| Reg. No. | | | | | | | | | | |
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# MANIPAL INSTITUTE OF TECHNOLOGY

**(A constituent unit of MAHE, Manipal 576104)**

**VI SEMESTER B.Tech.(BME) DEGREE MAKE UP EXAMINATIONS JUNE 2019**
**SUBJECT: INTRODUCTION TO BIOMEDICAL NANOTECHNOLOGY (BME 4012)**
**(REVISED CREDIT SYSTEM)**
**Tuesday, 18th June 2019: 2 PM to 5 PM**

**TIME: 3 HOURS** **MAX. MARKS: 50**

**Instructions to Candidates:**

1. **Answer all the questions.**
2. **Draw labeled diagrams wherever necessary.**

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| 1. | (a) | Explain the relation between surface energy and particle size. | 03 |
| | (b) | Explain the mechanisms for reducing overall surface energy in nanomaterials. | 03 |
| | (c) | You are preparing ZnO nanoparticles using Zinc nitrate and NaOH as reactants. Explain multiple steps in the growth process of ZnO nuclei? Recommend a method to limit the growth of ZnO nanoparticles to form monosized ZnO nanoparticles. | 04 |
| 2. | (a) | Explain micro emulsion-based methods for nanoparticle synthesis. | 03 |
| | (b) | Describe in detail the principle behind hydrothermal synthesis of nanomaterials. | 02 |
| | (c) | Describe the principle behind and operation modes of Scanning Tunneling Microscopy. | 05 |
| 3. | (a) | Explain in detail the applications of X-Ray Diffraction spectrometer in nanotechnology | 05 |
| | (b) | Explain in detail the principal behind and the applications of UV/Visible absorption spectroscopy and photoluminescence spectroscopy | 05 |
| 4. | (a) | Explain in detail, the effect of nanomaterials in biological systems. | 05 |
| | (b) | Explain four design strategies for Fluorescence Resonance Energy Transfer (FRET) based optical biosensors. | 05 |
| 5. | (a) | Describe the concept of photothermal therapy (PTT) and how nanomaterials are improving the efficiency of photothermal therapy (PTT). | 03 |
| | (b) | Design a temperature induced intracellular drug delivery system for doxorubicin delivery, which can also deliver multi modal imaging nanoprobes (MRI+CT imaging). | 07 |