Day : Monday                                          Time : 10:00 AM-01:00 PM
Date : 1/8/2022               **S-14248-2022**        Max. Marks : 60

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**N. B. :**
1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Answers to both the sections should be written in **SEPARATE** answer books.
4) Assume suitable data, if necessary.

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## SECTION – I

**Q. 1**   What do you understand by quantum mechanical tunneling? How it is used in   **(10)**
Scanning Tunneling Microscopes (STM).

### OR

Explain with neat sketch working principle of Scanning Electron Microscope   **(10)**
(SEM). What information you get from SEM images.

**Q. 2**   Explain any one technique used for thermal analysis of 1D nanomaterials.   **(10)**
Justify with suitable example.

### OR

Explain with neat sketch working principle of Differential Thermal Analysis.   **(10)**

**Q. 3**   Describe how the resolution of Atomic Force Miscrope (AFM) can be   **(10)**
improved using nanotechnology with suitable example.

### OR

Explain the principle of lithography and state its application. What advantages   **(10)**
scanning probe lithography had over conventional photo lithography and
E-beam lithography?

## SECTION – II

**Q. 4**   Discuss advantage and limitations of Fourier Transform Infra-Red   **(10)**
Spectroscopy (FTIR) and Raman spectroscopy over each other.

### OR

State and explain the basic principle of operation of Nuclear Magnetic   **(10)**
Resonance (NMR) spectroscopy. Explain what information do you get from
NMR spectroscopy about nanomaterials.

**Q. 5**   Explain the method of mechanical characterization i.e modulus, compression,   **(10)**
micro hardness, fatigue abrasion and wear resistance of nano region, when
loaded with nano-particles or nano fibers.

### OR

Describe nanotribometer and its application for characterization of nano   **(10)**
materials.

**Q. 6**   Explain what do you understand by luminescence. Explain how Luminescence   **(10)**
of materials changes when size is reduced from bulk to nanometer.

### OR

Explain different methods of x-ray diffraction and state their strengths and   **(10)**
limitations.

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