BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: IMSC/MSC/PRE-PHD **SEMESTER : X/IV/NA**
BRANCH: PHYSICS **SESSION : SP/2023**

SUBJECT: PH519 PHYSICS OF THIN FILMS

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	Outline the working principle of a rotary pump with the help of a schematic diagram. What is the use of gas ballast in a rotary pump?	[5]	CO1	BL2
Q.1(b)	What are direct and indirect pressure gauges? Develop the working formula of a McLeod gauge to determine low pressure of a system.	[5]	CO1	BL3
Q.2(a)	Explain the liquid surface energy measurement by capillary effect.	[5]	CO2	BL2
Q.2(b)	Define jump frequency and diffusion flux. Explain the Fick's law for steady state diffusion.	[5]	CO2	BL2
Q.3(a)	Explain the various stages of thin film growth.	[5]	CO3	BL2
Q.3(b)	Formulate the expression of free energy change in a nucleation process as per the capillarity theory. Show that to condense a permanent deposit, aggregates of critical size or larger must be created within the residence time of the adsorbed atoms.	[5]	CO3	BL5
Q.4(a)	Distinguish between PVD and CVD. Under which of the two categories the following thin film deposition techniques belong to: Sputtering, reactive evaporation, spray pyrolysis, molecular beam epitaxy, atomic layer deposition	[5]	CO4	BL4
Q.4(b)	Outline the mechanism of a RF sputtering process. What is the role of magnetron in a sputtering system?	[5]	CO4	BL2
Q.5(a)	Which technique is used to measure the roughness of a thin film? Outline the working principle and various modes of operation of the technique.	[5]	CO5	BL2
Q.5(b)	Explain the four-point probe method for the measurement of sheet resistance of a thin film. How is it different from a two-probe method?	[5]	CO5	BL2

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