

**K. J. Somaiya Institute of Technology, Sion, Mumbai-22**  
(Autonomous College Affiliated to University of Mumbai)

Nov – Dec 2023		
Program: B.Tech. Scheme : III		
Examination: FY Semester: I		
Course Code: BSC102 and Course Name: Engineering Physics		
Date of Exam: 28-12-2023	Duration: 02 Hours	Max. Marks: 45

Instructions:				
(1) All questions are compulsory.				
(2) Draw neat diagrams wherever applicable.				
(3) Assume suitable data, if necessary.				
		Max. Marks	CO	BT level
<b>Q 1</b>	<b>Solve any 5 questions out of six.</b>	<b>15</b>		
i)	Explain De Broglie hypothesis on the basis of Bohr's postulate.	3	CO1	U
ii)	Calculate the glancing angle on the cube (200) of a rock salt ( $a = 2.814 \text{ \AA}$ ) corresponding to 2 <sup>nd</sup> order diffraction maximum for X-rays of wavelength $0.714 \text{ \AA}$ .	3	CO1	APP
iii)	Derive the relation between conductivity and mobility.	3	CO3	U
iv)	A wedge shaped air film having angle of 40 seconds is illuminated by monochromatic light. Fringes are observed vertically through a microscope. The distance between ten consecutive dark fringes is 1.2 cm. Find the wavelength of monochromatic light.	3	CO4	App
v)	What are High $T_C$ superconductors? What are advantages of High $T_C$ superconductors?	3	CO5	U
vi)	Compare the supercapacitor and battery on the basis of energy density and power density.	3	CO6	U
<b>Q.2</b>	<b>Solve any three questions out of four.</b>	<b>15</b>		
i)	Show that the group velocity of the wave packet associated with the particle is equal to the particle velocity.	5	CO1	U
ii)	An electron has a speed of 900 m/s with an accuracy of 0.001%. Calculate the uncertainty in the position of the electron.	5	CO1	APP
iii)	Explain the working of a solar cell with energy level diagram? Write its advantages and disadvantages.	5	CO3	U
iv)	In a Hall effect experiment, a potential difference of $4.5 \mu\text{V}$ is developed across a foil of Hall sensor of thickness 0.02 mm, when a current of 1.5A is carrying in a direction perpendicular to applied	5	CO3	APP

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	magnetic field of 2 tesla. Calculate a) Hall coefficient for zinc b) concentration of electrons.			
<b>Q.3</b>	<b>Solve any three questions out of four.</b>	<b>15</b>		
i)	Explain three steps to determine Miller Indices of crystal plane which intercepts all the three axes. Give one example.	5	CO2	U
ii)	Obtain the relation for the optical path difference between two light rays reflected from a thin film of uniform thickness having refractive index $\mu$ .	5	CO4	U
iii)	A drop of oil of volume 0.2 cc is dropped on the surface of a tank water of area 1 sq. m. The film spreads uniformly over the whole surface. White light which is incident normally on the surface is observed through spectroscope. The spectrum is seen to contain one dark band whose centre has wavelength $5500 \text{ \AA}$ in air. Find the refractive index of the given oil.	5	CO4	APP
iv)	State and explain Meissner's effect with the help of a diagram.	5	CO5	U

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