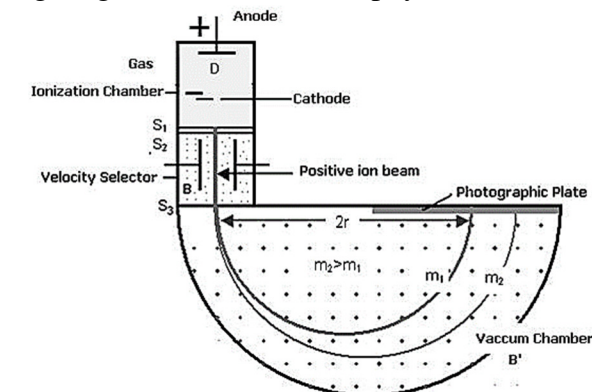## Faculty of Engineering / Science
End Sem Examination Dec-2023
EN3BS16 / BC3BS06 Engineering Physics
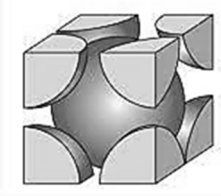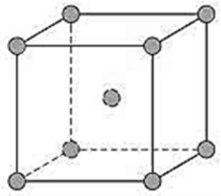
Programme: B.Tech. / B.Sc.   Branch/Specialisation: All / Computer Science

Duration: 3 Hrs.   **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

Q.1 i. Which of the following relations is correct for Heisenberg Uncertainty Principle?   **1**

(a) $\Delta E.\Delta t \setminus \geq h/4\pi$ (b) $\Delta x.\Delta p \geq h/4\pi$

(c) $\Delta J. \Delta\varphi \geq h/4\pi$ (d) All of these

ii. The energy of a particle in infinite potential well is-   **1**

(a) Proportional to n^2 (b) Inversely proportional to n^2

(c) Proportional to n   (d) Inversely proportional to n

Here, n corresponds to the no. of shell

iii. When the liquid is introduced between the plano convex lens and the plate in Newton's ring experiment, the diameters of the rings-   **1**

(a) Decreases   (b) Increases   (c) Remains same   (d) None of these

iv. The Fresnel's bi prism based on the principle of-   **1**

(a) Interference   (b) Diffraction

(c) Polarization   (d) Quantum mechanics

v. The following diagram used in nuclear physics for-   **1**

(a) Cyclotron   (b) Betatron

(c) Synchrotron   (d) Bainbridge Mass spectrograph

vi. The nucleus contains nucleons- **1**
   (a) Electron and proton   (b) Electron and neutron
   (c) Proton and neutron   (d) Electron, proton and neutron

vii. The following diagram for which type of crystal- **1**

   (a) Simple Centred Cubic (SCC)   (b) Body Centred Cubic (BCC)
   (c) Face Centred Cubic (FCC)   (d) End Centred Cubic

viii. Hall effect is useful for the measurement of a semiconductor- **1**
   (a) Only the type (p-type or n type) of semiconductor material
   (b) Type (p-type or n type), mobility and carrier concentration
   (c) Type (p-type or n type), conductivity and temperature
   (d) Mobility, carrier concentration and temperature

ix. The He-Ne Laser emits the light of following wavelength (in Angstrom- **1**
   (a) 6943   (b) 6040   (c) 6328   (d) 5090

x. Which one is the correct expression for normalized frequency (V- parameter) for optical fibre- **1**
   (a) $2\,a\sqrt{(n_1^2 - n_2^2)}/\lambda$ (b) $2\pi\,a\sqrt{(n_1^2 - n_2^2)}/\lambda$
   (c) $2\pi\,\sqrt{(n_1^2 - n_2^2)}/a\lambda$ (d) $2\pi\,\lambda\,\sqrt{(n_1^2 - n_2^2)}/a$

Q.2 i. Calculate the de-Broglie wavelength associated with a proton moving with a velocity equalto one twentieth of the velocity of light. Given mass of a proton m=1.67×10^{-27}kg and h = 6.6×10^{-34} joule-sec. **3**

ii. What is wave function? Write the three important properties of wave function. Derive the expression of Schrodinger Time Independent Wave Equation for free particle. **7**

OR iii. What is Compton effect? Deduce an expression for the shift in wavelength of X- rays beams. Why is Compton effect not found in visible region of light? **7**

Q.3 i. Write the two engineering applications of polarization phenomenon. **2**
ii. Describe the Fresnel's Biprism with ray diagram. **3**
iii. Write short note on- **5**
   (a) Diffraction Grating
   (b) Rayleigh's Criteria of resolution

OR iv. Obtain the expression of Intensity due to the single slit Fraunhofer diffraction with suitable ray diagram. **5**

Q.4 i. Explain construction and working principle of linear particle accelerator, and show that for successive acceleration in successive gaps the length of evacuated tubes must be proportional to 1: √2 : √3 : √4…………etc. **4**

ii. Explain the construction and working of Geiger Muller Counter. How quenching is achieved in it? **6**

OR iii. Draw a schematic sketch of a Cyclotron and explain its working. Hence derive the cyclotron frequency and maximum kinetic energy of an ion accelerated through it. **6**

Q.5 Attempt any two:
i. What is Miller Indices? Determine the miller indices of a plane, whose intercepts along the axes are (a, 2b, 3c)? **5**
ii. What is Superconductivity? Distinguish between type–I and type-II superconductors. **5**
iii. Draw the diagram of Fermi level for Intrinsic and Extrinsic Semiconductors. Differentiate conductor, insulator, and semiconductors based on band energy diagram. **5**

Q.6 i. What do you mean by population inversion? **2**
ii. Why 'He' gas is used in He-Ne gas laser? Discuss the construction and working of He – Ne laser level with help of energy level diagram. **8**

OR iii. Write down the principle of optical fibre with suitable diagram. Define the acceptance angle and derive expression for acceptance angle of an optical fibre. **8**

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Scheme of Marking

Engineering Physics (T) - EN3BS16 (T)

Q.1 i)   d) All of these   **1**

ii)   a) proportional to n^2 **1**

iii) a) decreases   **1**

iv)   a) Interference   **1**

v)   d) Bainbridge Mass spectrograph   **1**

vi)   c) proton and neutron   **1**

vii) b) Body Centred Cubic (BCC)   **1**

viii) b) Type (p-type or n type), mobility and carrier concentration   **1**

ix)   (c) 6328   **1**

x)   b) $2\pi\, a\sqrt{(n_1^2 - n_2^2)}\,/\,\lambda$ **1**

Q.2 i.   The de-Broglie wavelength associated with a proton   **3**

$\lambda = h/mv$; $\lambda = 2.834 \times 10\text{-}14$ m

Formula   1 mark

Remaining part with answer   2 marks

ii.   What is wave function   1 Mark   **7**

Two important properties of wave function   2 Marks

Derivation Schrodinger Time Independent Equation 4 marks

OR iii. What is Compton effect?   1 mark   **7**

Deduce an expression for the shift in wavelength of X- rays beams

5 marks.

Why is Compton effect not found in visible region of light?

1 mark

Q.3 i.   Two engineering applications of polarization   **2**

ii.   Describe the Fresnel's Biprism with ray diagram.   **3**

For ray diagram   1 mark

Description   2 Marks

iii. a) Diffraction Grating   2.5 marks   **5**

b) Rayleigh's Criteria of resolution   2.5 marks

OR iv.   Obtain the expression of Intensity due to the single slit Fraunhofer   **5**

diffraction   4 marks

Suitable ray diagram.   1 mark

Q.4 i.   Explain construction   1 mark   **4**

working principle of linear particle accelerator   2 marks

show that for successive acceleration in successive gaps the length
of evacuated tubes must be proportional to 1: $\sqrt{2}$: $\sqrt{3}$:
$\sqrt{4}$…………etc.   2 marks

ii.   Explain the construction and working of Geiger Muller Counter.   **6**

5 marks

How quenching is achieved in it   1 mark

OR iii. Draw a schematic sketch of a Cyclotron.   1 mark   **6**

Explain its working. Hence derive the cyclotron frequency

3 marks

maximum kinetic energy of an ion accelerated through it

2 marks

Q.5 i.   What is Miller Indices   1 mark   **5**

Determine the miller indices of a plane, whose intercepts along the
axes are (a, 2b, 3c)?   4 marks

ii.   What is Superconductivity?   1 mark   **5**

Distinguish between type–I and type- II superconductors.

4 marks

OR iii. Diagram of Fermi level for Intrinsic and Extrinsic Semiconductors.   **5**

2 marks

Differentiate conductor, insulator, and semiconductors based on
band energy diagram.   3 marks

Q.6 i.   Population inversion?   **2**

ii.   Why is Helium gas used in He-Ne gas laser?   1 mark   **8**

Construction and   2 marks

working of He – Ne laser level with help of   3 marks

energy level diagram   2 marks

OR iii. Principle of optical fibre with suitable diagram   2 marks.   **8**

Define the acceptance angle   1 mark

Expression for acceptance angle of an optical fibre   5 marks

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[2]

[3]