

III B.Tech I Semester Regular Examinations, November 2006
BIO-FLUIDS AND MECHANICS
(Bio-Medical Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. Explain Newton's law for flow of biological fluids. Describe Poiseuille's law to study flow of liquids through blood vessels. Explain the terms stress, strain and elasticity critically with examples. [16]
2. (a) Explain the working and applications of an oscillating magnetic microrheometer in detail.
(b) Describe the deformability of the red blood cell in micro vessels. [8+8]
3. (a) Explain the inverse effect of FAHRAEUS-LINDQUIST effect.
(b) How the R.B.C moves in a tightly fitted tube whose diameter is less than R.B.C. [8+8]
4. Explain the Maxwell, voigt and Kelvin models of viscoelasticity. [16]
5. (a) Describe the composition and mechanical properties of collagen.
(b) Write down the non-uniformity of haematocrit distribution among the capillary blood vessels. [8+8]
6. (a) Describe the mechanism involved in inspiration and expiration.
(b) What is air-way resistance?
(c) Justify the airway resistance as a diagnostic parameter. [6+5+5]
7. (a) Describe briefly about the Viscoelasticity of soft tissues.
(b) Justify the viscoelastic nature of the bone. [8+8]
8. Describe various joints in human body and role of articular cartilage in smooth locomotion. [16]

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1. Explain Vascular tree with illustrations. Describe the relationship of diameter, velocity and pressure of blood in blood vessels. [16]
2. (a) Explain the effect of any four factors on the viscosity of blood.
(b) Explain the physical properties of blood. [8+8]
3. (a) Explain the inverse effect of FAHRAEUS-LINDQUIST effect.
(b) How the R.B.C moves in a tightly fitted tube whose diameter is less than R.B.C. [8+8]
4. (a) What are the different viscoelastic models?
(b) Derive the equations for creep and stress relaxation for a Maxwell model. [8+8]
5. What are the essential components of cardiovascular system? Enumerate any five diseases and cause of the diseases of cardiovascular system? Explain about the replacements of heart valves. [16]
6. (a) Draw and label a spirogram.
(b) Explain the diagnostic importance of lung ventilation parameters.
(c) Describe the process of airway mechanics. [5+5+6]
7. (a) Describe briefly about the Viscoelasticity of soft tissues.
(b) Justify the viscoelastic nature of the bone. [8+8]
8. (a) Enumerate and discuss various mechanical and diffusion properties of cartilage with examples.
(b) Write briefly about lubrication of joints? [8+8]

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1. (a) What are the factors which determine the resistance to flow?
(b) Given the radius of aorta as $1.3 \times 10^{-2}m$, determine the resistance and pressure drop over a 0.2m distance, if the flow rate is $10^{-4}m^3/s$. [8+8]
2. Plot and explain the shear rate Vs shear stress characteristics of various types of non-Newtonian fluids. [16]
3. Explain critically about distribution of suspended particles in narrow rigid tubes and red blood cells in tightly fitting tubes. [16]
4. (a) Write down on Synovial fluid and mucus on the light of their viscoelastic behaviour.
(b) Which one is better though they have different functions? [8+8]
5. (a) Describe the composition and mechanical properties of collagen.
(b) Write down the non-uniformity of haematocrit distribution among the capillary blood vessels. [8+8]
6. (a) Describe in detail the breathing mechanism.
(b) Enumerate any five lung diseases by indicating their cause for development of diseases. [8+8]
7. What do you mean by soft tissue? Explain the terms viscoelasticity and pseudoelasticity critically? Elaborate your answer how pseudoelasticity and viscoelasticity influence the properties and functions of skin ligaments? [16]
8. (a) Describe the role of rheology in joint motion and lubrication.
(b) Write briefly about Kinetics of Joints. [8+8]

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2. (a) How is the blood viscosity determined?
(b) What are the factors on which the blood viscosity depends? [8+8]
3. (a) Elaborate the role of capillaries in blood flow.
(b) What is plasma skimming.
(c) Explain FAHRAEUS-LINDQUIST effect. [5+5+6]
4. (a) Describe the viscoelastic features of protoplasm and saliva.
(b) Describe the use of viscoelastic models in biomechanical studies. [8+8]
5. (a) Describe the flow behaviour of blood as it flows through aorta to venacava.
(b) What are the medical applications of blood Rheology? [8+8]
6. (a) With the help of a P-V curve of a lung, explain the normal breathing mechanism.
(b) What are the lung mechanical parameters? Differentiate normal and abnormal respiratory states. [8+8]
7. (a) Explain the structure and properties of tendons.
(b) Describe structural properties of ligaments and effect of injuries on locomotion. [8+8]
8. Describe the Structure and mechanical properties of bone with examples. Explain what do you understand by Lubrication of Joints? [16]
