Reg. No. :

Question Paper Code: UB401

B.E./B.Tech. DEGREE EXAMINATION, APRIL 2024

Professional Elective

Biomedical Engineering

21BMV401 BIOMECHANICS

(Regulations 2021)

Duration: Three hours   Maximum: 100 Marks

Answer All Questions

PART A - (10x 2 = 20 Marks)

1. Compare stress and strain.   CO1-U

2. Mention the parameters required to characterize the force.   CO1-U

3. How fluid mechanics is related to physiological system?   CO1-U

4. Mention the names of various prosthetic heart valves.   CO1-U

5. Draw the Voigt model of Viscoelasticity.   CO1-U

6. List the anisotropic characteristics of Bone tissue.   CO1-U

7. Differentiate movement and locomotion.   CO1-U

8. List the types of joint in skeletal system.   CO1-U

9. Outline the causes and effect of vibration.   CO1-U

10. List the most common ergonomic injuries in the workplace.   CO1-U

PART – B (5 x 16= 80 Marks)

11. (a) (i) Elaborate in brief about the resolution and composition of forces. CO1-U (10)

         (ii) Discuss briefly about the Hookean Elastic solid.   CO1-U (6)

                                    Or

    (b) (i) Summarize about the Newtonian viscous fluid with necessary   CO1-U (10)
             equation.

         (ii) Brief about the different forces that acts on the body.   CO1-U (6)

12. (a) (i) How the fluids are classified based on Newtonian concept? CO1-U (10)
Derive the constitutive equation for blood.
(ii) Describe the material behavior of blood vessels. CO1-U (6)

Or

(b) (i) Explain in brief the flow property of blood and its need in the CO1-U (10)
field of medicine.
(ii) Explain the concepts of fluid mechanics in the straight tube. CO1-U (6)

13. (a) (i) With a neat diagram explain the mechanical property of CO1-U (10)
Cartilage.
(ii) Derive the expression of constitutive equation for soft tissue. CO1-U (6)

Or

(b) (i) Illustrate and explain the structure and functions of tendon and CO1-U (10)
ligaments.
(ii) Explain in brief about the functional adaptation of bone. CO1-U (6)

14. (a) (i) What is lubrication? How are-they classified? Explain in detail CO1-U (8)
the lubricating property of joints.
(ii) Consider the total hip joint prosthesis shown in Fig. The CO2-App (8)
geometric parameters of the prosthesis are such that ℓ_1=52mm,
ℓ_2= 90mm θ_1=30° and θ_2= 90°. Assume that,when standing
symmetrically on both feet, a joint reaction force of 450N is
acting atthe femoral head due to the body weight of the patient.
Consider 2 different lines of action for the applied force.
Determine the moments generated about point B and C on the
prosthesis device.

Or

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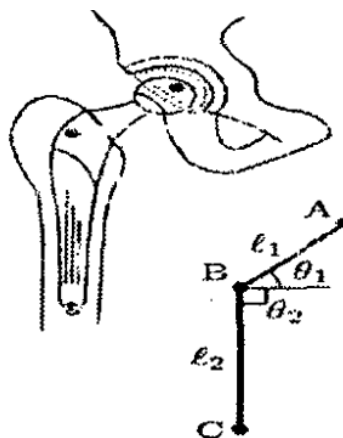
(b) (i) Describe the function of various types of joints.   CO1-U   (8)

(ii) The Fig. shows a Russells traction rig used to apply an axial, CO2-App (8) tensile force to a fractured femur for immobilization.

    A)   What magnitude weight W must be suspended from the free end of the cable to maintain the leg in static equilibrium?

    B)   Compute the average tensile force applied to the thigh under these conditions. The weight of the person is 65Kg.
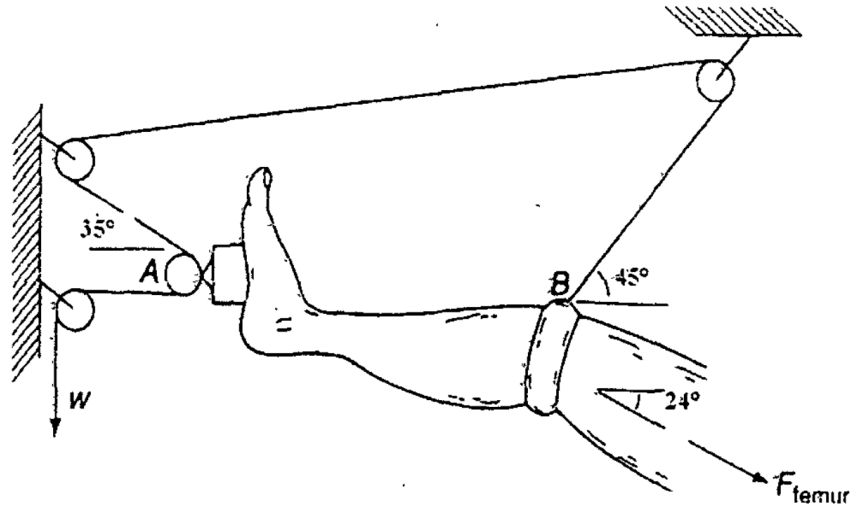
15. (a) (i) Explain the basic consideration to use the ergonomics in the CO1-U (8) work place.

    (ii) Examine the process of designing a computer workstation that CO4-Ana (8) prevents musculoskeletal disorders.

<div align="center">Or</div>

(b) (i) Describe the role of Finite element modeling in biomechanics.   CO1-U   (8)

    (ii) Analyze the effects of aging on the biomechanics of the lumbar CO4-Ana (8) spine using finite element analysis.

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