

SEVENTH SEMESTER B.Tech. (E & C) DEGREE END SEMESTER EXAMINATION NOV 2017 SUBJECT: NANO TECHNOLOGY (ECE -4029)

TIME: 3 HOURS

MAX. MARKS: 50

Instructions to candidates

- Answer **ALL** questions.
- Missing data may be suitably assumed.
- Graph sheets will be provided.
- 1A. An electron occupies the ground state of a one-dimensional infinite square well between 0 < x < L. If you measure the position of the electron, what is the probability that you will find it between 0 and L/4?
- 1B. From the SEM image shown in Figure 1B, interpret the meaning of all text written on the images(i) S3400 (ii) 15 kV (iii) 9.9 mm (iv) 30 um (v) 1500k



Figure 1B.

1C. Explain the Molecular orbitals and how to obtain it?

(5+3+2)

- 2A. In a X-ray diffraction experiment of α -iron taken using a diffractometer and monochromatic X-radiation having a wavelength of **0.574** Angstrom; each diffraction peak on the pattern has been indexed at 14.10⁰, 19.98⁰, 24.57⁰, 28.41⁰, 31.85⁰, 34.98⁰, 37.89⁰, 40.61⁰.
 - (i) Determine the crystal structure
 - (ii) Calculate the lattice constant.
 - (iii) Calculate the atomic radius.
 - (iv) Determine hkl value.
- 2B. Explain the basic principle of UV-VIS spectrophotometer.

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2C. Explain the concept of quantum confinement. How the absorption and emission occur depends on size of Quantum dots.

(5+3+2)

- 3A. Explain the processes involve in synthesis of Graphene using CVD.
- 3B. (i) Shown in the Figure 3B is XRD peak of some nanomaterial. What information it carries for nanomaterials in terms of grain size and orientation?



Figure 3B.

- (ii) Calculate the crystallite size of FWHM B for 45 and 70° .
- 3C. Calculate (a) the volume and (b) the mass of one million unit cells of body-centered cubic iron. The atomic radius of iron is 1.241 A⁰. Given density is 7.87 mg/m³.

(5+3+2)

4A. Data for the photoelectric effect experiment on sodium metal is given below. Use this data to determine a value for Planck's constant, h, and the work function φ for sodium metal. Report your result for h in units of Joule-seconds, and your value of φ in electron volts (eV).

Photon frequency, (s ⁻¹)	Electron Kinetic energy (eV)
9.993×10 ¹⁴	1.848
8.817×10 ¹⁴	1.309
7.889×10 ¹⁴	0.972
7.138×10 ¹⁴	0.695
6.517×10 ¹⁴	0.408
5.996×10 ¹⁴	0.182
5.552×10 ¹⁴	0.0085

- 4B. Derive DOS for 3D nanomaterial.
- 4C. (i) Green Nanotechnology means.....
 - (ii) Draw the Nanosensor setup (any one) used for Agriculture field.

(5+3+2)

- 5A. Within a cubic unit cell, sketch the following directions. (i) [2 1 1] (ii) [1 0 -2] (iii) [3 -1 3] (iv) [3 0 1] (v) [1 0 1].
- 5B. Explain the process of growth of Silicon nanowire using VLS process.
- 5C. Explain about the band structure of semiconductor heterojunction.

(5+3+2)