Name: **Enrolment No:**	

UPES

End Semester Examination, December 2023

Course: Foundations in Material synthesis and Characterization **Semester: III**

Program: M.Sc. Physics **Time : 03 hrs.**

Course Code: PHYS8068P **Max. Marks: 100**

Instructions:

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Differentiate between x-ray spectra and optical spectra.	**4**	**CO2**
Q 2	Describe the molecular beam epitaxy (MBE) growth technique with a sketch. What are the benefits and drawbacks of the MBE method?	**4**	**CO1**
Q 3	Write four differences between Scanning Tunneling microscope (STM) and Atomic force microscope (AFM)	**4**	**CO1**
Q 4	Explain in detail the Sol-Gel processes (with a neat diagram) to prepare NPs of different types like emulsion, aerogel, powder.	**4**	**CO1**
Q 5	Discuss the physical vapor deposition (PVD) process for the synthesis of thin films. What are the shortcomings of the PVD method?	**4**	**CO1**
SECTION B **(4Qx10M= 40 Marks)**			
Q 6	What is Raman spectroscopy? What information can be obtained from the Raman spectrum? What are the advantages and limitations of Raman Spectroscopy?	**10**	**CO1**
Q 7	Explain the principle, working and applications of XRD with a neat diagram. Explain in detail how XRD analysis is important in nanomaterial characterization. Explain Scherrer powder method in nanoparticle size analysis with a suitable XRD diagram.	**10**	**CO2**
Q 8	Explain Ultra-violet (UV) and Fourier Transform Infrared Spectroscopy (FTIR) analysis of NPs and their significance.	**10**	**CO2**
Q 9	Define Nanotechnology. Why is one nm a magical point on the dimensional scale? Explain with an example. Give examples of 1D, 2D and 3D nanostructured materials. List out challenges faced by Nanotechnology. **Or** Discuss the reason for the high surface-to-volume ratio in nanoparticles compared to bulk materials. Explain with a simple example. Highlight any two problems associated with an increase in surface area.	**10**	**CO2**

SECTION-C (2Qx20M=40 Marks)			
Q 10	Write short note on: a. DC sputtering b. RF Sputtering c. Magnetron Sputtering d. Ion beam Sputtering	**20**	**CO2**
Q 11	Explain the principle, construction and working of Transmission electron microscope (TEM) technique in detail with neat diagram. Write three main applications of TEM and the drawbacks of TEM. **Or** Explain working principle and instrumentation of the Scanning electron microscopy (SEM) technique with neat diagram. What do you mean by secondary, backscattered and augur electron in SEM? Why do we require coating in the analysis of samples in SEM? Write three main applications of SEM and the drawbacks of SEM.	**20**	**CO2**