

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular/Backlog), April 2016

B. Tech./B. Tech+M. Tech (Branch: CSE, EE, ECE), Semester II

Roll No.....

PH101: Engineering Physics

Time: 3 hours

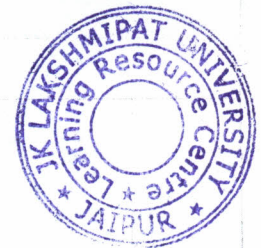
Max. Marks: 100

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. Coherence time for perfectly monochromatic sinusoidal wave is.....
(a) infinite (b) 0 (c) 1 (d) 2
- ii. In Fraunhofer diffraction, the incident and diffracted wave front can be considered
(a) spherical (b) plane (c) elliptical (d) circular
- iii. The sensitive tint in a bi-quartz plate has a color field of view.
- iv. Polarization of light proves the_____.
(a) corpuscular nature of light (b) quantum nature of light
(c) transverse nature of light (d) longitudinal nature of light
- v. State Malus law.
- vi. The average life time of the metastable state is_____
(a) 10^{-15} (b) 10^{-10} (c) 10^{-8} (d) 10^{-3}
- vii. A laser requires mirrors because
(a) they provide optical feedback (b) they invert the population inversion
(c) they determine the wavelength at which lasing occurs (d) none
- viii. Why diffraction of light is not observed in daily life?
- ix. To be a solution of the Schrodinger equation, the wave function should be
(a) single valued, continuous (b) multivalued and continuous
(c) single valued and discontinue (d) multivalued and discontinuous





x. The eigen energy value of a particle confined in a one dimensional box is

(a) $E_n = \frac{n^2 h^2}{8ma^2}$ (b) $E_n = \frac{nh^2}{2ma^2}$ (c) $E_n = \frac{nh}{4ma}$ (d) $E_n = \frac{nh}{6ma}$

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

10

- i. What do you understand by missing order spectrum?
- ii. A diffraction pattern is observed using a beam of red light. What happens if the red light is replaced by blue light?
- iii. What does pumping mean for laser action?
- iv. What is the significance of the numerical aperture of an optical fibre?

Q.3A Explain the basic reasons behind the production of incoherent waves. How does spatial coherent length can be determined?

05

Q.3B In a costume jewelry, rhinestones ($\mu=1.50$) are often coated with silicon monoxide ($\mu=2.0$) to make them more reflective. How thick should the coating be to achieve strong reflections for light of wavelength $5600 \text{ \AA}$ incident normally?

05

Q.4A Distinguish the step index and graded index optical fibre on the basis of operation and applications? What are the advantages of communication through optical fibre rather than other conventional medium?

05

Q.4B A step index optical fibre with $n_1=1.50$ and $n_2=1.40$ is used in water, $n_w=1.33$. Find maximum angle of acceptance and velocity of the wave through the fibre.

05

Q.5A What is the physical significance and origin of wave function? Derive the time dependent Schrodinger equation for a moving particle in potential V .

05

Q.5B Compare the uncertainties in velocity of a proton and an electron contained in a one dimensional box of $10 \text{ \AA}$. [Given $m_e=9.1 \times 10^{-31} \text{ kg}$, $m_p=1.67 \times 10^{-27} \text{ kg}$]

05

Q.6A Deduce the expression of the intensity distribution for Fraunhofer's diffraction in a plane diffraction grating. Prove that intensity of the secondary maxima is negligible with respect to intensity of the principal maxima at large number of slits.

05

Q.6B Fraunhofer diffraction pattern is obtained using light of wavelength $6000 \text{ \AA}$ and

05

a single slit. When the source of light is changed to another wavelength, the angular width of the central maxima decreases by 20%. Calculate the new wavelength.

OR

Q.6B A monochromatic light of wavelength $5860 \text{ \AA}$ is incident normally on a 2 cm wide grating. The first order spectrum is produced at an angle of 20° with respect to the normal. Determine the total number of lines on the grating. 05

Q.7A What are half wave plate and quarter wave plate? Explain how one of them can be used in getting circularly and elliptically polarized light. 05

Q.7B The refractive indices for right handed and left handed circularly polarized light of wavelength $7620 \text{ \AA}$ for quartz are 1.53914 and 1.53920 respectively. Calculate the rotation of the plane of polarization of light in degree produced by a plate of 0.5 mm thickness. 05

OR

Q.7B The specific rotation of quartz for light of wavelength 589 nm is $21.7^\circ/\text{mm}$. what thickness of quartz cut parallel to its axis and inserted between parallel polarizers, will cause no light to be transmitted? 05

Q.8 What are essential requirements to produce a laser? Describe the characteristics, working and applications of He-Ne laser? 10

Q.9A Explain Newton's ring method for determining the wavelength of monochromatic light. Discuss the different cases for which center of the ring is bright. What will happen with the diameter of newton's ring if plano-convex lens is replaced by plano-concave lens? 10

Q.9B Explain the Plank's hypothesis. Why Compton effect can't be explained by classical mechanics? Derive an expression for the frequency of the scattered photon from a carbon material in terms of frequency of incident radiation. 10

OR

Q.9B Define optical activity? Describe the Fresnel's explanation of it and deduce the expression of optical rotation based on Fresnel's explanation. 10

