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Question Paper Code:UB401

B.E./B.Tech. DEGREE EXAMINATION, APRIL / MAY 2025

Professional Elective

21BMV401- BIOMECHANICS

Biomedical Engineering

(Regulations 2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

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| 1. Mention the parameters required to characterize the force. | CO1- U |
| 2. Differentiate kinetics and kinematics. | CO1-U |
| 3. Mention the names of various prosthetic heart valves. | CO1- U |
| 4. How fluid mechanics is related to physiological system? | CO1- U |
| 5. Write a short note on mechanical properties of articular cartilage. | CO1- U |
| 6. Draw the Voigt model of Viscoelasticity+ | CO1- U |
| 7. What factors influence the stability of synovial joints? | CO1- U |
| 8. List the types of joint in skeletal system. | CO1- U |
| 9. Outline the causes and effect of vibration. | CO1- U |
| 10. Identify the methods that are generally associated with the finite element analysis. | CO1- U |

PART – B (5 x 16= 80 Marks)

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| 11. (a) (i) What is biomechanics? Explain the different forces that acts on the body. | CO1- U | (8) |
| (ii) Derive the constitutive equations of non-viscous fluid. | CO1- U | (8) |
| Or | | |
| (b) (i) Discuss in detail about fundamental concepts of Mechanics in terms of static and dynamic motion. | CO1- U | (8) |
| (ii) Discuss briefly about the Hookean Elastic solid. | CO1- U | (8) |

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| 12. | (a) | (i) Discuss the dynamics of fluid flow in cardiovascular system. | CO1- U | (8) |
| | | (ii) Justify when the blood will be Newtonian and Non Newtonian. | CO3-Ana | (8) |
| | | Or | | |
| | (b) | (i) Prove the velocity profile of blood based on their distribution. | CO1- U | (8) |
| | | (ii) Analyze the fluid dynamics of artificial heart valves using a case study. | CO3-Ana | (8) |
| 13. | (a) | Analyze the relationship between the viscoelastic properties of hard tissues and their ability to withstand repetitive mechanical stresses over time. | CO4- Ana | (16) |
| | | Or | | |
| | (b) | Compare and contrast the biomechanical performance of traditional fixation methods with emerging technologies for different types of bone fractures.. | CO4- Ana | (16) |
| 14. | (a) | What is free body diagram? Draw a free body diagram of an adult in skate. Describe about the forces acting on the person. | CO1-U | (16) |
| | | Or | | |
| | (b) | (i) What is Gait analysis? Explain the procedure for gait analysis. | CO1-U | (8) |
| | | (ii) Explain in detail about the lubrication of synovial joints. | CO1-U | (8) |
| 15. | (a) | (i) Describe the role of Finite element modeling in biomechanics. | CO1-U | (8) |
| | | (ii) Design a computer workstation ergonomically for an adult. | CO2-App | (8) |
| | | Or | | |
| | (b) | (i) Explain the mechanics involved in injury prevention using ergonomics. | CO1-U | (8) |
| | | (ii) Apply Finite element analysis to the lumbar spine to evaluate the disease and predict future fracture risk. | CO2-App | (8) |