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MANIPAL INSTITUTE OF TECHNOLOGY

(A constituent unit of MAHE, Manipal 576104)

III SEMESTER B.Tech.(BME) DEGREE END SEMESTER EXAMINATIONS NOV/DEC 2018 SUBJECT: BIOMECHANICS (BME 2104) (REVISED CREDIT SYSTEM) Saturday, 1st December 2018: 9 am to 12 noon

TIME: 3 HOURS

MAX. MARKS: 50

Instructions to Candidates:

1. Answer all the questions.

- 2. Draw labeled diagrams wherever necessary.
- 1. (a) When blood flows through aortic stenotic valve, what will be its effect on the 03 hydrostatic pressure of blood? Justify your answer with appropriate reasons.
 - (b) Obtain the relative viscosity as a function of particle volume fraction for the following 03 particles suspended in plasma: RBC, sickle cell, rigid sphere.
 - (c) Calculate the flow rate within an arteriole with a length of 100 μm and a radius of 35 μm. The pressure difference along the length of arteriole is 10 mmHg. Also, calculate the change in diameter needed to reduce the flow rate by 5% and to increase the flow rate by 10%.
- 2. (a) Obtain the coefficient of viscoelasticity of the mechanical model that responds well 03 with the relaxation and creep functions.
 - (b) Calculate the Reynolds number and wall shear stress for the blood flow in retinal 03 arteriole, whose density is 1060 kg/m³ flowing with an average velocity of 4 cm/s in the arteriole whose diameter is 3 mm. Is the flow laminar or turbulent?
 - (c) Explain the mechanism involved in case of both normal and forced respiration. 04
- 3. (a) What will be the impact on the RBCs if the blood flow is accelerated at the vicinity of 05 prosthetic heart valves? Explain it in detail.
 - (b) What do you mean by muscle frequency coding? How do the motor units respond 05 when activated both in case of sub-maximal and maximal muscle contraction?

- 4. (a) A person is holding a dumbbell and the arm whose length is 50 cm is flexed to 60° 03 from the reference position. Calculate the length of moment arm between the dumbbell and the shoulder joint. Also, draw the free body diagram.
 - (b) Differentiate the sensory receptors present in the skeletal muscles that allows and 04 inhibits muscles to stretch.
 - (c) Justify with appropriate reasons to show why the mechanical properties of cortical 03 bone is said to be strongly anisotropic.
- 5. (a) Explain in detail about the mechanical properties of soft tissues. 05
 - (b) What is the component in the skin whose tensile properties play a major role in determining the tensile equilibrium modulus of skin? Explain the structure of that component.