

**ST. JOSEPH'S COLLEGE (AUTONOMOUS), BENGALURU -27**  
**M.Sc (PHYSICS) – III SEMESTER**  
**SEMESTER EXAMINATION: OCTOBER 2022**  
(Examination conducted in December 2022)  
**PH 9520 – SOFTCORE**

Time: 1 1/2 Hour

Max Marks: 35

This paper contains 2 printed pages  
The question paper has two parts A & B. Answer any 3 questions from one part and 4 questions from the other part. Each question carries 5 Marks.

**PART A**

1.
  - (a) Describe schematically the top-down and bottom-up approach for preparing nanomaterials.
  - (b) Describe the process of successive ionic layer adsorption and reaction (SILAR) technique with suitable. [2+3]
2. Discuss the Beer-Lambert law for different conditions. How do you estimate direct and indirect bandgaps?
3. With the help of the Jablonski diagram, explain the following process. (a) absorption, (b) Fluorescence, and (c) phosphorescence.
4. Compare the X-ray diffraction (XRD) pattern and selected area electron diffraction (SAED) for single crystals, polycrystals, nanocrystals and amorphous with the suitable diagrams.
5. Using the XRD pattern, estimate average grain size, dislocation density and micro strain. Which samples will have better crystallinity? Just your answer based on the results. [4+1]

Sample	Pos. [ $2\theta^\circ$ ]	FWHM [ $2\theta^\circ$ ]	d-spacing [ $\text{\AA}$ ]
A	32.8148	0.2676	2.72931
	35.8704	0.4349	2.50352
	39.0397	0.3346	2.30727
B	32.3056	0.2342	2.77116
	35.9841	0.3346	2.49587
	39.2465	0.5018	2.29559

## PART B

6.

(a) Describe the alt-azimuth coordinate system.

(b) Describe the phenomenon of Analemma. [3+2]

7. What are color filters? When you place a red color filter from the light from a projector (which has primarily red, green and blue light), what do you expect to be transmitted - explain? If you place a cyan filter over the red color filter, what would you expect to see?

[2+2+1]

8. The resolving power of the Event Horizon Telescope when operating at 345 GHz is reported as:  $15 \times 10^{-6}$  arcsec . What is the effective diameter of the telescope?

9. How long would it take a rock of 1 kg to reach the center of the Sun from its surface if the entire mass of the Sun could be assumed to be concentrated at its center and we neglect any resistance from the material making up the Sun? ( $M_{\odot} = 1.9891 \times 10^{30}$  kg (**Solar mass**),  $R_{\odot} = 6.9 \times 10^8$  m )

10. What is the Pogson magnitude scale? Explain with a graph.