

MAHATMA GANDHI UNIVERSITY, KOTTAYAM
MGU-UGP (HONOURS) DEGREE EXAMINATION
FIFTH SEMESTER
(2024 Admission Onwards)
Discipline Specific Elective (DSE) Course
MG5DSECEHA00: APPLICATIONS OF NANOMATERIALS -I

Time : 2hrs

Total Marks: 70

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S),
Interest (I) and Appreciation (Ap)

Section A
(Answer all Questions, each question carries 1 mark)

1. Identify the cathode used in Na ion battery (U) [CO2]
a) NaCl b) NaCoO₂ on Al foil c) LiCoO₂ d) none of these
2. Predict the electrolyte used in supercapacitor (A) [CO3]
a) KOH b) LiCl c) BaO d) none of these
3. Predict the electrolyte used in solid oxide fuel cell (A) [CO3]
a) Zirconium oxide and yttria b) Zirconium Carbonate c) Zirconium Chloride
d) none of these (A) [CO3]
4. What unique arrangement is engineered to fabricate a superlattice?
a) Alternating periodic layers of different materials b) Random arrangement of atoms
c) single thick layer of one material d) None of these (An) [CO 4]
5. How does quantum confinement affect the energy bandgap of the superlattice?
a) Decreases the band gap to zero b) No effect on the band gap
c) modify and increases the effective band gap d) None of these (An) [CO 4]
6. What is the dielectric constant of silicon nanomaterials?
a) 2.1 b) 3.9 c) 11.7 d) None of these (An) [CO 4]
7. Name the most important reactive species produced in many AOPs. (E) [CO5]
a) OH₂ b) OH⁻ c) H₂ d) None of these
8. Predict the commonly used nanocatalyst in hydrogen fuel cells (E)[CO-5]
a) Pt b) Cu c) Ni d) None of these
9. Choose the material commonly used to create nanoparticles for targeted drug delivery? (C) [CO6]
(a) Gold (b) polymeric materials (c) aluminium (d) silica
10. Which field is closely associated with applications that repair or replace portions or whole tissues? (C) [CO6]
(a) Tissue culture (b) tissue repair (c) surgery (d) tissue engineering

(10x1=10 Marks)

Section B (3 marks) (Short Answer Questions)
(Answer any Eight Questions)

11. List the main components of Li ion battery (Knowledge) [CO1]
12. Differentiate between alkaline fuel cell and phosphoric acid fuel cell (U) [CO2]
13. Illustrate the main components of Na-ion battery (U) [CO2]

14. Distinguish between a Multiple Quantum Well and a Semiconductor Superlattice (An) [CO 4]
15. What are the characteristics of porous silicon based diodes of nanomaterials? (An) [CO 4]
16. What is the excitonic binding energy of nanomaterials? Explain its significance. (An)[CO 4]
17. Distinguish between a conventional catalyst and a nanocatalyst (E)[CO5]
18. Evaluate the properties of colloidal gold nanoparticles that make them ideal for immune gold labelling. (C)[CO6]
19. Generalise the advantages of polymeric nanomaterials to design, select and optimize targeted drug delivery systems (C).[CO6]
20. What are the challenges of using tissue engineering to develop therapies? (C) [CO6]

(8x3=24 Marks)

Section C (7 marks) (Short Essay Questions)
(Answer any 3 questions)

21. Describe the working principle of hydrogen-oxygen fuel cell (K) [CO1]
22. Explain the charging and discharging mechanism of supercapacitor (A)[CO3]
23. Explain the semiconductor superlattices based on their structure, properties and applications. (An) [CO 4]
24. Discuss the nonlinear optical properties of nanomaterials with examples. (An)[CO 4]
23. Explain the basic principle of photocatalytic water splitting. (E)[CO5]

(3x7=21 Marks)

Section C (15 marks) (Essay Questions)
(Answer any one question)

24. Explain the general mechanism of semiconductor photocatalysis. Compare TiO₂, ZnO and doped photocatalysts. (E) [CO5]
25. Critically evaluate the advantages, disadvantages and need for controlled and targeted drug delivery systems in comparison to conventional dosage forms. (C)[CO6]

(1x15=15 Marks)