Paper Code: MEC-933	**Roll No.**									

M.Tech
THIRD SEMESTER EXAMINATION 2016-17
NANOTECHNOLOGY

[Time: 3 hrs.] [Max. Marks: 100]

Note- Attempt All questions. All questions carry equal marks.

1. Attempt any *four* parts of the following: - **(5x4=20)**

(a) Explain the effect of scaling on Average & Static power dissipation, Threshold voltage and Sub-threshold leakage.
(b) Compare Dual-Material Double Gate Fully-Depleted SOI MOSFET with Single Material Gate SOI MOSFET.
(c) Describe methods of measuring properties of nanoparticles such as atomic structure, particle size determination and surface structure.
(d) Discuss the size dependence properties of materials. Also explain face centered cubic nanoparticles.
(e) What are quantum dot lasers and superconductivity? Describe the preparation and properties of quantum dot.
(f) Discuss rare gas and molecular clusters with examples.

2. Attempt any *two* parts of the following:- **(10x2=20)**

(a) Sketch the circuit diagram of single electron transistor. Explain single electron transistor as a charge sensor.

(b) Discuss optical properties and photo fragmentation of semi conducting nanoparticles. Mention the applications of optoelectronics devices.

(c) What are the principal challenges before nano-MOS transistor? How does high k-dielectric reduce the gate leakage problem?

3. Attempt any *two* parts of the following:- **(10x2=20)**

(a) Is there a difference between "charge transfer "and "charge tunneling"? What is ballistic transport? How is it different from diffusive transport?

(b) Explain the construction and working of Transmission Electron Microscope (TEM). What are the difference between SEM and TEM.

(c) Explain the construction and working of FINFET with supporting equations. Mention advantages, design challenges and application of FINFET.

4. Attempt any *two* parts of the following:- **(10x2=20)**

(a) What is molecular Electronics? Can you propose a molecule which acts as a diode? Give reason to support your answer.
(b) Explain charge transport mechanism in molecular structure. Compare and explain classical Hall Effect and Quantum Hall Effect.
(c) How are clean room classified? Enlist the various methods of conventional lithography and explain any one method.

5. Attempt any *two* parts of the following: - **(10x2=20)**

(a) Explain the different Geometry of Carbon nanotube. Discuss how single walled nanotubes are different from multiwalled nanotubes?
(b) Write short note on (i) Raman spectroscopy (ii) Nano Robot

(c) Enlist the different methods of production of carbon nanotube? Explain any one method.