SET 2

RV UNIVERSITY

School of Computer Science and Engineering
B.Tech (Hons.)
CP2: Midterm Question Paper
Academic Year 2024 – 2025

Course: Exploring Science - 1	Course Code: CS1804	Semester: 1
Time: 2:15 PM to 4:00 PM	Max marks: 25	Date: Dec 06, 2024

Instructions:

- All questions are mandatory. Part A contains 5 questions of 1 mark each, and Part B contains 4 questions of 5 marks each.
- Feel free to use calculators (simple or scientific) where necessary. Graphing calculators are not allowed.
- Electronic devices (including, but not limited to mobile phones, laptops, headphones/earpods, smart devices, etc.) are strictly prohibited. Using them may result in disqualification from the exam.
- To ensure your work is evaluated effectively, please present your answers in a clear and structured manner.
- The constants are provided at the end of this paper for reference, assume standard constant values if not mentioned.

S. No	Question	Marks	Level	CO
	Part A			
1	Identify the correctly the number of nearest neighbors in a face-centered cubic structure? a) 4 c) 8 b) 6 d) 12	1	L2	CO2
2	Select the property of nanomaterials that explains their enhanced catalytic behavior. a) Decreased density b) Increased electrical conductivity c) High surface area and reactivity d) Improved crystalline structure	1	L2	CO2
3	In Young's double-slit experiment, when both slits are open, an interference pattern is observed on the screen. This is because of superposition between the two states, namely, electron passing through the uppser slit and the electron passing through the lower slit. Evaluate and reason the impact of a measurement conducted to ascertain the slit through which the particle passes on the interference pattern. a) The interference pattern remains unchanged because the particle's state is still in a superposition. b) The interference pattern disappears because the act of measurement collapses the state and destroys the superposition. c) The interference pattern becomes more distinct because the particle's state collapses, revealing which slit it passes through. d) The interference pattern is unaffected because the measurement does not alter the state of the particle.	1	L3	CO2

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4	Evaluate the following statement: "The properties of nanomaterials are independent of their size." Is this statement: a) True b) False	1	L2	CO2
5	Photolithography involves the use of light to: a) Create high-energy electron beams for material ablation b) Pattern photoresist layers on a substrate c) Directly deposit atoms on a surface d) Increase the grain size of nanoparticles	1	L2	CO2
	Part B			
6	A cubic crystal has planes with Miller indices (2 1 1) and a lattice parameter of 5 Å. a) Calculate the interplanar spacing. b) Determine the angle for second-order diffraction using X-rays of wavelength 9.89 Å.	3 + 2	L3	CO2
7	a) List any two synthesis techniques you will employ to obtain a nanomaterial in a laboratory. Explain each of the techniques in one or two sentences. b) List any three crystal structures that have more than one Bravais lattice associated with them. Also, identify the Bravais lattices associated with them.	2 + 3	L1	CO2
8	Consider a hot star with a surface temperature of 6657 K. a) Determine the peak wavelength of its emitted radiation using Wien's displacement law. b) Identify the hydrogenic transition responsible for this radiation using Rydberg's formula. c) Classify the identified transition into its corresponding series.	2 + 2 + 1	L3	CO2
9	a) Explain why Bragg's law fails to detect amorphous materials but works effectively for crystalline solids. b) In a Young's double-slit experiment, the distance between the two slits is 0.2 mm, and the screen is placed 1.2 m away. If the fourth-order bright fringe appears at 2.4 cm from the central maximum, calculate the wavelength of the light.	1 + 4	L4, L3	CO2

Constants:

- $b = 2.89 \times 10^{-3}$ m·K
- $c = 3 \times 10^{8}$ m·s^{-1}
- $R_H = 1.097 \times 10^{7}$ m^{-1}
- $k_B = 1.38 \times 10^{-23}$ J·K^{-1}

Course Outcomes

CO2 Apply the fundamental principles of crystallography and analyze the structure of solids and nanomaterials.

CO3 Apply the foundational concepts of quantum mechanics leading to the formulation of quantum technologies.

Marks Distribution										
L1	L2	L3	L4	L5	L6	CO1	CO2	CO3	CO4	CO5
5	4	15	1	-	-	-	✓	✓	-	