



COLLEGE OF ENGINEERING, PUNE

(An Autonomous Institute of Government of Maharashtra.)
SHIVAJI NAGAR, PUNE - 411 005

END Semester Examination

(MT404-3) Nanomaterials and Nanotechnology DE1 TH

Course: B.Tech/M.Tech. First year

Branch: Metallurgical Engineering

Semester: Sem VII (B.Tech.)/ Sem I (M.Tech.)

Year: 2014-2015

Max.Marks:60

Duration: 3 Hours Time: 2.00 pm to 5.00 pm

Date: 26/11/2014

Instructions:

MIS No.

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1. Figures to the right indicate the full marks.
2. Mobile phones and programmable calculators are strictly prohibited.
3. Writing anything on question paper is not allowed.
4. Exchange/Sharing of anything like stationery, calculator is not allowed.
5. Assume suitable data if necessary.
6. Write your MIS Number on Question Paper

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| Q. 1 | Draw and explain a flow chart for the preparation of modified clay filled polymer nanocomposites. How will you confirm the intercalation or exfoliation of modified clay particles into the polymer matrix? Explain how the presence of modified clay affects the thermal and mechanical properties of the polymer matrix. | 10 |
| Q. 2 | Discuss the basic principle and sample preparation methods for any 4 characterization techniques used for the analysis of nanomaterials. | 10 |
| Q.3 | Explain in brief the important steps involved in a photolithography. What efforts will you take in shrinking the lateral dimensions of the conducting lines in electronic devices? Also discuss pros and cons of each lithography technique. | 10 |
| Q.4 | Explain, with self illustrative curves , about the (i) melting temperature versus particle size, (ii) sensitivity of sensor versus particle size, (iii) lattice parameter versus crystallite size, and (iv) band gap energy versus particle size of the nanomaterials. | 10 |
| Q. 5 | Write answer of any 04 sub-questions. | |
| a. | Discuss in brief about two techniques used for the synthesis of carbon nanotube (CNT). | 5 |
| b. | What will happen on the properties of CNT and/or its composites, if you do not purify CNT? Discuss all the important steps used for the purification of the CNT. | 5 |
| c. | Explain synthesis of expended graphite (EG) from the raw graphite powder? Is it better than CNT for the fabrication of polymer matrix composites? Give your thoughts. | 5 |
| d. | Discuss the factors which affects percolation threshold of CNT-polymer nanocomposite? | 5 |
| e. | What is the increment in surface area and percentage surface atoms, if one spherical metal particle diameter of 1 μm is reduced to 'N' particles with diameter of 10 \AA each. | 5 |