K. K. Wagh Institute of Engineering Education & Research, Nashik

(An Autonomous Institute From A.Y. 2022-23)

WINTER-2025	
Exam Seat No.:	
Academic Year:2025-2026	Semester:I
Class:FY	Program:B.Tech
Branch Code:FYE	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 __3__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. Given Constant: -
   a. Charge of electron / proton = 1.6×10^{-19} C
   b. Mass of electron = 9.1×10^{-31} Kg
   c. Mass of proton = 1.673×10^{-27} Kg
   d. Mass of neutron = 1.673×10^{-27} Kg
   e. Planks constant = 6.626×10^{-34} J.s
   f. Permeability $\mu_0 = 4\pi \times 10^{-7}$
   g. Velocity of light = 3×10^{8}m/sec

		Marks	CO
Question No. 1			
1a)	Write down the methods used to find the direction of the magnetic field around a current-carrying conductor, and briefly discuss any one of them.	(2)	CO1
1b)	A science student is doing an experiment using a coil with 500 turns of wire. During the experiment, the magnetic field passing through the coil drops from 0.06 Wb to 0.02 Wb in 0.2 seconds. What is the average EMF (voltage) induced in the coil?	(4)	CO5
Question No. 2			
2a)	Discuss the concept of quantum confinement of particles and its effects on the properties of nanoparticles.	(2)	CO2
2b)	Silicon has a conductivity of only $5 \times 10^{-4}\ \Omega^{-1}m^{-1}$ in its pure form. An engineer wanted it to have conductivity of 200 $\Omega^{-1}m^{-1}$ and doped it with aluminium to produce p-type semiconductor. Calculate the impurity concentration. Assume μ_h=0.05 m^2/V.s.	(4)	CO5
Question No. 3			
3a)	Explain about ordinary ray and extraordinary waves? How do these differ from each other according to Huygens wave theory of double refraction?	(6)	CO3
	OR		
3b)	Distinguish between the Fresnel and Fraunhofer diffraction.	(6)	CO3

3c) Write the conditions for constructive and destructive interference in a reflected system of uniform thin film. A glass plate having parallel sides has thickness 4×10^{-4} mm and refractive index 1.5. If it is illuminated normally by white light, what wavelengths will be absent in reflected beam in visible spectrum? (6) CO4

OR

3d) State the law of Malus. How should intensity be reduced if the polariser and analyser are arranged with respect to each other at an angle (6) CO4

i) 30°

ii) 60°

3e) A parallel beam of light with $\lambda = 5890 \times 10^{-10}$ m is incident on a thin glass plate ($\mu = 1.5$) such that the angle of refraction onto the plate is 60°. Calculate the smallest thickness of the glass plate which will appear dark by reflection. (4) CO4

OR

3f) A single slit is illuminated by light composed of two wavelengths λ_1 and λ_2. One observes that due to diffraction at same angle of diffraction, the first minima obtained for λ_1, coincides with the second diffraction minima of λ_2. What is the relation between λ_1 and λ_2? (4) CO4

Question No. 4

4a) With a suitable diagram, describe the construction and working of the Stern-Gerlach experiment. (6) CO1

OR

4b) Derive the time-dependent Schrödinger wave equation for a particle in a three-dimensional motion. (6) CO1

4c) Show that the de Broglie wavelength for an electron is found to be equal to $\frac{12.27}{\sqrt{V}}$ Å. Calculate the de Broglie wavelength of the electron which is accelerated by a potential difference of 800 V. (6) CO4

OR

4d) Derive the expression for the de Broglie wavelength of a particle moving with kinetic energy 'E'. What is the kinetic energy of electron whose wavelength is 5000 Å. (6) CO4

4e) An X-ray with frequency 1.5×10^{19} Hz, interact with an electron inside an atom. After collision with the electron, X-ray with a new frequency of 1.2×10^{19} Hz is emitted. How much is the de-Broglie wavelength associated with the electron after the collision? (4) CO4

OR

4f) Evaluate the ratio of the de-broglie wavelength of electron to that of proton when both have the same kinetic energy. (4) CO4

Question No. 5

5a) Explain the formation of depletion region in a *p-n* junction diode. (6) CO2

OR

5b) Explain the working of the wind farm. Classify the types of wind farm. (6) CO2

5c) Write the advantages and disadvantages associated with the use of solar cells as a source of energy? (6) CO1

OR

5d) i) With the schematic diagram of solar cell define the terms open circuit voltage, short circuit current, fill factor and efficiency of solar cell. (6) CO1

ii) Draw the I-V characteristics of solar cell.

5e) A wind turbine produces a power output of 200 kW. The wind turbine will operate in an area with an average wind speed of 9 m/s and an air density of 1.225 kg/m^3. Assume a wind turbine efficiency of 40% for converting wind energy into electrical energy. (4) CO4

1. Calculate the total power required from the wind

2. Determine the required swept area to achieve this power output.

3. Find the rotor diameter needed to achieve the required swept area.

OR

5f)	A solar cell having Fill Factor (FF) 60% gives 2.5A current at maximum power at standard testing condition. The cell gives 3 A short circuit current and 0.5 V open circuit voltage. How much is the voltage at maximum power of the solar cell?	(4)	CO4

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