

Printed Pages : 3



NOE042

(Following Paper ID and Roll No. to be filled in your Answer Book)

**PAPER ID : 199432**

Roll No.

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**B. Tech.**

(SEM. IV) THEORY EXAMINATION, 2014-15  
NANO SCIENCE

Time : 3 Hours]

[Total Marks : 100

- Note : (1) Attempt all questions.  
(2) Marks of each question are shown against it.

- 1 Attempt any four parts of the following :  $5 \times 4 = 20$
- What are applications of nano technology in industries ?
  - Why are energy bands form in solids ? How these energy bands depend on intermolecular distances ?
  - What is nano-scale ? Why are nano-structures posses amazing properties ?
  - What are excitons ? Give properties.
  - What do you mean by effective mass of an electron in solid ?
  - Explain concept of fermi surfaces.

- 2 Attempt any two parts of the following :  $10 \times 2 = 20$   
 (a) A potential function is defined as follows

$$V(x) = \begin{cases} 0 & \text{for } x < 0 \\ V_0 & \text{for } 0 < x < a \\ 0 & \text{for } x > 0 \end{cases}$$

Solve Schrodinger's wave equation for each potential value and show that  $R+T=1$ , where symbols have usual meaning.

- (b) What is single electron tunneling effect ? How this effect distinguish nano-scale properties to micro-scale properties?
- (c) Describe quantum confine effect in nano science.
- 3 Attempt any two parts of the following :  $10 \times 2 = 20$   
 (a) Describe E-beam evaporation technique for synthesis of nano materials.  
 (b) Describe ion beam deposition technique for synthesis of thin film of nano materials.  
 (c) What is method of molecular beam epitaxy ? How it is superior to other techniques ?
- 4 Attempt any two parts of the following :  $10 \times 2 = 20$   
 (a) How particle size is determine by X-ray crystallography ?  
 (b) What is principle of atomic force microscopy and how it is used in nano-structure analysis ?

- (c) What is magnetic resonance effect ? How it is used in specific atomic level structure analysis ?
- 5 Attempt any two parts of the following :  $10 \times 2 = 20$
- (a) What are nano robots ? What are applications of nano robots ?
- (b) How the electrical and mechanical properties of carbon nanotubes depend on structure of nano tubes ? Explain in details. What is molecular rotor ?
- (c) Write short notes on :
- (i) Single electron transistors
  - (ii) Molecular Machine.
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