Exam Date & Time: 18-Jul-2022 (02:00 PM - 05:00 PM)



## MANIPAL ACADEMY OF HIGHER EDUCATION

## FOURTH SEMESTER B.TECH MAKE UP SEMESTER EXAMINATIONS, JULY/ AUG 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) What happens to the Haematocrit, when blood has to flow from a larger blood vessel through a smaller vessel whose orientation is perpendicular to the larger vessel? Justify (3)with specific reasons. A) B) Derive the differential equation to develop a mechanical model, that responds well with the creep function and not the relaxation function. Find out the response of that (4) mechanical model to stress relaxation, creep and also to periodic excitation. C) What are the various zones present in the articular cartilage? Illustrate with features. (3) Calculate the stress on the cartilage and the change in length of cartilage, assuming that 2) the force on the cartilage is 9875 N and the diameter of the cartilage is 2 cm (assume that it is circular). The cartilage has a thickness of 1.5 mm and an elastic modulus of 250 (3) Mpa. A) B) With respect to generation of force in a muscle, compare the types of muscle fibers. (4) C) Compare parallel muscle fiber from penniform muscle fiber. (3) 3) Compare the biomechanical properties of cortical bone with that of trabecular bone. (3) A) B) What are the factors influencing joint flexibility? Analyze the techniques for increasing the joint flexibility. (4) C) Analyze the force velocity relationship in a skeletal muscle. (3) 4) Calculate the height of the center of mass above its starting height during a squat jump (3)

|    | based on the following information: Body weight = $670$ N, Total vertical force = $788$ N and the time of force application = $0.9$ sec.  |  |
|----|---|--|
| A) |   |  |
| B) | Elaborate on the fracture mechanics of bone with a highlight on the various types of bone fracture.   | (4)  |
| C) | Elaborate on the various cardiovascular diseases.   | (3)  |
|    | Justify with brief explanation, the various types of forces.  |  |
|    |   | (3)  |
| A) |   |  |
| B) | How do the horizontal velocity and the acceleration of the foot vary during the various phases of a gait cycle of a running person? Illustrate.   | (4)  |
| C) | A punter kicks the football, which leaves the punter's foot with a vertical velocity of 20 m/s and a horizontal velocity of 15 m/s. For how long will the ball remain in the air? Assume that the height of the release and landing are same. | (3)  |
|    | <ul> <li>A)</li> <li>B)</li> <li>C)</li> <li>A)</li> <li>B)</li> <li>C)</li> </ul>  | <ul> <li>based on the following information: Body weight = 670 N, Total vertical force = 788 N and the time of force application = 0.9 sec.</li> <li>A)</li> <li>B) Elaborate on the fracture mechanics of bone with a highlight on the various types of bone fracture.</li> <li>C) Elaborate on the various cardiovascular diseases.</li> <li>Justify with brief explanation, the various types of forces.</li> <li>A)</li> <li>B) How do the horizontal velocity and the acceleration of the foot vary during the various phases of a gait cycle of a running person? Illustrate.</li> <li>C) A punter kicks the football, which leaves the punter's foot with a vertical velocity of 20 m/s and a horizontal velocity of 15 m/s. For how long will the ball remain in the air? Assume that the height of the release and landing are same.</li> </ul> |

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