Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. /B.Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, NOV / DEC 2024

MATERIALS SCIENCE AND ENGINEERING
IV Semester
ML5003 - NANOSTRUCTURED Materials
(Regulation2019)

Time:3hrs Max.Marks: 100

CO1	Ability to evaluate nanomaterials and employ different processing methods, properties of nanomaterials for the future engineering applications
CO2	Ability to process zero dimensional nanomaterials and use them in engineering applications
CO3	Ability to process one dimensional nanomaterials and use them in engineering applications
CO4	Ability to process two dimensional nanomaterials and use them in engineering applications
CO5	Ability to use characterisation techniques to characterize different nanostructures.

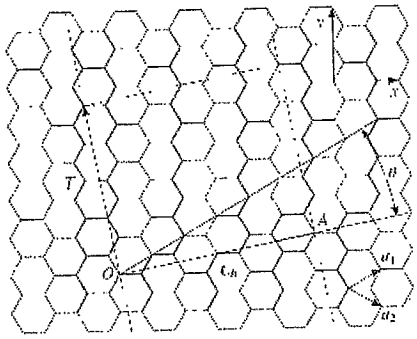
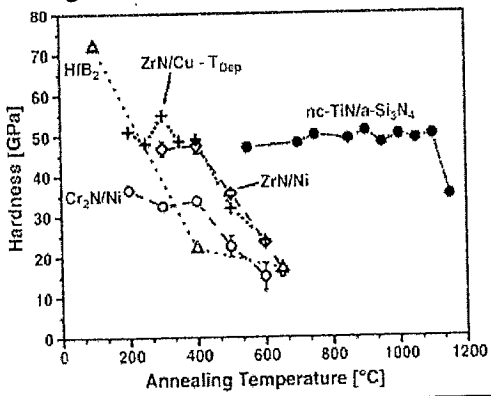
BL – Bloom's Taxonomy Levels
(L1-Remembering, L2-Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

PART- A(10x2=20Marks)
(Answer all Questions)

Q.No.	Questions	Marks	CO	BL
1	Hall-Petch relationship is valid for nanomaterials- True or false: Justify your answer	2	1	2
2	The melting temperature of the materials doesn't change with dimensional change- Is this stamen true: Justify your answer	2	1	1
3	What is quantum confinement effect	2	2	1
4	State the four important applications of nanoparticles	2	2	1
5	What changes in the mechanical properties of the CNTs happen if the topological defects present in CNT?	2	3	2
6	Name suitable nanomaterials for (a) electrical interconnect and (b) optical wave guiding	2	3	2
7	Which method of SPD technique produces highly inhomogeneous grain refinement- Why .	2	4	1
8	Super hardness can be achieved only through grain size reduction- True or false: Justify your answer	2	4	2
9	Nano indentation uses only loading cycle data to compute the stiffness of the coating-True or false: Justify your answer.	2	5	2
10	A system get the feedback of the tunneling current to characterize the nano surface- name the technique	2	5	2

PART- B(5x 13=65Marks)
(Restrict to a maximum of 2 subdivisions)

Q.No.	Questions	Marks	CO	BL
11 (a)	Apply the concepts of dimensionality to classify the nanostructures	13	1	3
	OR			
11 (b)	How properties can be modified with the change of size in materials	13	1	3
12 (a)	Suggest a suitable technique to produce Cu Nanoparticles? Discuss the role of different process variables of the suggested	13	2	3

	process in controlling the size in the nano range.			
	OR			
12 (b)	Suggest a suitable process to synthesis GaN Quantum dots. State the practical applications of Quantum dots	**13**	2	3
13 (a)	As a metallurgist, you are asked to prepare Si nanowire, what method you will suggest and how do you control the diameter of the nanowire less than 20nm.	**13**	3	3
	OR			
13 (b)(i)	For the carbon nanotube given, you are asked to find the a_1, a_2 and θ. Derive the expression for calculating them. 	**9**	3	3
(ii)	Can you suggest a method to rectify the defects in CNTs	**4**	3	3
14 (a)	Suggest a suitable method to produce nanostructure in a plate like materials- discuss the process variables role on the nanostructure formation	**13**	4	3
	OR			
14 (b)	Use the thermal stability data presented below and analyse the coatings behaviour in the thermal environment 	**13**	4	3
15 (a)	For nanoindentation, $A = 24.5\ hc^2$ for calculating the hardness of a Superhard coatings. The surface profile of the coating is given below for your reference  What are the corrections factors will you consider to correct Area of projection?	**13**	5	3
	OR			

15 (b)	For the coating developed, how do you measure the surface roughness? Explain the principle of operation.	**13**	5	3

PART- C(1x 15=15Marks)

(Q.No.16 is compulsory)

Q.No.	Questions	Marks	CO	BL
16.	A cutting tool manufacture encounter frequent wear on the tool surface. You are asked to suggest a suitable solution to avoid the wear on the cutting tool. What solution would you provide the knowledge gained through this course. How do you ensure that the solution that you have provided is technically reliable.	15	5	4

ADDITIONAL CONTROLLER OF EXAMINATIONS
AU
CHENNAI
600 025