

NCEES Fundamentals of Engineering (FE) Mechanical Practice Exam (Sample)

Study Guide



Everything you need from our exam experts!

Copyright © 2025 by Examzify - A Kaluba Technologies Inc. product.

ALL RIGHTS RESERVED.

No part of this book may be reproduced or transferred in any form or by any means, graphic, electronic, or mechanical, including photocopying, recording, web distribution, taping, or by any information storage retrieval system, without the written permission of the author.

Notice: Examzify makes every reasonable effort to obtain from reliable sources accurate, complete, and timely information about this product.

SAMPLE

Questions

- 1. In terms of energy, what does the first law of thermodynamics imply for an isolated system?**
 - A. Energy can be created and destroyed**
 - B. Energy is conserved**
 - C. Energy can be transformed into mass**
 - D. Energy flows freely in and out of the system**
- 2. Define specific volume in the context of thermodynamics.**
 - A. The total volume of a substance**
 - B. The volume per unit mass of a substance**
 - C. The volume occupied by gas at standard conditions**
 - D. The total mass of a substance divided by its volume**
- 3. What role does an actuator play in mechanical systems?**
 - A. It amplifies sound in a system**
 - B. It converts energy into mechanical motion**
 - C. It measures the speed of components**
 - D. It stabilizes vibrations in machinery**
- 4. What is the main purpose of using fixed cell references in spreadsheets?**
 - A. To allow variations in column or row designators**
 - B. To "fix" the column and/or row designator**
 - C. To create formulas without using variable cells**
 - D. To optimize performance of the spreadsheet**
- 5. What is the primary advantage of using structured programming?**
 - A. It allows for more complex algorithms**
 - B. It simplifies debugging and maintenance**
 - C. It requires less memory**
 - D. It increases the speed of execution**

- 6. What does ductility refer to in materials?**
- A. The ability to conduct electricity**
 - B. The capability of a material to undergo significant plastic deformation before rupture**
 - C. The measure of resistance to permanent deformation**
 - D. The maximum rate of heat transfer through a material**
- 7. What does the term "fatigue" refer to in materials science?**
- A. Weakening of a material due to static loads**
 - B. Failure caused by heat treatment processes**
 - C. Weakening due to repeatedly applied loads or stress**
 - D. Permanent deformation from overloading**
- 8. What does the impact test primarily measure?**
- A. Hardness**
 - B. Yield strength**
 - C. Toughness**
 - D. Creep strength**
- 9. In what scenario would laminar flow typically occur?**
- A. In high-viscosity fluids at high velocities**
 - B. In low-viscosity fluids at low velocities**
 - C. In any fluid regardless of the viscosity**
 - D. In fluids with high temperature gradients**
- 10. What best describes a control volume in fluid mechanics?**
- A. A defined region through which no fluid flows**
 - B. A boundary used for energy calculations in thermodynamic cycles**
 - C. A specific area analyzed for mass and energy balances**
 - D. An abstract concept with no physical relevance**

Answers

SAMPLE

1. B
2. B
3. B
4. B
5. B
6. B
7. C
8. C
9. B
10. C

SAMPLE

Explanations

SAMPLE

1. In terms of energy, what does the first law of thermodynamics imply for an isolated system?

- A. Energy can be created and destroyed**
- B. Energy is conserved**
- C. Energy can be transformed into mass**
- D. Energy flows freely in and out of the system**

The first law of thermodynamics states that energy cannot be created or destroyed in an isolated system; it can only be transformed from one form to another. This principle is fundamentally about the conservation of energy, which means that the total energy within an isolated system remains constant over time. In practical terms, for an isolated system, any energy that is converted from one form (like kinetic energy to thermal energy) must equal the energy that is taken from or added to the system. This concept is crucial in understanding various thermodynamic processes, such as heat transfer and work done by or on the system. The notion that energy is conserved is a core principle in thermodynamics and underlies many calculations in engineering, physics, and other scientific fields. Understanding this law is key to analyzing energy interactions in any thermodynamic system, making it an essential concept for engineers.

2. Define specific volume in the context of thermodynamics.

- A. The total volume of a substance**
- B. The volume per unit mass of a substance**
- C. The volume occupied by gas at standard conditions**
- D. The total mass of a substance divided by its volume**

Specific volume is defined as the volume per unit mass of a substance. This measurement is important in thermodynamics as it helps characterize the behavior of substances under various conditions, especially in processes involving gases and fluids. Specific volume is an extensive property; it varies with temperature and pressure, and is expressed in units such as cubic meters per kilogram (m^3/kg). Understanding specific volume is crucial for applications in thermodynamic cycles, refrigeration, and gas laws, as it helps engineers calculate mass flow rates, analyze energy efficiency, and design systems that involve fluid movement and heat transfer. When assessing different states of a substance, specific volume provides insight into the density and behavior of the material in question, allowing for better predictions of behavior under changing conditions. The other options presented do not accurately capture the definition of specific volume. The total volume of a substance refers to its overall space occupied without consideration for mass. The volume occupied by gas at standard conditions is a specific scenario that does not define specific volume in all contexts. Finally, the total mass of a substance divided by its volume yields density, which is the reciprocal of specific volume, thus highlighting the importance of recognizing these different but related concepts in thermodynamics.

3. What role does an actuator play in mechanical systems?

- A. It amplifies sound in a system
- B. It converts energy into mechanical motion**
- C. It measures the speed of components
- D. It stabilizes vibrations in machinery

An actuator plays a critical role in mechanical systems by converting energy into mechanical motion. This process is essential in a wide range of applications, from industrial machines to consumer devices. Actuators are responsible for moving or controlling mechanisms or systems by transforming various forms of energy—such as electrical, hydraulic, or pneumatic—into physical movement. For instance, in an electric actuator, electrical energy is converted into linear or rotational motion, enabling the movement of components like valves, jaws, or robotic arms. The function of actuators is integral in automation, where precise control is required for tasks such as opening and closing valves in a fluid control system or positioning a part in a robotic assembly line. The effectiveness and responsiveness of an actuator can significantly impact the overall performance and efficiency of the mechanical system in which it operates. Understanding the role of actuators is crucial for engineers when designing and implementing various mechanical systems.

4. What is the main purpose of using fixed cell references in spreadsheets?

- A. To allow variations in column or row designators
- B. To "fix" the column and/or row designator**
- C. To create formulas without using variable cells
- D. To optimize performance of the spreadsheet

Using fixed cell references in spreadsheets serves the main purpose of "fixing" the column and/or row designators. When a cell reference is fixed, it remains constant, no matter where the formula is copied or moved within the spreadsheet. This is particularly useful when you want to refer to a specific cell that contains a constant value, such as a tax rate or a reference figure, without having it change when you drag the formula across other cells. For example, if you have a formula that multiplies a variable amount by a constant value located in a fixed cell, using a fixed reference ensures that the constant value is always taken from that specific cell, leading to accurate calculations across the spreadsheet. Fixed references typically use the dollar sign (\$) to denote them, such as \$A\$1, which indicates that neither the row nor the column will change when copying the formula. In contrast, the other options do not capture the essence of what fixed cell references achieve. Variations in column or row designators, creating formulas without variable cells, and optimizing spreadsheet performance do not relate directly to the purpose of fixing references, which focuses on maintaining specific cell links regardless of formula adjustments.

5. What is the primary advantage of using structured programming?

- A. It allows for more complex algorithms**
- B. It simplifies debugging and maintenance**
- C. It requires less memory**
- D. It increases the speed of execution**

The primary advantage of structured programming lies in its ability to simplify debugging and maintenance. Structured programming emphasizes the use of clear, well-defined structures such as sequences, selections (if/else), and iterations (loops), which leads to code that is easier to read and understand. This clarity helps developers quickly identify errors and inconsistencies within the code. When the code structure is straightforward, it becomes less complicated to modify or enhance the code later, which is a crucial aspect of software development. A well-structured program allows for easier tracking of program flow and logical organization, making it more manageable to troubleshoot issues and make updates without inadvertently affecting other parts of the program. While complex algorithms, memory efficiency, and execution speed can be important considerations in programming, they are not the primary benefits associated with structured programming. The focus of structured programming is more on fostering a disciplined coding approach that enhances code maintainability and reliability.

6. What does ductility refer to in materials?

- A. The ability to conduct electricity**
- B. The capability of a material to undergo significant plastic deformation before rupture**
- C. The measure of resistance to permanent deformation**
- D. The maximum rate of heat transfer through a material**

Ductility in materials refers specifically to the capability of a material to undergo significant plastic deformation before rupture. This property is especially important in engineering and material selection, as ductile materials can absorb energy and deform without breaking, making them safer and more reliable in structural applications. When a ductile material is subjected to stress, it can stretch or elongate considerably, which allows them to withstand loads without failing catastrophically. This attribute is critical in various applications, such as in metals used for construction or in components that should not fail suddenly under load. Being able to deform allows for mechanisms such as yielding and redistribution of stress, which can prevent sudden failures and provide visual cues of impending failure through permanent deformation, giving engineers and users time to mitigate hazards. The other options refer to different properties that do not accurately define ductility. For instance, the ability to conduct electricity relates to electrical conductivity, resistance to permanent deformation pertains to hardness or stiffness, and the maximum rate of heat transfer is related to thermal conductivity. These distinctions highlight how ductility specifically concerns mechanical behavior under stress and strain, emphasizing its significance in material science and engineering principles.

7. What does the term "fatigue" refer to in materials science?

- A. Weakening of a material due to static loads**
- B. Failure caused by heat treatment processes**
- C. Weakening due to repeatedly applied loads or stress**
- D. Permanent deformation from overloading**

In materials science, "fatigue" specifically refers to the process of weakening that occurs in a material due to the application of cyclic or repetitive loads over time. This can lead to the development of microscopic cracks in the material, which may eventually grow and cause failure even if the applied stress is less than the material's ultimate tensile strength. Fatigue can be influenced by various factors including the magnitude of the load, the number of cycles, the material properties, and the environment in which the material is operating. Understanding fatigue is crucial for engineers when designing components that will encounter fluctuating loads, such as in automotive, aerospace, and structural applications, where safety and reliability are paramount. This concept highlights the importance of not only the maximum stress that a material can withstand, but also how that material behaves under conditions that involve repeated loading over time.

8. What does the impact test primarily measure?

- A. Hardness**
- B. Yield strength**
- C. Toughness**
- D. Creep strength**

The impact test is primarily designed to measure toughness, which is the ability of a material to absorb energy and deform plastically before fracturing. Toughness is a critical property that indicates how well a material can withstand sudden impacts or shocks without breaking. During the impact test, a standardized specimen is struck by a hammer or pendulum, and the amount of energy absorbed by the specimen during the fracture is measured. This energy absorption capacity is directly related to the material's toughness and provides insight into its performance in real-world applications where sudden loads may occur. In practice, toughness is especially important for materials used in construction, machinery, and structural applications, where unexpected impacts can lead to catastrophic failures if a material is brittle or has low toughness. The test thus serves to inform engineers about the suitability of materials for specific applications where resilience to impact is a concern. Other options, such as hardness, yield strength, and creep strength, are related to different material properties and are measured using different types of tests. Hardness measures a material's resistance to deformation, yield strength defines the point at which a material begins to deform plastically, and creep strength assesses a material's ability to sustain loads at elevated temperatures over time. While these properties are also important, they do

9. In what scenario would laminar flow typically occur?

- A. In high-viscosity fluids at high velocities**
- B. In low-viscosity fluids at low velocities**
- C. In any fluid regardless of the viscosity**
- D. In fluids with high temperature gradients**

Laminar flow typically occurs in scenarios characterized by low velocities and low-viscosity fluids. In this type of flow, fluid moves in parallel layers with minimal mixing between them. This orderly motion contrasts with turbulent flow, where the flow moves chaotically, usually at higher velocities. When the viscosity of a fluid is low, it encounters less resistance to movement, facilitating smooth layers of flow. Low velocity further ensures that the inertial forces, which can disrupt the smooth layers in a fluid, remain low compared to the viscous forces. Together, these factors help maintain the organized structure of laminar flow. The other scenarios describe conditions that are not conducive to laminar flow. High-viscosity fluids operating at high velocities, for instance, are more likely to develop turbulent behavior due to increased inertial effects. Similarly, high temperature gradients can lead to significant changes in viscosity and density, affecting the stability of flow regimes. Thus, the specified conditions of low viscosity and low velocity create the ideal environment for laminar flow to occur.

10. What best describes a control volume in fluid mechanics?

- A. A defined region through which no fluid flows**
- B. A boundary used for energy calculations in thermodynamic cycles**
- C. A specific area analyzed for mass and energy balances**
- D. An abstract concept with no physical relevance**

A control volume in fluid mechanics is best described as a specific area analyzed for mass and energy balances. This concept involves defining a physical boundary in space, allowing engineers to systematically study the behavior of fluids entering and exiting that region. By applying the principles of conservation of mass and energy, one can assess how fluids interact within this volume, which is crucial for understanding fluid dynamics and designing systems such as pumps, turbines, and heat exchangers. Within this control volume, one can perform detailed analyses, accounting for flows in and out, changes in pressure and temperature, and other relevant properties. This is essential for solving practical engineering problems, providing a structured approach to evaluate the performance of fluid systems. The other options do not accurately capture the function and importance of a control volume. A defined region through which no fluid flows suggests a static system, which is not appropriate for the dynamic analysis typically necessary in fluid mechanics. A boundary used for energy calculations is only a part of the control volume concept and does not encompass the analysis of mass balances. Finally, describing it as an abstract concept with no physical relevance undermines the practical application of control volumes in real-world engineering scenarios.