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:2022
Name of Course:Applied Physics-B	Course Code:FYE221004
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 __2___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.

		Marks	CO
Question No. 1			
1a)	Explain the term displacement and instantaneous velocity.	(2)	CO1
1b)	The motion of the particle is defined by the relation $x = t^3 - 6t^2 - 15t + 40$, where x & t are expressed in m & sec resp. Find i) the time at which velocity is zero. ii) the position and the acceleration at that time.	(4)	CO5
Question No. 2			
2a)	Write the formula for radial and transverse component of velocity in polar coordinate system.	(2)	CO2
2b)	A bullet is fired from a point making an angle of 56 degrees to the horizontal. The initial velocity of the bullet is 65 m/s. Find the greatest height reached, and the time taken to reach the maximum height.	(4)	CO4
Question No. 3			
3a)	i) Draw energy band diagrams for p-type semiconductor at 0 K and at 300 K. ii) Calculate the conductivity of pure silicon at room temperature when the concentration of charge carriers is $2.6 \times 10^{10}/cm^3$. (Given that, $\mu_e = 1000\ cm^2/V.Sec$, $\mu_h = 500\ cm^2/V.Sec$).	(6)	CO4
	OR		
3b)	i) What is Fermi-Dirac Distribution function? Write its distribution function. ii) Calculate the number of acceptor atoms that need to be doped in germanium sample to obtain the resistivity of 8 Ω cm. (Given: $\mu = 1600\ cm^2/V.\ s$).	(6)	CO4
3c)	Distinguish between type-I and type-II superconductors.	(6)	CO2
	OR		
3d)	What is nanotechnology? Explain how surface area to volume ratio affects properties of nanoparticles?	(6)	CO2

3e)	A slab of silicon 2 cm in length 1.5 cm wide and 2 mm thick is applied with magnetic field of 0.4 T along its thickness. When a current of 75 A flows along the length, the voltage measured across the width is 0.81 mV. Calculate the concentration of mobile electrons in silicon.	(4)	CO4
	OR		
3f)	A copper wire has an electron concentration of 8.5×10^{28} electrons/m^3 and an electron mobility of 4.5×10^{-3} m^2 /Vs. Calculate the conductivity of the wire.	(4)	CO4
Question No. 4			
4a)	i) Write the necessary conditions required for the positive and negative crystals in double refraction. ii) How should the polarizer and analyzer be oriented to reduce the intensity of the beam to 25% and 60% of its original intensity?	(6)	CO4
	OR		
4b)	i) What is plane transmission grating? Write the condition for principal maxima. ii) In a grating, the angle of diffraction for the second order principal maximum for the light of Wavelength 5×10^{-5} cm is 30°.Calculate the number of lines/cm of the grating surface.	(6)	CO4
4c)	With a neat diagram, explain the construction and working of an optical fiber.	(6)	CO2
	OR		
4d)	What is LASER? Compare laser light from normal source of light.	(6)	CO2
4e)	A monochromatic beam of light of wavelength 5893 A° is incident normally on the top of a glass which is coated by transparent material MgF_2 having R.I. 1.38. Calculate smallest thickness of the MgF_2 layer which will act as a non-reflecting surface.	(4)	CO4
	OR		
4f)	Calculate the angles at which the first dark band is formed in the Fraunhofer diffraction pattern of a slit 0.3 mm wide (λ = 5890 A^o).	(4)	CO4
Question No. 5			
5a)	Explain the working of quantum dot solar cells with a diagram.	(6)	CO2
	OR		
5b)	What is the function of a wind turbine, and what are the different types of wind farms used for generating electricity?	(6)	CO2
5c)	Explain the behavior of a p-n junction diode when it is in forward and reverse biased conditions with the help of Energy band diagram.	(6)	CO1
	OR		
5d)	Define the below terms: i) Photovoltaic effect ii) Fill factor. What are the merits & demerits of a solar cell?	(6)	CO1
5e)	A single solar cell on illumination by insolation of about 800 Wm^{-2} produces a voltage of 0.5 V and a current upto 2 A. The efficiency of the solar cell is 12.5%. what is the area of the solar cell?	(4)	CO5
	OR		
5f)	The wind is blowing at 12 m/sec, how much total power is the wind hitting the wind turbine if the blades are 45 m long, assuming the turbine is at sea level? (Air density at sea level = 1.225 kg/m^3)	(4)	CO5

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