

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

May-June 2024
Program: B. Tech Scheme : III
<i>Supplementary</i> Regular 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)	What is the role of resonant cavity in the operation of laser?	3	2	2
ii)	For a grating having 15000 lines/inch, how many orders of primary maxima are possible to see, when Na-light is used as an incident ray? (For Sodium $\lambda = 5893 \text{ \AA}$)	3	1	3
iii)	Find the gradient of $r = \sqrt{x^2 + y^2 + z^2}$.	3	4	3
iv)	Explain two approaches used for synthesis of nanomaterials.	3	6	2
v)	What are nano materials? What is significance of surface area to volume ratio in nano materials.	3	5	2
vi)	Calculate the acceptance angle for an optical fibre whose core refractive index is 1.48 and cladding refractive index is 1.39.	3	3	3
Q.2	Solve any three questions out of four.	15		
i)	Explain construction and working of Scanning Electron Microscope.	5	6	2
ii)	Derive the expression for numerical aperture for a step index optical fibre.	5	3	2
iii)	Explain with suitable diagram, ball milling method used for synthesis of nanomaterials? State advantages and disadvantages of this method.	5	6	2

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iv)	What is Rayleigh criterion of just resolution? Define resolving power of grating. A grating has 10 cm of the surface ruled with 5000 lines per cm. What is the resolving power of the grating in the first order?	5	1	3
Q.3	Solve any three questions out of four.	15		
i)	What do you mean by divergence of a vector field? If $\vec{A} = xz\hat{x} - 2y^2z^2\hat{y} + xy\hat{z}$, find $\vec{\nabla} \cdot \vec{A}$ at point (1,-1,1).	5	4	3
ii)	With a neat energy level diagram, describe the construction and working of He-Ne laser.	5	2	2
iii)	How nanomaterials are classified based on dimensions. Write one example of each type.	5	5	2
iv)	State Faraday's law. Obtain third Maxwell's equation for static field and varying field.	5	4	2
