Reg. No.



MANIPAL INSTITUTE OF TECHNOLOGY

## III SEMESTER B.Tech. (BME) DEGREE MAKE-UP EXAMINATIONS DEC/JAN 2017-18 SUBJECT: BIOMECHANICS (BME 2104) (REVISED CREDIT SYSTEM) Tuesday, 2<sup>nd</sup> January 2018: 9 to 12 noon

## **TIME: 3 HOURS**

## MAX. MARKS: 100

## Instructions to Candidates:

Answer all the questions.
Draw labeled diagram wherever necessary.

1.	(a)	Describe in detail about the Fahraeus-lindquist effect.	06
	(b)	Explain the relationship between blood pressure and blood flow in the vascular tree.	06
	(c)	Explain the rheological properties of blood.	06
	(d)	The modulus of elasticity for a prosthetic material is 20 GPa. A 3 cm long sample of this material is circular in cross-section with a radius of 1 cm. This sample is stretched 3.003 cm. What tensile force was applied to the material to create this stretch?	02
2.	(a)	Illustrate the features of viscoelasticity.	06
	(b)	What is the effect of protein content of blood on the blood's viscosity?	06
	(c)	Obtain the differential equation for the Voigt model.	06
	(d)	Estimate the "wall shear stress" on the blood that is placed in a concentric cylinder viscometer. The width of gap between inner and outer cylinders is 1 mm and the radius of inner cylinder is 30 mm. The outer cylinder rotates with an angular velocity of 60 rpm.	02
3.	(a)	Explain the mechanical properties of veins.	06
	(b)	What are the various instances where the cardiovascular murmurs can be heard?	06
	(c)	Explain in detail about the airway resistance.	06

(d)	Calculate the stress on the cartilage and the change in length of cartilage, assuming	02
	that the force on the cartilage is 9875 N and that 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 Mpa.	

4.	(a)	Explain the measuring principle of a device which is used to measure the skin hardness.	06
	(b)	Write in detail about the tensile material properties of tendon & ligament.	06
	(c)	Illustrate the intrinsic parameters used for characterizing materials by the ballisometer.	06
	(d)	What are the effects of asthma and fibrosis?	02
5.	(a)	Draw the mechanical model of the musculotendinous unit and explain its components.	06
	(b)	Explain the procedure followed to stretch the gastrocnemius muscle using the "Proprioceptive Neuromuscular Facilitation" stretching routine.	06
	(c)	Explain the fracture mechanics of bone and also the types of bone fracture.	06
	(d)	The biceps brachii muscle, attached to the radius bone at a distance of 2.5 cm from the	02

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