2023

Time - 3 hours

Full Marks - 80

*Answer **all groups** as per instructions.*
Figures in the right hand margin indicate marks.
Candidates are required to answer
in their own words as far as practicable.

GROUP – A

1. Answer all questions and fill in blanks as required. [1 × 12

(a) _____ are known as quantum wires.

(b) Nanorods, nano tubes and nano wires are _____ nano structured materials.

(c) Band gap nanostructures are _____ proportional to the wave-length.

(d) _____ process is based on natural self-organization process.

(e) _____ process is very useful in nanofabrication process.

(f) _____ devices are less sensitive to interference.

(g) _____ is an allotrope of carbon.

(h) Write full form of MWNT and SWNT.

(i) _____ dots are referred to as artificial atoms.

(j) Nano wire is a nanostructure with the order of a _____ m.

(k) _____ is based on the principle of quantum tunneling.

(l) The degree of freedom of 2D nanomaterials is _____.

GROUP – B

2. Answer any eight of the following questions within two to three sentences each. [2 × 8

(a) What are quantum dots ?

(b) What are 3D NSMs ?

(c) What is eigen function ?

(d) Write the time independent Schrodinger equation in 3D.

(e) Classify CVD process according to the source of energy.

(f) Why CNT has a very high strength ?

(g) How carbon nanotubes are formed ?

(h) What are single electron devices ?

(i) Write an expression for the eigen energy for infinite potential well.

(j) Write the uses of nano-metals.

GROUP – C

3. Answer any eight of the following questions within 75 words each. [3 × 8

(a) Differentiate between nano wires and nanorods.

(b) What are 3D nanostructured materials ?

(c) What are fermi surfaces in solids ?

(d) Define Density of States (DoS) for electrons.

(e) Write various factors that affect the synthesis of nanoparticles.

(f) What is Chemical Vapour Deposition (CVD) ?

(g) Discuss the limitations of optical microscopes for the observation of very small objects.

(h) Write the principle of Scanning Tunneling Microscope (STM).

(i) Write the applications of MEMS.

(j) What are CNT based transistors ?

GROUP – D

4. Answer any four of the following questions within 500 words each.

(a) Describe the band structure of materials at nanoscale. [7

(b) Explain the quantum confinement of an electron in one dimension and it is free to move along two other axes. [7

(c) What are quantum dots ? How are nanowired used in LED ? [7

(d) Discuss about Nano Electro Mechanical Systems. [7

(e) Describe the working principle of scanning tunneling microscopy. [7

(f) Write notes on within 250 words each. [3½ × 2

(i) Magnetic quantum dots

(ii) Micro Electro Mechanical Systems

(g) Write notes on within 250 words each. [3½ × 2

(i) Nanoparticle Solar Cell

(ii) Nanowire Solar Cell