

Biomechanical Engineering Systems

Mechanical Engineering · Practice Test · 12 Questions

1. In human joint mechanics, what is the specific function of the synovial fluid within a diarthrodial joint?

- A) To facilitate bone growth
- B) To act as a non-Newtonian lubricant
- C) To provide electrical insulation for nerves
- D) To transport oxygen to cartilage

2. What is the typical Young's modulus range for healthy human cortical bone?

- A) 1-3 GPa
- B) 15-20 GPa
- C) 100-150 GPa
- D) 500-600 GPa

3. In cardiac mechanics, what is the primary purpose of the 'Frank-Starling mechanism'?

- A) To regulate blood viscosity
- B) To adjust stroke volume based on end-diastolic volume
- C) To control heart valve resonance
- D) To calibrate aortic pressure sensors

4. What mechanical property of the human Achilles tendon allows it to function as a spring during locomotion?

- A) High hysteresis
- B) High elastic modulus
- C) Viscoelasticity
- D) Low tensile strength

5. Which mechanical component of the inner ear functions as a frequency analyzer by varying its stiffness along its length?

- A) Semicircular canals
- B) The basilar membrane
- C) The malleus
- D) The stapes

6. In prosthetic socket design, what phenomenon describes the mechanical interaction where shear forces cause tissue breakdown?

- A) Fretting corrosion
- B) Interface strain
- C) Cavitation
- D) Hysteresis loss

7. The human spine functions as a column under axial load; what is the main mechanical purpose of the nucleus pulposus in the intervertebral disc?

- A) To act as a hydrostatic shock absorber
- B) To provide structural rigidity for rotation
- C) To anchor the spinal cord
- D) To conduct nerve impulses

8. What is the primary mode of failure in human hip implants made of cobalt-chromium alloys due to repetitive micro-motion?

- A) Fatigue cracking
- B) Fretting and crevice corrosion
- C) Thermal expansion
- D) Brittle fracture

9. In blood flow mechanics, what describes the tendency of red blood cells to migrate toward the center of a vessel?

- A) The Fåhræus-Lindqvist effect
- B) The Bernoulli principle
- C) Reynolds number instability
- D) The Venturi effect

10. What is the architectural efficiency of trabecular bone defined by?

- A) Anisotropy and apparent density
- B) Total volume only
- C) Hydrostatic pressure
- D) Elastic deformation rate

11. During respiration, the mechanical work of breathing is predominantly expended to overcome what?

- A) Airway resistance and elastic recoil of the lungs
- B) Blood flow turbulence
- C) Alveolar surface tension only
- D) Diaphragm muscle mass

12. In orthopedic mechanics, what is the 'Wolff's Law' primarily concerned with?

- A) Bone remodeling in response to mechanical stress
- B) Ligament elasticity
- C) Nerve conduction velocity
- D) Muscle fiber recruitment