

Advanced Mechanical Engineering Principles

Mechanical Engineering · Answer Key · 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