

**Birla Institute of Technology & Science, Pilani**  
Introduction to Sports Engineering, ME F340  
Mid-Semester test, Sem –I, 2022-23, November 2022

**CLOSEDBOOK**

**Weightage: 30**

**Duration: 60 min.**

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*Answer all parts of a question in continuous sequence*  
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Q1)

- a. What are the major planes and axes system about which the human motions in sports biomechanics are analysed (show in a sketch the major planes and axes with their names).
- b. Consider a standing Jump, what is the physics behind knee bend and hand swings during standing jump explain with sketch.
- c. Can you divide the phases in a standing jump into “preparatory phase”, “Action phase” and “landing phase” and define them as un-ambiguously as possible for a successful jump?
- d. Ideally how these phases should be timed for maximum performance enhancement?
- e. Which are the planes involved in the various motions during a standing jump.
- f. What might be the dependence of ROM and effective ROM on performance enhancement for the standing jump action for an athlete?
- g. Can you identify muscles involved and to be strengthened?
- h. Can human body physique (mesotype) have any impact on standing jump performance, according to you which type(s) will be most suited and why?
- i. Suppose performance in standing jump has been identified as an early talent identification stratagem – as a sports engineer devise a system for low cost and speedy measure of standing jump performance to be administered in all primary schools within India for the 5<sup>th</sup> graders, write your answer in 5 bullet points.
- j. As a sports engineer you are asked to design one consolidated exercising device for performance enhancement of athletes in a standing jump – write down crux of the solution in 5 bullet points.

[2+2+2+2+2+2+2+2+5+5=26]

Q2. A 1 kg baseball bat has a moment of inertia around a transverse axis through its centre of gravity of  $650 \text{ kg.cm}^2$ . Find the moment of inertia of the bat about an axis through the handle of the bat if this axis is 50cm away from the centre of gravity of the bat? [4]

