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MANIPAL INSTITUTE OF TECHNOLOGY Manipal University

SIXTH SEMESTER B. Tech. (E & C) DEGREE END SEMESTER EXAMINATION MAY/LUNE 2016 SUBJECT: NANO SCIENCE & TECHNOLOGY (ECE -360)

TIME: 3 HOURS

Instructions to candidates

MAX. MARKS: 50

- Answer **ANY FIVE** full questions.
- Missing data may be suitably assumed.
- 1A. How close packed crystal structures are named like that. Prove with two examples.
- 1B. State and illustrate with examples how crystal planes and group of planes are indexed in a crystal structure.
- 1C. Calculate number of Ga and As atoms per cubic centimetre of GaAs crystal. Given that the lattice parameter of GaAs crystal is 5.95 Å and crystal is FCC.

(3+3+4)

- 2A. Calculate binding energy of exciton in the following cases. Comment on the result.
 - a) For CdS : m $_e$ = 0.2 m $_o$ and m $_h$ = 0.7 m $_o~$ and ϵ = 8.6
 - b) For InP : $m_e = 0.07 m_o$ and $m_h = 0.4 m_o$ and $\epsilon = 14$.
- 2B. Describe two parameters in characterising nanoscale dimensions in semiconductors for optical property

(5+5)

- 3A. Describe the photolithography process in fabricating sub-micron features. What is chief limitation of the process. Indicate various techniques to overcome the limitation.
- 3B. Describe how the scanning tunnelling spectroscopy be utilised to estimate local density of states in a nanostructured materials. What type of materials be probed into by STM.

(5+5)

- 4A. Describe the chemical reactions involved in extracting and refining the Si to its purest form. Explain the process of single crystal formation from pure Si.
- 4B. Why the nanostructures of the nobel metals exhibit different colours? Describe the underlying phenomenon and how it be realised.
- 5A. Describe different configurations in which SNOM can be realised.
- 5B. Explain the construction and operation of Atomic Force Microscopy (AFM). How it differs with STM?

(6+4)

(5+5)

- 6A. How can we utilise the hetero-epitaxial growth modes in realising nanostructures.
- 6B. Describe two thin film techniques (one CVD one PVD) by which we can grow epitaxial layers

(5+5)