

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular/Backlog), December 2015

B. Tech./B. Tech+M. Tech (Branch: CHE, CE, ME), Semester I

Roll No.....

PH101: Engineering Physics

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.
4. Mobiles are not allowed during examination.
5. Non-programmable calculator is allowed.

Q.1A Objective type multiple choice questions (10 questions @ 1 mark) 10

- i. Which of the following is conserved when light waves interfere
(a) intensity (b) energy (c) mass (d) amplitude
- ii. When the white light is incident on a thin film of oil then multiple colors appear due to of light.
(a) interference (b) diffraction (c) polarization (d) none
- iii. Along the optic axis _____
(a) velocity of E-ray is larger than O-ray
(b) velocity of E-ray is less than O-ray
(c) both the rays have the same refractive index (d) none of the above
- iv. $\mu_o < \mu_e$ for
(a) quartz (b) calcite (c) both a and b (d) none of above
- v. The de-Broglie wavelength of a moving electron is given by
(a) $\lambda = \frac{12.27}{\sqrt{mkt}} \text{ \AA}$ (b) $\lambda = \frac{6}{\sqrt{3mkt}} \text{ \AA}$ (c) $\lambda = \frac{12.27}{\sqrt{V}} \text{ \AA}$ (d) $\lambda = \frac{10.89}{\sqrt{V}} \text{ \AA}$
- vi. Examples for _____ emission light are glowing tube light, electric bulb, candle flame, etc.
(a) stimulated (b) spontaneous (c) both a & b (d) none
- vii. Numerical Aperture is independent of _____
(a) refractive index change (b) refractive index of medium (c) acceptance angle
(d) incidence and refractive angles

- viii. The correct choice for fabricating LED is _____
 (a) Si (b) Ge (c) GaAs (d) Carbon
- ix. Coherence time for a perfectly monochromatic sinusoidal wave is
 (a) infinity (b) 0 (c) 1 (d) 2
- x. What happen to the width of the central diffraction maxima when the width of the circular aperture increases ;
 (a) increase (b) decrease (c) unchanged (d) cannot be predicted

Q.2 Short answer type questions (4 questions @ 2.5 marks)

10

- i. How is the transverse nature of the light waves established by the polarization of light?
- ii. Prove that only first order is possible if the width of a grating element is less than twice the wavelength of light.
- iii. How can diffraction be explained on the basis of wave theory?
- iv. Discuss the dual nature of material and waves. Derive an expression for the de Broglie wavelength.

Q.3A Discuss different conditions to be fulfilled by coatings/thin films for working as anti-reflection coatings. 05

Q.3B Can a thin film of thickness ($\lambda/4$) of magnesium fluoride ($\mu_f = 1.38$) be deposited on a convex lens of ($\mu_g = 1.9$) to act as a non-reflecting film? 05

Q.4A Explain the principle behind the functioning of an optical fibre. Describe the structure of different types of optical fibres with ray paths. 05

Q.4B Find the lowest energy of an electron confined to move in one-dimensional box of length $1 \text{ \AA}$. 05

Q.5A The refractive index of core of step index is 1.40 and the fractional change in refractive index is 2%. Calculate refractive index of the cladding and acceptance angle in air. 05

Q.5B A beam of γ -rays of energy 450 keV is incident on a foil of Al. Calculate the wavelength and energy of scattered γ -rays at 90° . 05

Q.6A What is quarter wave plate? Explain its use in getting circularly and elliptically polarized light. 05

Q.6B	In a Newton's ring experiment, find the radius of curvature of the lens surface in contact with the plane glass surface when illuminated with sodium light. The diameter of the 3 rd dark ring is 3.2×10^{-3} m. the light is falling at such an angle that it passes through the air film at an angle of zero degree to the normal.	05
OR		
Q.6B	The optic axis of a quartz crystal is parallel to its faces. What is the thinnest possible plate that would serve to put the ordinary and extraordinary rays of $\lambda = 589$ nm a half-wave apart on their exit?	05
Q.7A	Discuss the phenomenon of Fraunhofer's diffraction at a single slit and show that intensities of first and second maxima are $\frac{1}{22}$ and $\frac{1}{61}$ of the intensity of the central maxima.	05
Q.7B	A plane transmission grating has 5000 lines/cm. Calculate the longest wavelength of light for which spectrum can be obtained.	05
OR		
Q.7B	In a Fraunhofer diffraction pattern due to a single slit, the screen is at a distant of 1 m from the slit and the slit is illuminated by monochromatic light of 589.3 nm wavelength. The width of the slit is 0.1×10^{-3} m. calculate the width of the central maxima.	05
Q.8	Explain the Compton effect. Why is the Compton effect not observed in visible light? Derive an expression for the frequency of the scattered photon in terms of frequency of incident radiation.	10
Q.9A	Describe the formation of dark and bright circular fringes by reflected monochromatic light in the Newton's rings experiment. Discuss how these rings can be used to determine the refractive index of liquid. Show that width of successive Newton's rings goes on decreasing.	10
Q.9B	What do you understand by spontaneous emission and stimulated emission? What are essential requirements to produce a laser? Describe the working of He-Ne laser?	10
OR		
Q.9B	Define optical activity and specific rotation. How will you measure specific rotation of glucose solution using Laurent's half shade device?	10