Registration No : | | | | | | | | | | |

Total Number of Pages : 02 **M.Tech**

P2NTBC02

2nd Semester Back Examination 2018-19

FABRICATION TECHNIQUES & CHARACTERIZATION OF NANOMATERIALS

BRANCH : NANO TECH.

Max Marks : 100

Time : 3 Hours

Q.CODE : F162

Answer Question No.1 (Part-1) which is compulsory, any EIGHT from Part-II and any TWO from Part-III.

The figures in the right hand margin indicate marks.

Part- I

Q1 **Only Short Answer Type Questions (Answer All-10)** **(2 x 10)**

a) Define nanomaterials

b) Write briefly on fabrication

c) What is "lithography" and what are "resist"

d) What are the highest possible magnification for (a)optical microscope, (b)SEM and (c)TEM

e) Define "band gap". What is its SI unit?

f) What are spectrophotometers and what are they used for?

g) Explain briefly the need to carry out band gap measurement.

h) The band gap energy of insulators is large, whereas it is lower for semiconductors. Prove or disprove this sentence.

i) What is the significance of RF in RF-Plasma system?

j) Define pyrolysis.

Part- II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Distinguish the "top down" and "bottoms up" approaches in fabrication of nanomaterials.

b) Explain how a scanning electron microscope functions. Make use of appropriate illustrations.

c) Explain the operating principles of a method used to prepare ultrafine metallic nanoparticles via evaporation from a metallic source in an inert gas environment.

d) Write down the similarities and dissimilarities between "mask lithography" and "scanning lithography".

e) Elaborate on the RF-Plasma method used for the production of nano metal and metal-oxides.

f) Name some materials that can be synthesized using the laser pyrolysis process. Explain this technique and also state why the word "pyrolysis" is used here.

g) Write down the characteristics of chemical vapor deposition process used to synthesize carbon nanotubes.

h) Explain in detail why electrodeposition is considered a versatile method in preparation of nanomaterials.

i) Describe in detail with the help of suitable diagram, the high energy ball milling process used in the synthesis of nanoparticles.What is the importance of "high energy" in this process?

j) Explain with the help of suitable illustration(s) the synthesis of MWNT and SWNT using arc-discharge method.

k) Explain how the "molecular beam epitaxy' method, used to make thin film deposition of single crystals; is a powerful tool in nanotechnology.

l) Explain in detail the operating principle of an optical microscope. Also mention the role of polarized light in optical microscope.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3	Discuss in detail on the sample preparation for analysis of nanomaterial using (a)SEM and (b)TEM	**(16)**
Q4	Explain with the help of a suitable and well labeled diagram the principle and working of a scanning probe microscope.	**(16)**
Q5	Describe in detail the sample preparation and method to measure band gap of nano titanium dioxide. State also the precautions if any to be taken for accurate results.	**(16)**
Q6	What is EDAX analysis used for? Explain in detail EDAX analysis.	**(16)**