

[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 7299

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Unique Paper Code : 2513010026

Name of the Paper : Nanomaterials and their Applications (DSE)

Name of the Course : **B.sc. (H) Electronics**

Semester : VIII

Duration : 3 Hours

Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Question No. 1 is compulsory.
3. Attempt any **five** questions in all. **All** carry equal marks.

1. (a) Tabulate the difference between polymers, conducting polymers and Nanopolymers. 3
(b) What are 0D materials? Mention its examples. 3
(c) What is energy conversion? Differentiate between Direct and Indirect energy conversion process. 3
(d) Distinguish the characteristics of Primary and Secondary battery 3
(e) How do nanocatalysts improve fuel cell performance? 3
(f) Mention one application of each dielectric, ferroelectric and magneto ceramic nanomaterials. 3
2. (a) How do nanoscale dimensions influence the properties of materials? Discuss any four properties of nanomaterials (structural, mechanical, thermal, magnetic, optical, transport or electronic) highlighting their unique characteristics compared to bulk materials. 6
(b) Discuss how polymers can be utilized in photovoltaic Devices. Explain the solar energy conversion with help of diagram before and after incorporation of graphene. 6
(c) What are nano-ceramics? Explain How does embedding nanoparticles within polymer matrices alters the mechanical, optical and catalytic properties of composite materials? 6
3. (a) What are hybrid adsorbents? Discuss their composition and advantages over pure nanomaterials in wastewater treatment. Illustrate with one case study. 6
(b) Explain briefly different electro chemical storage system. Give one application for each. 6
(c) What are the key features of advanced battery system? Explain the working principle, electrode materials and applications of Nickel–Cadmium battery. 6
4. (a) Differentiate between direct and indirect energy conversion processes. With suitable examples. Explain how nanoscale catalysts contribute to energy savings and improved industrial productivity. 6
(b) Explain the impact of nanomaterial on the energy storage system in terms of efficiency, cost effectiveness and environment sustainability. 6
(c) What is nanoscale catalyst? Explain how it contributes to energy savings and improved industrial productivity. 6

P.T.O.

5. (a) What are Super capacitors? What are the benefits of using nanomaterials in supercapacitors? 6
- (b) Define Carbon Nanotubes (CNTs) and list their primary types. Explain the role of carbon nanotubes in hydrogen storage devices. 6
- (c) What are quantum dots and how do they improve solar cell performance? 6
6. (a) Explain the characteristics of gas sensors and describe the working principle of Chemi resistive Semiconducting metal oxide-based gas sensors. 6
- (b) Explain the change in magnetic properties of nanosized magnetic materials compared to bulk materials. Discuss their applications in data storage, memory devices. 6
- (c) Describe the application of nanomaterials in optic gas sensors and electrochemical gas sensors. How do nanostructured materials enhance detection efficiency, selectivity, and response time? 6
7. (a) Compare top-down and bottom-up approaches in nanomaterial synthesis with one example of each. 6
- (b) Discuss the importance of carbon nanotechnology in LEDs. 6
- (c) Discuss the applications of polymeric nanomaterials in the field of drug delivery, water treatment and electronics. 6