Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
Manipal University

SIXTH SEMESTER B.TECH (E & C) DEGREE END SEMESTER EXAMINATION - APRIL / MAY 2017

SUBJECT: INTRODUCTION TO NANOSCIENCE AND TECHNOLOGY (ECE - 3290)

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

Instructions to candidates

- Answer **ALL** questions.
- Missing data may be suitably assumed.

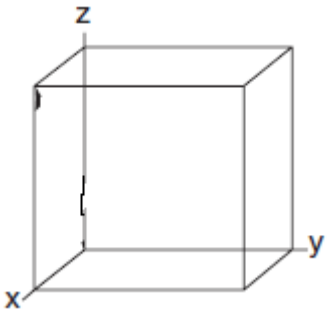
1A. Consider the wave function $\psi(x,t) = A\sin(n\pi x)\exp(-jwt)$ for 0≤x≤1. Determine A so that $\int_0^1 |\psi(x,t)|^2 dx = 1$.

1B. Differentiate between bulk and Nano scale semiconducting material under structural properties (Atleast 3).

1C. Explain how Quantum dots are used in displays.

(5+3+2)

2A. Sketch the following planes and directions within a cubic unit cell. (i) [101] (ii) [0 -1 0] (iii) [2 -1 3] (iv) (0 -1 -1) (v) (102). Use following convention only for cubic cell.



2B. Explain the ALD process with neat diagrams.

2C. Explain Quantum confinement.

(5+3+2)

3A. The density of thorium, which has the FCC structure and one atom per lattice point, is 11.72 g/cm3. The atomic weight of thorium is 232 g/mol. Calculate (a) the lattice parameter and (b) the atomic radius of thorium.

3B. Explain AAO template based nanotube fabrications.

3C. (i) Lattice spacing in bulk state is …….

(ii) There is no confinement for nano scale material. (T/F).

(5+3+2)

4A. In a X-ray diffraction experiment using incident alpha radiation (λ=1.542 Å) gave the following set of reflections expressed as 2θ : 38.40°; 44.50°; 65°; 78°; 82°; 98.40°; 111.20°.

(i) Determine the crystal structure. (ii) Calculate the lattice constant, a.

(iii) Assume that the crystal is a pure metal and on the basis of the hard-sphere approximation calculate the atomic radius.

4B. Explain the working of the SEM.

4C. Explain fabrication of Gold nanoparticle.

(5+3+2)

5A. Derive the equation of total energy when electrons are confined to infinite potential. (i) Plot the four discrete energy levels (ii) Corresponding wave functions (iii) Corresponding probability density functions.

5B. Explain the working of TiO2 memresistor.

5C. Explain mold fabrication using cicada wing in imprint lithography.

(5+3+2)