MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
A Constituent Institution of Manipal University

I SEMESTER M.Tech. (BME) DEGREE MAKE-UP EXAMINATIONS, DEC 2017
SUBJECT: BIOMECHANICS & BIODYNAMICS (BME 5104)
(REVISED CREDIT SYSTEM)
Thursday, 28th December 2017: 9 AM to 12 NOON

TIME: 3 HOURS   **MAX. MARKS: 100**

Instructions to Candidates:
1. **Answer all the questions.**
2. **Draw labeled diagram wherever necessary.**

1.	(a)	Provide two examples each for one and two degrees of freedom in the joints of human body.	02
	(b)	Differentiate parallel muscle fiber arrangement from penniform muscle fiber arrangement.	04
	(c)	Write about the four-task model used to qualitatively analyze human movement?	06
	(d)	Explain all the movements possible at the hip joint.	08
2.	(a)	What is the angular acceleration of 1.7 kg forearm and hand when the forearm flexors are attached 3 cm from the elbow joint, produce 10 N of tensile force at 90° position of the elbow joint, having the radius of gyration of 20 cm?	02
	(b)	Explain how angular momentum of human movement can be calculated.	04
	(c)	What are the functions performed by the skeletal muscle?	06
	(d)	Explain in detail about the skeletal muscle tissue properties.	08
3.	(a)	Calculate the height of the center of mass above its starting height during a squat jump based on the following information: body weight = 670 N, total vertical force = 788 N and the time of force application = 0.9 sec.	02

(b) 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? — 04

(c) With an example, briefly explain about force couple. — 06

(d) Write the formulae to calculate the lower extremity joint angles? Also mention the joint angles in the case of walking and running. — 08

4. (a) Define parallel axis theorem. — 02

(b) Calculate the center of mass of the thigh segment, if the center of mass is 42.8% of the length of the thigh measured from proximal end along the long axis of the segment. The location of hip and knee joints are (846.6 mm, 833.2 mm) and (861.4 mm, 464.3 mm) respectively. — 04

(c) Write about the internal and external work done which is associated with the biomechanics of human movement. — 06

(d) Explain the timing parameters of gait. — 08

5. (a) When holding a large quantity of inspired air in lungs, a person weighing 22 kg has a body volume of 0.025 m^3. Can the person float in fresh water? With the given body volume, how much can the person weigh and still be able to float? — 02

(b) How is lift force generated in case of air-foil or wing-shaped objects? — 04

(c) What are the factors influencing the lift force? — 06

(d) Explain the effects of drag force in case of long jump, running, cycling and downhill speed skiing. — 08