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

May-June 2024
Program: B. Tech Scheme : II
Supplimentary / KT Examination: FY/ Semester: II
Course Code: BSC202 and Course Name: Physics and Nanotechnology
Date of Exam: 05/08/2024 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
Q 1	Solve any 5 questions out of six.	15		
i)	How holography differs from the photography? What are the advantages of hologram?	3	2	3
ii)	How to find width of the central maximum in single slit diffraction?	3	1	1
iii)	What divergence tells you? Find divergence of a position vector.	3	4	3
iv)	Two vectors are represented by - $\vec{A} = 2\,\hat{x} + 2\,\hat{y}$ and $\vec{B} = 3\,\hat{x} + 4\,\hat{y} - 2\,\hat{z}$. Find $\vec{A} \times \vec{B}$ and show that $\vec{A} \times \vec{B}$ is at right angles to $\vec{A}$.	3	4	3
v)	What is the reason behind change in chemical properties at the nano scale?	3	5	2
vi)	Why would you recommend the use of optical fibre in communication system?	3	3	3
Q.2	Solve any three questions out of four.	15		
i)	Which effects lead to altered conductivity in nanomaterials? Mention any two examples showing change in electrical properties in nanomaterials.	5	5	2
ii)	What is grating? What is grating element? Derive condition for maximum in diffraction grating experiment.	5	1	2
iii)	How to increase resolving power of diffraction grating? For a grating having 12000 lines / inch, how many orders of primary maxima are possible to see, when Na-light is used as an incident ray? (For Sodium λ= 5893 Å).	5	1	3

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iv)	An optical fibre has core diameter of 15 micrometer and core refractive index is 1.45. The critical angle is 79°. Calculate i) refractive index of cladding, ii) acceptance angle and iii) number of modes propagating through fibre when wavelength of light is 1150 nm.	5	3	3
Q.3	Solve any three questions out of four.	15		
i)	State Ampere's circuital law. Obtain fourth Maxwell's equation for static field and time varying field.	5	4	2
ii)	Explain the following terms and their significance in lasers Spontaneous emission, Stimulated emission, Metastable state, Population inversion and Pumping.	5	2	2
iii)	What is gradient of a scalar field? What is its significance? Find the gradient of $r = \sqrt{x^2 + y^2 + z^2}$.	5	4	3
iv)	With a neat sketch explain construction and working of Nd-YAG laser.	5	2	2

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