Exam Date & Time: 09-Jun-2022 (02:00 PM - 05:00 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

FOURTH SEMESTER B.TECH END SEMESTER EXAMINATIONS, JUNE 2022

BIOMECHANICS [BME 2251]

Marks: 50 **Duration: 180 mins.**

A

Answer all the questions.

Instructions to Candidates:

Answer ALL questions Missing data may be suitably assumed

1) Differentiate Non-Newtonian fluid flow from Pulsatile fluid flow. (3)

A)

B) Derive the differential equation to develop a mechanical model, that responds well with the creep function and the relaxation function. Find out the response of that mechanical model to stress relaxation, creep and also to periodic excitation. (4)

C) What are the three wall materials of the blood vessels? Explain them in detail. (3)

2) Calculate the resistance to blood flow within the descending aorta and the inferior vena cava. Assume that the pressure difference between the distal portion of the aortic arch and the iliac artery is 20 mmHg. The pressure difference within the inferior vena cava is 3 mmHg. Assume that the flow-rate through both blood vessels is 4.5 L/min. (3)

A)

B) Compare the various types of skeletal muscle tension. (4)

C) Differentiate slow twitch muscle fibers from the fast twitch muscle fibers. (3)

3) Justify with appropriate reasons to show why the mechanical properties of cortical bone is said to be strongly anisotropic. (3)

A)

B) Illustrate the gait cycle and write about the phases and sub-phases of the gait cycle. (4)

C) The biceps brachii muscle, attached to the radius bone at a distance of 2.5 cm from the elbow joint, produces a muscle tension of 250 N perpendicular to the bone. The triceps brachii muscle, attached to the radius bone at a distance of 3 cm away from the elbow joint, exerts 200 N of muscle tension perpendicular to the bone. Calculate the net torque (3)

at the elbow joint. Will there be flexion, extension or no movement at the joint?

4) A runner weighing 52 Kg is running forward at 5 m/s when his foot strikes the ground. The vertical ground reaction force acting under his foot at this instant is 1800 N. The friction force acting under his foot is a 300 N braking force. These are the only external forces acting on the runner other than the gravitational force. What is the runner's vertical acceleration, as a result of these forces. (3)

B) Elaborate about the muscle action that creates, opposes, stabilizes and neutralizes movements. Justify the answer with appropriate examples. (4)

C) Elaborate on the various instances where the cardiovascular murmurs can be heard (3)

5) How different is non-contact forces from contact forces that affect the human locomotion? Justify with appropriate examples. (3)

A)

B) What are the main factors that differentiate walking from running pertaining to human gait cycle? Sprinting around a curve in the inside lane is more difficult to do than sprinting around the curve in the outside lane: Justify with an appropriate answer. (4)

C) Calculate the relative angle at the knee and the absolute angles of the leg and thigh, given the following positions in degree: hip (2.128, 1.891), Knee (2.122, 1.642), ankle (1.897, 1.210) (3)

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