3 Hrs. M. M. 70

Section A

Q1. Attempt all questions: **(2X7 = 14 Marks)**

a) Describe the Planck's assumptions of blackbody radiation. CO1

b) Define Compton shift and Compton wavelength. CO1

c) Define Poynting vector and skin depth in conducting medium. CO1

d) Define dispersive power and resolving power. CO1

e) Define population inversion and stimulated emission of radiation. CO1

f) State any two difference between step index and graded index fiber. CO1

g) Define quantum well and quantum dots. CO1

Section B

Q2. Attempt all questions: **(7X3 = 21 Marks)**

a) Determine an expression of Eigen value and Eigen function for a particle in one-dimensional box using Schrodinger independent wave equation. CO3

b i) Construct an expression for Poynting theorem and interpret physical significance of each term. CO3

OR

ii) Show that the interference patterns of reflected and transmitted monochromatic light are complementary in thin films. CO3

c i) Construct an expression for acceptance angle and numerical aperture of an optical fiber. CO3

OR

ii) Show that the relative intensities of successive maxima in Fraunhofer diffraction due to a single slit are nearly, CO3

$$1 : \frac{4}{9\pi^2} : \frac{4}{25\pi^2} : \frac{4}{49\pi^2} \ldots\ldots\ldots$$

Section C

(7X1 = 7 Marks)

Q3. Attempt any one part of the following questions:

a) Establish an expression of Schrodinger's time independent wave equation for a free particle. CO4

OR

b) Illustrate using Maxwell's equations that electromagnetic wave is propagating with speed of light in free space. CO4

(7X1 = 7 Marks)

Q4. Attempt any one part of the following questions:

a) Illustrate the fabrication techniques and properties of Nanomaterial. CO4

OR

b) Explain the Meissner effect and types of superconductors. CO4

(7X1 = 7 Marks)

Q5. Attempt any one part of the following questions:

a) Calculate the energy difference between the ground state and the first excited state for an electron in a one-dimensional box of length 10^{-8} cm. Mass of an electron is 9.1×10^{-31} Kg. CO2

OR

b) Calculate the skin depth of an electromagnetic wave in Aluminum at the frequency of 71.6 MHz. The electrical conductivity of Aluminum is 3.54×10^7 mhos/m and $\mu = \mu_0 = 4\pi \times 10^{-7}$ Weber/Am. CO2

(7X1 = 7 Marks)

Q6. Attempt any one part of the following questions:

a) Calculate the least thickness of the film that will appear dark and bright if the light of wavelength 5893 Å is reflected at nearly normal incidence from a soap film of refractive index $\mu = 1.42$. CO2

OR

b) Calculate the diameter of 20^{th} dark ring of Newton's ring experiment if the diameter of 4^{th} and 12^{th} dark rings are 0.4 cm and 0.7 cm respectively. CO2

(7X1 = 7 Marks)

Q7. Attempt any one part of the following questions:

a) Calculate the cut-off parameter and the number of modes which the fiber will support in a step index fiber consisting core refractive index 1.466 and cladding refractive index 1.46. If the operating wavelength of the rays is 0.85 μm. The diameter of core is 50 μm. CO2

OR

b) Calculate the temperature and critical current density of a lead wire with a critical magnetic field of 6.5×10^3 tesla at zero Kelvin. The transition temperature is 7.18 Kelvin. The critical magnetic field is 4.5×10^3 tesla at T Kelvin. The diameter of the lead wire is 2mm. CO2