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Question Paper Code: 1215463

B.E. / B.Tech. DEGREE EXAMINATIONS, NOV/ DEC 2024

Fifth Semester

Biomedical Engineering

U20BM510 – BIOMATERIALS

(Regulation 2020)

Time: Three Hours

Maximum: 100 Marks

Answer ALL questions

PART – A

(10 x 2 = 20 Marks)

1. Classify biomaterials based on their origin.
2. How does viscoelasticity affect biomaterial applications in the body?
3. How does corrosion affect the performance of metallic implants in the body?
4. Compare bioinert and bioactive ceramics in terms of their interaction with body tissues.
5. List two factors that influence the properties of polymers.
6. What role does elastin play in biomedical applications?
7. What is small intestinal submucosa (SIS), and how is it used in tissue repair?
8. What are maxillofacial augmentation implants, and what are they typically made of?
9. What is tissue compatibility testing?
10. Differentiate between in vitro and in vivo testing for biomaterials.

PART – B

(5 x 16 = 80 Marks)

11. (a) Explain blood compatibility in biomaterials. What are the primary factors that influence the blood compatibility of a material, and how can these factors be optimized? (16)

(OR)

- (b) Compare and contrast the body's response to metallic, ceramic, and polymeric biomaterials. Discuss how these responses are managed in biomedical applications. (16)

12. (a) Explain the different types of metallic implants used in biomedical applications. Discuss their properties, advantages, and limitations. (16)

(OR)

- (b) Discuss the impact of nanotechnology on ceramic biomaterials. How does the incorporation of nanoscale features influence their mechanical and biological properties? (16)

13. (a) Explain the materials used in ophthalmology, specifically for contact lenses and intraocular lenses. What are the key requirements for these materials, and how do they meet the needs of the eye? (16)

(OR)

- (b) Discuss the use of medical textiles in biomedical applications. What are the properties of medical textiles that make them suitable for use in implants, wound care, and surgical materials? (16)

14. (a) Explain the different types of soft tissue replacements such as sutures, surgical tapes, adhesives, and percutaneous implants. How do these materials contribute to wound healing and tissue repair? (16)

(OR)

- (b) Explain the role of tissue scaffolding in tissue engineering and its use with nano biomaterials. How do nanomaterials enhance the functionality of scaffolds for tissue regeneration? (16)

15. (a) (i) Given a new implant material, apply the principles of ETO, gamma radiation, and autoclaving sterilization methods to outline an appropriate sterilization protocol. Explain the conditions under which each method would be considered suitable for this material. (8)

- (ii) Using the properties of the new implant material, determine the most suitable sterilization method among ETO, gamma radiation, and autoclaving. Justify your choice by predicting how each method might impact the material's mechanical properties and biocompatibility. (8)

(OR)

- (b) (i) Given a new polymer-based biomaterial for joint replacement, apply the principles of toxicity testing, including sensitization, carcinogenicity, and mutagenicity. Describe the importance of each test in evaluating the material's safety. (8)

- (ii) Using the results of toxicity testing (sensitization, carcinogenicity, and mutagenicity), analyze how these findings influence the selection of the biomaterial and the regulatory approval process for joint replacement implants. (8)