ATTEMPT ALL THE QUESTIONS (100%)

1. **What do you understand by the following words?**

   i. **Biomechanics -** Biomechanics is the science of movement of a living body, including how muscles, bones, tendons, and ligaments work together to produce movement. Biomechanics is part of the larger field of kinesiology, specifically focusing on the mechanics of the movement. It is both a basic and applied science, encompassing research and practical use of its findings. This is the study of the structure, function and motion of the mechanical aspects of biological systems, at any level from whole organisms to organs, cells and cell organelles, using the methods of mechanics. Biomechanics is a branch of biophysics.

   ii. **Anthropometry –** This refers to the measurement of the human individual. It has been used for the purposes of understanding human physical variation.

   iii. **Force platforms** or **force plates –** this are measuring instruments that measure the ground reaction **forces** generated by a body standing on or moving across them, to quantify balance, gait and other parameters of biomechanics.

   iv. **Sprain – A sprain,** also known as a torn ligament, is the stretching or tearing of ligaments within a joint, often caused by an injury abruptly forcing the joint beyond its functional range of motion. Ligaments are tough, inelastic fibers made of collagen that connect two or more bones to form a joint and are important for joint stability and proprioception, which is the body's sense of limb position and movement. Sprains can occur at any joint but most commonly occur in the ankle, knee, or wrist.

   v. **Range of motion (or ROM),** is the linear or angular distance that a moving object may normally travel while properly attached to another. It is also called range of travel (or ROT), particularly when talking about mechanical devices and in mechanical engineering fields. For example, a sound volume control knob. As used in the biomedical field and by weightlifters, range of motion refers to the distance and direction a joint can move between the flexed position and the extended position.

2. **Sports biomechanics studies human motion during exercise and sports. Physics and the laws of mechanics are applied to athletic performance. Explain the following four uses for biomechanics in the sporting and exercise field:**
    i. **Equipment**: Biomechanics can be used in the design of sports equipment, clothing, shoes, and the fields and facilities where sports are played. For example, a shoe can be designed for the best performance for a middle-distance runner or a racket for the best grip.
    ii. **Individuals**: Biomechanics can be applied to individuals, analysing their movements and coaching them for more effective movement during exercise and sports movement. For example, an individual's running gait or golf swing can be filmed and recommendations made for them to change and improve it.
    iii. **Injuries**: Biomechanics can be applied to studying the causes, treatment, and prevention of sports injuries. The research can analyze the forces at work that can lead to an ankle sprain and how shoe design or the playing surface might reduce the risk of injury.
    iv. **Training**: Biomechanics can study sports techniques and training systems and develop ways to make them more efficient. This can include basic research into how hand position affects propulsion in swimming. It can propose and analyze new training techniques based on the mechanical demands of the sport, aimed at resulting in better performance.

3. **What is the difference between stress and strain?**

    Stress is defined as the force experienced by the object which causes a change in the object while a strain is defined as the change in the shape of an object when stress is applied.

    Stress is measurable and has a unit while a strain is a dimensionless quantity and has no unit.

    Stress can occur in the absence of strain whereas strain does not occur in the absence of stress.

4. **There are three main flexor muscles at the elbow as written below. Explain them**

- **Brachialis** acts exclusively as an elbow flexor and is one of the few muscles in the human body with a single function. It originates low on the anterior side of the humerus and is inserted into the tuberosity of the ulna.
- **Brachioradialis** acts essentially as an elbow flexor but also supinates during extreme pronation and pronates during extreme supination. It originates at the lateral supracondylar ridge distally on the humerus and is inserted distally on the radius at the styloid process.
- **Biceps brachii** is the main elbow flexor but, as a biarticular muscle, also plays important secondary roles as a stabilizer at the shoulder and as a supinator. It originates on the scapula with two tendons: That of the long head on the supraglenoid tubercle just above the shoulder joint and that of the short head on the coracoid process at the top of the scapula. Its main insertion is at the radial tuberosity on the radius.

5. **What do you understand by active, active assisted and passive range of motion?**

Passive Range of Motion (or **PROM**) - Therapist or equipment moves the joint through the range of motion with no effort from the patient.

Active Assisted Range of Motion (or **AAROM**) - Patient uses the muscles surrounding the joint to perform the exercise but requires some help from the therapist or equipment (such as a strap).

Active Range of Motion (or **AROM**) - Patient performs the exercise to move the joint without any assistance to the muscles surrounding the joint.

6. **State any FIVE common principles associated with biomechanics.**

i. Stability.
ii. Maximum Effort.
iii. Maximum Velocity.
iv. Impulse.
v. Reaction.
vi. Torque.
vii. Angular Momentum.