

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular/ Backlog), November 2017
B. Tech./B. Tech+M. Tech (Branch: CHE, CE, ME, CSE-IBM), 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.
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Q.1A Objective type multiple choice questions (10 questions @ 1 mark) 10

- i. In Newton's rings, the spacing between consecutive rings..... with increase of order of rings.
(a) increase (b) remain constant (c) decrease (d) none
- ii. The tip of the needle doesn't give a sharp image on the screen. This is due to...
(a) polarization (b) interference (c) diffraction (d) refraction
- iii. When the monochromatic light is incident on a thin film of oil then multiple colors appear due to interference of light. [YES/NO]
- iv. In Fraunhofer class of diffraction, the source of light and screen are at _____ distance from the diffracting aperture or obstacle
(a) finite (b) infinite (c) large (d) any
- v. Polaroid sun glasses decreases the glare on a sunny day because they
(a) block a portion of sun light (b) have a special colour
(c) completely absorb the sun light (d) refract the light
- vi. Optical fibre communication is based on the phenomenon of refraction.
[YES/NO]
- 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. Choose the incorrect statement

- (a) population inversion can be obtained by thermal processes
- (b) population inversion can't be obtained unless there is a metastable state
- (c) A three level laser is less efficient than four level laser
- (d) population inversion can be obtained by optical pumping

- ix. Hamiltonian operator defines the _____
- (a) total energy of the system (b) potential energy of the system
 - (c) kinetic energy of the system (d) all of these
- x. De-Broglie wavelength is independent of
- (a) mass (b) velocity (c) charge (d) all of these

Q.2 Short answer type questions (4 questions @ 2.5 marks) 10

- i. How diffraction does differ from the interference 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 do matter waves differ from electromagnetic wave?
- iv. State Plank radiation rule with any three experimental evidence of it.

Q.3A Explain the conditions which are required to a thin film for working as anti-reflection coatings. What are the applications of the antireflection coatings? 05

Q.3B A soap film of refractive index 1.33 is illuminated with light of different wavelengths at an angle of 45° . There is complete destructive interference for $\lambda = 5890 \text{ \AA}$. Find the thickness of the film. 05

Q.4A What does an optical fibre function in transporting electromagnetic energy? Show that numerical aperture of a step index fibre is given by $NA = n_1 \sqrt{2\Delta}$ Where symbols have their usual meanings. 05

Q.4B An optical fibre has a numerical aperture of 0.20 and a cladding refractive index of 1.59. Find the acceptance angle for the fibre in water which has a refractive index of 1.33. 05

Q.5A What are the properties of wave function? Derive the time independent Schrodinger equation for a moving particle in potential V. 05

Q.5B Calculate the minimum energy of a photon at which it can transfer its half energy to the electron at rest. 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 In a grating spectrum, Which spectral line in 5th order will overlap with 4th order line of 5890 Å. 05

OR

Q.6B A lens whose focal length is 50 cm forms a Fraunhofer diffraction pattern of a single slit of 0.3 mm width. Calculate the distance of first dark band and of the next bright band on either side of the central maximum. The wavelength of light used is 5890 Å. 05

Q.7A Discuss the phenomenon of double refraction in a calcite crystal. How can a phase retardation plate be obtained from it? 05

Q.7B Two Nicols are crossed to each other. Now one of them is rotated through 60°. What percentage of incident unpolarised light will pass through the system. 05

OR

Q.7B The specific rotation of the quartz at 5086 Å is 29.73 deg/mm. Calculate the difference in the refractive indices. 05

Q.8 What do you understand by spontaneous emission and stimulated emission? Obtain a relation for Einstein coefficients A and B for spontaneous and stimulated emission. What are essential requirements for laser action? 10

Q.9A Describe the Newton's ring experiment with neat diagram to determine the wavelength of sodium light. What will happen to fringes if the air film between the plano-convex lens and the glass plate is filled with a liquid of refractive index μ . Explain. 10

Q.9B Write down the Schrodinger's equation for a free particle enclosed in one dimensional box of size 'a'. Solve it for eigen values and eigen functions. Find lowest energy of the non-degenerate state. 10

OR

Q.9B Define specific rotation. How will you determine it using Lorentz half shade polarimeter? Discuss the relative merits of biquartz and half shade devices. 10