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Total Number of Pages : 02 **B.Tech.**
PBT6J004

6th Semester Regular Examination 2017-18
NANOBIOTECHNOLOGY
BRANCH : BIOTECH
Time : 3 Hours
Max Marks : 100
Q.CODE : C416

Answer Part-A which is compulsory and any four from Part-B.
The figures in the right hand margin indicate marks.

Part – A (Answer all the questions)

Q1 **Answer the following questions : *multiple type or dash fill up type :*** **(2 x 10)**

a) Which of these is at the nanoscale?
(a) a red blood cell (b) a hydrogen atom
(c) DNA (d) all of the above

b) Who popularize the term Nanotechnology?
(a) Richard Feynman (b) Eric Drexler
(c) Norio Taniguchi (d) Gerd Binnig

c) A particular molecule of carbon made up of sixty carbon atoms has received huge attention as a basic building block in nanofabrication. What is the whimsical non-technical name for these molecules?

d) What is the general name for the class of structures made of rolled up carbon lattices?

e) The tensile strength of a carbon nanotube is _____ times that of steel.
(a) 10 (b) 25
(c) 100 (d) 1000

f) Biosensors contains
(a) immobilized enzymes (b) metal sensing devices
(c) mobilized enzymes (d) a bar code sensing device

g) What does 'F' stand for in AFM?

h) The two important properties of nanosubstances are _____.
(a) pressure and friction (b) sticking and friction
(c) sticking and temperature (d) temperature and friction

i) Which of the following is an example of bottom-up approach for the preparation of nanomaterials?
(a) Etching (b) Dip pen nano-lithography
(c) Lithography (d) Erosion

j) A graphene sheet differs from the framework of a fullerene because:
(a) the graphene sheet consists of C_n rings in which n = 5 and 6, but in a fullerene n = 5
(b) the graphene sheet consists of C_n rings in which n = 6, but in some fullerenes n = 5
(c) the graphene sheet consists of C_n rings in which n = 6, but in fullerenes n = 5 and 6
(d) the graphene sheet consists of C_n rings in which n = 5 or 6, but in most fullerenes n =6

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Q2 **Answer the following questions :** ***Short answer type :*** **(2 x 10)**

a) Give 3 examples of nanomaterials that differ in properties when at the nanoscale vs. bulk.

b) Give some examples of DNA Nanostructures.

c) Name two physical entities that have negligible effect on nanostructures.

d) Give examples of nano-particles used for cellular imaging?

e) Differentiate between top-down and bottom-up approach.

f) Which are possible risks of nanotechnology today?

g) What are magnetosomes?

h) Give some examples of MEMs?

i) Give few lists of enzymes involved in biosensors.

j) Examples of dry etching?

Part – B (Answer any four questions)

Q3 **a)** What do you mean by Information-Driven nano-assembly? Explain with examples the role of energetics, enzymes in nano-assembly **(10)**

b) Briefly explain soft lithography. **(5)**

Q4 **a)** Elucidate with schematic diagram, the principles, working methods and limitations of STM? **(10)**

b) Give two examples of processes involving self-assembly or self-organisation at the nanoscale. **(5)**

Q5 **a)** Define CNT? Briefly explain types and properties of carbon nanotubes. **(10)**

b) Define and explain quantum dots and its application. **(5)**

Q6 **a)** What is photolithography? Describe the methods involved in photolithography and etching. **(10)**

b) What are lab-on-chip devices? Describe its potential in nanobiotechnology with examples? **(5)**

Q7 **a)** Describe different nano-structure mediated drug delivery system? How it is more efficient than conventional drug delivery? **(10)**

b) What are bionano-machines? Explain about bacteriorhodopsin as a typical bionano-machine. **(5)**

Q8 **a)** Why [surface area/volume] ratio is very large for nanoparticles compared to bulk materials? Explain with a simple example? Highlight any two problems associated with increase in surface area? **(10)**

b) What are the cell nanostructure interactions? Explain. **(5)**

Q9 **a)** Describe Chemical Vapor Deposition method of nanofabrication. **(10)**

b) Explain briefly about Bio-MEMS. **(5)**