

Faculty of Science & Technology

First Semester B.Tech. (CBCS) / Ist Semester B.Tech. (Fire Engineering)

(CBCS) Examination

APPLIED PHYSICS

Time : Three Hours]

[Maximum Marks : 70

INSTRUCTIONS TO CANDIDATES

- (1) All questions carry marks as indicated.
- (2) Solve Question 1 OR Question No. 2.
- (3) Solve Question 3 OR Question No. 4.
- (4) Solve Question 5 OR Question No. 6.
- (5) Solve Question 7 OR Question No. 8.
- (6) Solve Question 9 OR Question No. 10.
- (7) Due credit will be given to neatness and adequate dimensions.
- (8) Assume suitable data wherever necessary.
- (9) Diagrams and chemical equations should be given wherever necessary.
- (10) Illustrate your answers wherever necessary with the help of neat sketches.
- (11) Use of non programmable calculator is permitted.

List of constants :

- (i) Planck's Constant "h" = 6.63×10^{-34} Js
 - (ii) Velocity of Light 'c' = 3×10^8 m/s
 - (iii) Avogadro's constant $N_A = 6.023 \times 10^{26}$ atoms/kmole
 - (iv) Boltzmann's Constant "k" = 1.380×10^{-23} J/K
 - (v) Charge of electron "e" = 1.602×10^{-19} C
 - (vi) Mass of electron "m" = 9.11×10^{-31} kg
 - (vii) 1 amu = 1.67×10^{-27} kg
 - (viii) 1 electron volt = 1.602×10^{-19} J.
- 1 (a) Describe Newton's ring experiment with neat diagram to determine the wavelength of incident monochromatic light 6
 - (b) What is interference of light ? Write the conditions for maxima and minima due to interference of reflected light in uniform thin film. 3

- (c) In Newton's ring experiment, explain why the central spot is dark in reflected light. 2
- (d) A thin film on a lens is 1.0×10^{-7} m thick and is illuminated with white light. The index of refraction of the film is 1.4. For what wavelength of light, the lens will be non-reflecting? 3

OR

2. (a) What is thin film? Obtain the expression of fringe width in case of wedge shaped thin film. 5
- (b) Write a note on plane diffraction grating. Define grating spacing. 3
- (c) Explain any two applications of interference of light. 3
- (d) Fringes of equal thickness are observed in a thin glass wedge of R.I. of 1.52. The wedge angle is 0.11° ; wavelength of light is 5893 \AA . Calculate fringe width β . 3
3. (a) What is de-Broglie hypothesis? Describe the Davison and Germer experiment, which shows the existence of matter waves. 6
- (b) What is Compton shift? Write down the equations of conservation of momentum and energy in case of Compton experiment. At what scattering angle Compton shift is maximum and minimum? 5
- (c) An electron beam is accelerated from rest through a potential difference of 200 V. Calculate the associated wavelength with it. 3

OR

4. (a) Show that the energy of an electron confined in 1-D potential well of length 'L' and finite depth is quantized. 5
- (b) State and explain Heisenberg's Uncertainty Principle. 3
- (c) Write down Schrodinger time-dependent and time-independent wave equations in one dimension. 2
- (d) Maximum uncertainty in location of electron confined in potential well is 10 nm. Calculate the minimum uncertainty in its velocity. 4
5. (a) Derive Bragg's law of X-Ray diffraction. Write the applications of Bragg's law. 5
- (b) Derive the relation between atomic radius and lattice constant of cube in case of SC, BCC and FCC. 6
- (c) Draw crystal planes in cubic crystal for Miller Indices (010), (120) and (210). 3

OR

6. (a) Define:
- Space lattice
 - Co-ordination number
 - Atomic packing fraction
 - Miller indices
 - Unit cell

- (b) Deduce the relation between interplanar distance 'd' and Miller indices of the plane of cubic crystal structure. 5
- (c) Find the interplanar spacing of (2 1 2) and (0 3 0) planes in a FCC crystal having lattice constant 5 \AA . 4
7. (a) Distinguish between Single mode fibre and multimode fibre. 5
- (b) Explain the application of optical fibre as a sensor. 4
- (c) The core of optical fibre has Refractive index 1.6 and the clad has refractive index 1.3. What is the value of critical angle ? Also calculate the value of angle of the cone of acceptance. 5

OR

8. (a) Derive the mathematical expression for the numerical aperture and acceptance angle for step-index fibre. 6
- (b) Discuss the working of optical fibre as a temperature sensor with a suitable diagram. 4
- (c) An optical power of 1 mW is launched into an optical fibre of length 100 m. If the output power from the other end is 0.3 mW, calculate the fibre attenuation. 4
9. (a) State and explain Bethe's law of electron refraction. Write difference between Snell's law and Bethe's law. 6
- (b) Draw the well labeled block diagram of Cathode Ray Oscilloscope (CRO). 3
- (c) Define 1 electron volt. Write its value in joule. 2
- (d) An electron passes undeviated through crossed E and B fields, for which $E = 7.7 \times 10^3 \text{ V/m}$ and $B = 0.14 \text{ T}$. Determine velocity of electron. 3

OR

10. (a) Explain the construction and working of the Bainbridge mass spectrograph with the help of suitable diagram and obtain the equation of line separation. 5
- (b) Explain the trajectories of electron beam moving in magnetic field at various angles with the direction of magnetic field. 3
- (c) Explain the working of Velocity Selector. 3
- (d) An electron beam enters from a region of potential 100 V into a region of potential 150 V, making an angle of 45° with the direction of electric field. Find the angle of refraction. 3