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

CLASS: BE **SEMESTER : VII**
BRANCH: CHEM. ENGG. / CEP&P **SESSION : MO/18**

SUBJECT: CL7015 NANOTECHNOLOGY

TIME: 3 HOURS **FULL MARKS: 60**

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
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.

Q.1(a)	What do you mean by nanotechnology? Why Develop Nanotechnology?	[2]
Q.1(b)	What is nanomaterial? How can you classify nanomaterials based on the number of dimensions? Give examples.	[4]
Q.1(c)	What do you mean by bottom up synthesis of nanomaterials? Give examples. How can compare bottom-up method with top-down approach?	[6]
Q.2(a)	What are nanoparticles, nanotubes, and nanofilms? Give examples	[2]
Q.2(b)	Mention some effects of size reduction of nanoparticles (NPs).	[4]
Q.2(c)	Explain in detail why band gap of nanomaterials increases with size reduction. How does size change affect the optical properties of NPs?	[6]
Q.3(a)	How can you compare the structure and properties of carbon nanotubes and graphene?	[2]
Q.3(b)	Write down the advantages and disadvantages of surface functionalization of CNTs.	[4]
Q.3(c)	How can you prepare CNTs from CVD and arc-discharge approaches? Compare the structural difference of the CNTs obtained from these two methods.	[6]
Q.4(a)	What are nanostructured conducting polymers?	[2]
Q.4(b)	Briefly explain the merits and demerits three different types approaches, i.e., hard-template, soft-template and template-free methods used to synthesis nanostructured polyaniline.	[4]
Q.4(c)	How to synthesis nanostructured polyaniline by rapid-mixing method and dilution method?	[6]
Q.5(a)	What do you mean by MEMS and NEMS?	[2]
Q.5(b)	What are benefits of NEMS? What is cantilever sensor?	[4]
Q.5(c)	How to fabricate bottom-up NEMS? Give diagram of the process.	[6]
Q.6(a)	What do you mean by self-assembly method used for fabrication of nanostructured materials?	[2]
Q.6(b)	What are driving forces behind self-assembly?	[4]
Q.6(c)	Describe fabrication of nanostructured PMMA-b-PS di-block copolymers by self-assembly method.	[6]
Q.7(a)	What do you mean by nanoporous materials? Give examples	[2]
Q.7(b)	Express the energy equations for the 1D, 2D and 3D structured nanomaterials.	[4]
Q.7(c)	How to fabricate one-dimensional horizontal nanopore arrays based on the structure of SiO2/Al/SiO2/Si?	[6]

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