

[Total No. of Questions - 9] [Total No. of Printed Questions - 4]
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B. Tech 1st Semester Examination

Engineering Physics-I (NS)

NS-102

30 DEC 2016

Time : 3 Hours

Max. Marks : 100

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt five questions in all. Section A, B, C and D consist of 2 questions and students are advised to attempt at least one question from each of the sections. Section-E is compulsory consisting of 10 questions carrying 2 marks each. Where necessary, draw an appropriate diagram?

SECTION - A

1. (a) What do you understand by Fresnel's biprism? Derive an expression to determine the wavelength of light using Fresnel's biprism.
(b) Distinguish between dispersive power and resolving power of a plane diffraction grating. Derive an expression for the same.
(c) Newton's ring are observed in reflected light of wavelength $\lambda = 5.9 \times 10^{-7} \text{m}$. The diameter of the 10th dark ring is 0.005m. Find the radius of curvature of the lens and the thickness of the air film. (8+6+6=20)
2. (a) What is plane diffraction grating? Derive an expression to determine the wavelength of light. Write down characteristics of grating spectra.
(b) (i) Explain why the centre of Newton's Rings is black. How it can be made bright?

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- (ii) Why Newton's rings are circular in nature?
- (c) Describe the construction of a nicol prism and show how it can be used as a polarizer or on an analyser. Distinguish between quarter wave plate and half wave plate. (8+6+6=20)

SECTION - B

3. (a) Explain de-Broglie concept of matter waves. Derive an expression for de-Broglie wavelength. What are the characteristics of matter waves?
(b) An electron is confined to a box of length 10^{-8}m . Calculate the minimum uncertainty in its velocity.
(c) What do you understand by blackbody radiations? Derive an expression for Planck's radiation law. (8+6+6=20)
4. (a) Distinguish between the phase and group velocities. Show that the de-Broglie wave group associated with moving particle travels with same velocity as the particle.
(b) Write down Maxwell's equations in differential form. Comment on the statement that 'isolated magnetic poles do not exist'.
(c) Explain Heisenberg's uncertainty principle. What is its physical significance? (8+6+6=20)

SECTION - C

5. (a) Derive an expression for the time dependent Schrodinger wave equation.
(b) A particle is described by a wave function $\psi(x) = 2x^2$, $0 < x < 1$. Find the probability of finding the particle between $0 < x < 1/2$.

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- (c) What are the postulates of quantum mechanics? What is the importance of Compton effect? (8+6+6=20)
6. (a) Discuss harmonic oscillator in quantum mechanics. Define energy eigen values for it. Does it explain the tunneling phenomena for a particle in a box?
- (b) (i) Comment on the statement "light is both wave and particle".
- (ii) What is the significance of normalization of wave function?
- (c) (i) Define operators eigen function and eigen values.
- (ii) "There is no scope of quantum mechanics in macroscopic world" Comment with suitable example. (8+6+6=20)

SECTION - D

7. (a) Explain in detail the basic differences in the assumptions of liquid drop model and shell model.
- (b) Find the energy released (in MeV), if 4H nuclei are fused to form 1He atom. Given atomic mass of He=4.0039amu and H=1.0076amu.
- (c) (i) What is thermo-nuclear energy? Discuss its importance as a source of energy in universe.
- (ii) What are quarks? List names of all known quarks. (8+6+6=20)
8. (a) (i) Distinguish between nuclear fission and fusion.
- (ii) Write down few lines about π -mesons, μ -mesons and K-mesons.
- (b) Give brief account of cosmic rays, showing that their interaction with atmospheric nuclei give rise to elementary particles.

- (c) Comment on the statement "every form of matter is associated with antimatter". Discuss this statement in the context of elementary particles. (8+6+6=20)

SECTION - E

9. (a) What are coherent sources of light? How can coherent sources of light be produced?
- (b) Why does diffraction not occur when light passes through a window?
- (c) If the plane of vibration of the incident beam makes an angle of 30° with the optic axis, compare the intensities of ordinary and extraordinary rays.
- (d) What do you understand by zone plate?
- (e) What are the characteristics of electromagnetic waves?
- (f) What is photoelectric effect? Define work function.
- (g) Prove quantum mechanically that particle will not exist in a box if its energy is zero.
- (h) Bring out the importance of normalization of the wave function.
- (i) What do you understand by wave packet?
- (j) Differentiate between prompt and delayed neutrons in a fission reaction. (10×2=20)