K. K. Wagh Institute of Engineering Education & Research, Nashik
(An Autonomous Institute From A.Y. 2022-23)

	WINTER-2023		
	Exam Seat No.:		
	Academic Year: 2023-2024	Semester: I	
	Name of Programme: B.Tech	Pattern: 2023	
	Name of Course: Applied Physics (A)	Course Code: 2300103A	
	Max. Marks: 60	Duration:2.30 Hrs	

Instructions: Candidates should read carefully the instructions printed on the Question Paper
and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains _____page(s).
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. Draw the neat labelled diagrams, wherever necessary.
5. The last columns indicates the Course Outcome and level of Blooms Taxonomy of the Question/sub-question.
6. Charge of electron / proton = 1.6×10^{-19} C

Mass of electron = 9.1×10^{-31} Kg
Mass of proton = 1.673×10^{-27} Kg
Mass of neutron = 1.673×10^{-27} Kg
Planks constant = 6.626×10^{-34} J.s
Permeability $\mu_0 = 4\pi \times 10^{-7}$
Velocity of light = 3×10^{8}m/sec

Question No. 1 Attempt following Question

1a) State Faraday's first and second law of electromagnetic induction. (2) CO1

1b) A horizontal overhead power line carries a current of 50 A in the west-to-east direction. What is the magnitude of the magnetic field 1·5 m below the line? (4) CO5

Question No. 2 Attempt following Question

2a) Write two differences between type-I and type-II superconductors. (2) CO2

2b) Calculate the conductivity of Ge sample if the donor impurity is added to an extent of one part in 10^8 Ge atoms at room temperature. (Given: Na=6.023×10^{23} atoms/gm-mole. At. Wt. of Ge=72.6 Density of Ge=5.32gm/cc., μe =3800 cm^2/v-s.) (4) CO4

Question No. 3 Attempt following Question

3a) Provide a brief explanation about wedge-shaped films with a suitable diagram and write the conditions for constructive and destructive interference in such films. (6) CO1

OR

3b)	Write a short note on the diffraction grating and describe the conditions of maxima and minima in a diffraction grating.	(6)	CO1
3c)	What is an optical fiber, and on which working principle it operates? Explain with the help of a suitable diagram.	(6)	CO1

OR

3d)	Explain the three-level laser system with a suitable diagram.	(6)	CO1
3e)	Monochromatic light from the He-Ne laser source ($\lambda = 6328A^{\circ}$) is incident normally on a diffraction grating having 6000 lines/cm. Find the angle at which one would observe second-order maximum.	(4)	CO5

OR

3f)	A monochromatic light beam with a wavelength of 5893 A° is directed perpendicularly onto the surface of a glass covered with transparent MgF_2 material having a refractive index of 1.38. Determine the minimum thickness of the MgF_2 layer required to create a non-reflective surface.	(4)	CO5

Question No. 4 Attempt following Question

4a)	What are the fundamental properties exhibited by matter waves according to the de Broglie hypothesis?	(6)	CO3

OR

4b)	What is the definition of a wave function in quantum mechanics, and what are the criteria that define a well-behaved wave function within the framework of quantum theory?	(6)	CO3
4c)	How does the Stern-Gerlach experiment's setup demonstrate the quantization of angular momentum and the concept of spin in quantum mechanics?	(6)	CO1

OR

4d)	Explain the step-by-step derivation of the time-dependent Schrödinger equation for a one-dimensional quantum system.	(6)	CO1
4e)	Calculate the energy (in eV) with which a proton has to acquire a de-broglie wavelength of 0.1 A°.	(4)	CO4

OR

4f)	A proton and alpha particle are accelerated by the same potential difference. Find the ratio of their de- Broglie wavelength. ($m_{\alpha} = 6.680 \times 10^{-27}$ kg, charge on alpha particle = 2 x charge on proton, $m_p = 1.673 \times 10^{-27}$ kg)	(4)	CO4

Question No. 5 Attempt following Question

5a)	What is the photovoltaic effect? Explain the process of electron-hole pair generation and recombination.	(6)	CO1

OR

5b)	Draw the IV characteristic diagram of a solar cell and define terms such as Isc, Voc, efficiency, and fill factor in the solar cell.	(6)	CO1
5c)	How does quantum dot technology contribute to the advancements and efficiency in third-generation solar cells.	(6)	CO1

OR

5d)	What are the mechanisms governing carrier transport in p-type and n-type semiconductors?What are the mechanisms governing carrier transport in p-type and n-type semiconductors?	(6)	CO1
5e)	A wind turbine of 60 m diameter, where the air density is 2.134 kg/m^3. The wind speed at the location is 15.5 m/sec. Find available wind energy.	(4)	CO5

OR

5f)	Explain the Second and Third-generation solar cells.	(4)	CO5