

Advanced Mechanical Engineering Principles

Mechanical Engineering · Practice Test · 8 Questions

1. In the context of the Lamé equations for thick-walled cylinders, which stress component remains constant throughout the thickness of the wall under internal pressure?

- A) Radial stress
- B) Longitudinal stress
- C) Hoop stress
- D) Shear stress

2. What is the physical significance of the Biot number in heat transfer analysis?

- A) The ratio of convective heat transfer to conductive heat transfer within a solid
- B) The ratio of inertial forces to viscous forces
- C) The ratio of momentum diffusivity to thermal diffusivity
- D) The ratio of radiative heat flux to conductive heat flux

3. According to the Buckingham Pi theorem, what is the number of dimensionless groups required for a system with 8 variables and 3 primary dimensions?

- A) 3
- B) 4
- C) 5
- D) 8

4. In fluid mechanics, which phenomenon describes the reduction in fluid pressure that results when a fluid flows through a constricted section of a pipe?

- A) Reynolds effect
- B) Venturi effect
- C) Rayleigh effect
- D) Stokes effect

5. Which crystal system is characterized by three unequal axes intersecting at oblique angles, representing the lowest symmetry in metallurgy?

- A) Monoclinic
- B) Tetragonal
- C) Triclinic
- D) Orthorhombic

6. What is the fundamental difference between a Newtonian and a non-Newtonian fluid in terms of shear stress?

- A) Non-Newtonian fluids have a non-linear relationship between shear stress and shear rate
- B) Newtonian fluids exhibit time-dependent viscosity
- C) Non-Newtonian fluids have zero viscosity at high shear rates
- D) Newtonian fluids maintain a constant density regardless of pressure

7. In vibration analysis, what is the condition called when the forcing frequency equals the natural frequency of a system, leading to high amplitude oscillations?

- A) Damping
- B) Resonance
- C) Hysteresis
- D) Phase shift

8. Which thermodynamic law states that the entropy of a perfect crystal at absolute zero is exactly zero?

- A) First Law
- B) Second Law
- C) Third Law
- D) Zeroth Law