Registration No.: | | | | | | | | | | |

Total Number of Pages: 01 **Course: M.Sc.I**

Sub_Code: FPYC1002

10th Semester Regular Examination: 2024-25
SUBJECT: Nano Science & Technology
BRANCH(S): M.Sc.I(AP)
Time: 3 Hours
Max Marks: 70
Q.Code: S059

Answer Question No.1 (Part-I) which is compulsory, any five from rest (Part-II)
The figures in the right-hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) How does geometric structure influence the properties of nanoparticles?
b) What are magic numbers and how are they related to nanoparticle stability?
c) What is C_{60}? What are the different categories of C_{60}?
d) What are larger and smaller fullerenes and how do they differ from C_{60}?
e) Name two applications of carbon nanotubes.
f) Define quantum well, quantum wire, and quantum dot.
g) What are basic principles of Raman spectroscopy?
h) Define luminescence. What are the different types of luminescence?
i) What are potential wells and how do they influence the properties of quantum nanostructures?
j) What is porous silicon, and why is it important in nanostructures?

Part-II

Long Answer Type Questions (Answer Any five)

Q2 Explain the optical properties of semiconducting nanoparticles and describe the processes of photofragmentation and Coulombic explosion. **(10)**

Q3 How the nature of carbon bond leads to formation of new carbon structure? Explain the synthesis and characteristics of larger and smaller fullerenes, and discuss other types of bucky balls. **(10)**

Q4 Explain the fabrication methods, structure, and electrical, vibrational, and mechanical properties of carbon nanotubes in detail. **(10)**

Q5 **a)** Discuss the formation, properties, and applications of natural nanocrystals, cluster lattices, nanoparticle arrays in zeolites, and photonic crystals. **(5 + 5)**
b) Describe the basics of ferromagnetism and dynamics of nanomagnets.

Q6 **a)** Describe the different types of luminescence in nanomaterials, including photoluminescence and thermoluminescence. **(5 + 5)**
b) Explain surface spectroscopy, Raman spectroscopy, and Brillouin spectroscopy.

Q7 **a)** Explain the applications of quantum nanostructures in superconductivity. **(5 + 5)**
b) How conduction electrons, Fermi gas behavior, and density of states are influenced by the size of quantum structures.

Q8 Discuss the formation, properties, and significance of small carbon clusters with special emphasis on C_{60}, its crystal arrangement, and the effects of alkali doping on its properties. **(10)**