

Time: 3 hours

Max. Marks: 80

- Note: 1. Assume suitable data if necessary
 2. Figures to the right indicate full marks
 3. Question No. 1 is compulsory
 4. Solve any **three** out of the remaining **five** questions

**Q1. Write short notes on following: (Any Four)**

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|---|---|
| A Dielectric elastomers | 5 |
| B Define biomimetic materials. | 5 |
| C Piezoelectric effects | 5 |
| D Carbon Nanotubes | 5 |
| E Differentiate between energy harvesting and energy storage | 5 |
| F Role of Ion Beam Processing in manufacturing smart materials? | 5 |

Q2.

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|--|----|
| A Explain a term memory and energy storage. | 5 |
| B State applications of Nano composite. | 5 |
| C List and explain different types of smart materials. Highlight their unique properties and typical engineering applications. | 10 |

Q3.

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|--|----|
| A What is Hysteresis? State it's applications. | 5 |
| B Write down Different classifications of Self replications. | 5 |
| C Write a detailed note on adaptive structures and self-healing materials. Explain how these materials improve performance and reliability in real-world applications. | 10 |

Q4.

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| A Differentiate between Ferrofluids and Magnetorheological Fluids. | 5 |
| B What is the difference between Piezoelectric and Magnetostrictive transducers. | 5 |
| C What are smart sensors? Discuss the working principles of smart materials used as sensors. | 10 |

Q5.

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|---|----|
| A Briefly describe the key features and limitations of Shape Memory Alloys in smart structures. | 5 |
| B What are Hydrogen Storage Materials? Describe their types, synthesis methods, and mechanisms of hydrogen absorption and desorption. | 5 |
| C Illustrate Electroactive Polymers (EAPs). Explain their working mechanism, classification, synthesis techniques, advantages and limitations, and their role in actuation systems. | 10 |

Q6.

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| A List any four generative manufacturing processes and state one key application of each in smart material development. | 5 |
| B What is Self assembly process? Describe top-down and bottom-up approaches of self assembly. | 5 |
| C Explain the LIGA process in detail. Describe its steps, advantages, limitations, and applications in microstructure fabrication for smart materials. | 10 |