

JK LakshmiPat University, Jaipur
Institute of Engineering and Technology
End Term – Examination(BACK)
B.Tech. IYear/I Semester



Course Name: Engineering Physics-I

Course Code: PH101

Max Marks: 50

Time: 03.00 hr

Instructions:

1. Mobile phones are not allowed during Examination.
2. Use of calculator is allowed during Examination.

Section A

(Q1A) Write true or false/Fill in the blanks/Choose the correct answer (1*5=5)

(i) Two different light sources are sending light and spots from both beams on a screen are obtained. Which of the following statements is true?

- (a) The broad and faint spot is a laser while the bright and narrow spot is an ordinary light
- (b) The broad and bright spot is a laser while the narrow and faint spot is an ordinary light
- (c) the broad and low intensity spot is an ordinary light, the narrow and highly intense spot is a laser light
- (d) actually both the spots will merge into each other and form an interference pattern

(ii) A plane containing the optic axis and perpendicular to two opposite faces of a crystal is defined as the ----- section of the crystal

(iii) Interference of light proves the

- | | |
|---------------------------------|-----------------------------|
| (a) corpuscular nature of light | (b) quantum nature of light |
| (c) wave nature of light | (d) none of these |

(iv) Wave function must possess the property of superpositions(T/F)

(v) The tip of a needle does not give a sharp image on a screen. This due to

- (a) reflection (b) interference (c) diffraction (d) none of these

(Q1B)

(4+1=5)

(i) What will be the state of polarization of the emergent light when

- (a) A beam of circularly polarized light is passed through a QWP.
- (b) A beam of plane polarized light is passed through a QWP.
- (c) A beam of elliptically polarized light is passed through a QWP.
- (d) A beam of plane-polarized light falling on the QWP such that the vibrations of the plane polarized light falling on the QWP make an angle of 45° with the optic axis.

(ii) Define specific rotation.

Section B

(5*6=30)

Out of seven questions, six questions are to be attempted.

Q2 In a Compton scattering experiment, a beam of X-rays of wavelength $0.708\text{\AA}$ is incident on a target and X-rays of wavelength $0.732\text{\AA}$ scattered by a target through a right angle are detected. Determine the Planck constant. Given $m_0 = 9.1 \times 10^{-31} \text{ kg}$ and $c = 3 \times 10^8 \text{ m/s}$

If the wavelength of x-ray photon is $1\text{\AA}$, what will be its momentum?

[2.5+2.5]

Q3 (a) How will you analyze the three sources of light having the same physical appearance; partially polarized, elliptically polarized and mixture of unpolarized & circularly polarized light?

(b) How will you differentiate between Half wave and Quarter wave plates?

[3+2]

Q4. Starting with the expression of intensity distribution for Fraunhofer diffraction in a plane diffraction grating find the intensity and conditions for principal maxima and minima

[5]

Q5.(a) Explain how will you determine the wavelength difference of two components of a line by Michelson's interferometer.

(b) For Michelson's interferometer, calculate the distance between the two successive positions of the movable mirror giving well defined fringes in the case of sodium source of wavelengths of 589.0 nm and 589.6 nm . [3+2]

Q6 Explain the formation of Newton's rings in reflected light. Prove that the diameters of the bright fringes are proportional to the square root of odd natural numbers. Explain the formation of dark spot at the centre of Newton's rings

[0.5+4.5]

Q7(a) The x-coordinate of a proton is known to be somewhere between 0.0123 mm and 0.1127 mm . what is the order of uncertainty in the x-components of its velocity?

(b) A Proton is confined in one dimensional box of width 10^{-10} m . What is the minimum energy (zero point energy) of proton?

[2.5+2.5]

Q8(a) In Newton's rings experiment by reflected light, the diameter of the 4th and 12th rings are 0.4 cm and 0.7 cm respectively. Find the diameter of the 20th dark ring. What will be the order of dark ring which is formed where thickness of air film is equal to wavelength of light used.

(b) Calculate the de-Broglie wavelength associated with proton moving with a velocity equal to one twentieth of the velocity of light

[2.5+2.5]

Section-C

(5*2=10)

Q7 Write down and solve Schrödinger's equation of a particle confined in one dimensional box for energy values and wave functions.

Q8 Derive an expression for the resultant intensity on the screen produced by the Fraunhofer diffraction due to a single slit and find the conditions for principal maximum, secondary maxima and minima.