GERTC Principles of Surveying, Analysis, and Design (PSAD) Practice Exam (Sample)

Study Guide

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Questions

1. What does rigidity of a structure refer to in relation to deflection?

A. Reciprocal of Flexibility

B. Reciprocal of Stiffness

C. Reciprocal of Strength

D. Reciprocal of Load

2. In surveying design, what does a "sectional view" illustrate?

A. A view of a 3D model of land

B. A view of a slice through an object or land surface

C. A top-down view of the land

D. A detailed perspective of the surrounding area

3. What property describes a material's ability to regain its original shape after deformation?

A. Elasticity

B. Toughness

C. Malleability

D. Stiffness

4. What is the primary reason for conducting field surveys?

A. To gather environmental data

B. To collect primary data for analysis

C. To monitor wildlife

D. To establish land ownership

5. What indicates a diaphragm discontinuity irregularity?

A. A uniform stiffness throughout the diaphragm

B. Changes in effective diaphragm stiffness of more than 50%

C. Discontinuities that are less than 50%

D. All diaphragms are continuous

6. Define "control points" in the context of surveying.

- **A. Temporary markers for construction sites**
- **B. Fixed points of known geometric coordinates used as reference points**
- **C. Points used for planning survey boundaries**
- **D. Locations of significant geographic features**

7. Which of the following describes diaphragm irregularity?

- **A. A diaphragm with continuous stiffness**
- **B. A diaphragm that does not experience any load variation**
- **C. A diaphragm having abrupt discontinuities or stiffness variations**
- **D. A diaphragm with less than 50% gross area openings**

8. Which equipment would be best for establishing a horizontal plane in surveying?

- **A. GPS Receiver**
- **B. Dumpy Level**
- **C. Total Station**
- **D. Electronic Distance Measuring Device**

9. What determines the type of azimuth used in a surveying project?

- **A. The type of terrain being surveyed**
- **B. The reference plane or point of measurement**
- **C. The tools available for measurement**
- **D. The weather conditions during the survey**

10. Which concept refers to the ability of a structure to deform under load and return to its original shape?

- **A. Elasticity**
- **B. Ductility**
- **C. Flexibility**
- **D. Rigidity**

Answers

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

Explanations

1. What does rigidity of a structure refer to in relation to deflection?

A. Reciprocal of Flexibility

B. Reciprocal of Stiffness

C. Reciprocal of Strength

D. Reciprocal of Load

Rigidity of a structure refers to its resistance to deformation under an applied load, specifically focusing on how much it deflects when subjected to stress. In this context, rigidity is directly related to stiffness, which quantifies how much a structure deforms under load. The concept of rigidity being the reciprocal of stiffness means that as a structure becomes stiffer, its rigidity increases, leading to less deflection for a given load. Stiffness is defined as the ratio of the applied load to the resulting deflection; therefore, higher stiffness corresponds to lower deflection. Understanding rigidity as the reciprocal of stiffness captures this relationship succinctly: a more rigid structure exhibits lower deflection for the same applied forces, which is a critical factor in designing structural systems to ensure they can support intended loads without enduring significant deformations that could compromise their integrity or functionality.

2. In surveying design, what does a "sectional view" illustrate?

A. A view of a 3D model of land

B. A view of a slice through an object or land surface

C. A top-down view of the land

D. A detailed perspective of the surrounding area

A sectional view illustrates a slice through an object or land surface, allowing for an understanding of the internal features and relationships within that space. This type of representation is particularly important in surveying and design as it provides critical information about layers in the soil, utilities, or structural components that may not be visible from just a top-down or exterior view. By visualizing how different elements are arranged vertically, professionals can make better-informed decisions during the planning and analysis phases of a project, addressing factors such as drainage, foundation support, and other subsurface considerations that are crucial for effective design and construction. The other views mentioned do not convey this unique perspective. A 3D model may provide a comprehensive view but lacks the depth of information concerning internal configurations that a sectional view offers. A top-down view focuses on the layout of features on the surface without providing insights into the vertical relationships or hidden elements beneath. Lastly, a detailed perspective of the surrounding area may highlight context and environment but will not necessarily disclose internal details that the sectional view does, such as variations in ground or structural materials at different depths.

3. What property describes a material's ability to regain its original shape after deformation?

A. Elasticity

B. Toughness

C. Malleability

D. Stiffness

The property that describes a material's ability to regain its original shape after deformation is elasticity. Elasticity refers to the capacity of a material to undergo deformation under stress and return to its original dimensions once the stress is removed. This characteristic is fundamental in materials science and engineering, as it determines how materials respond to forces and how they can be used in structural applications. When a material exhibits elastic behavior, it means that it can absorb energy when deformed and release that energy when returning to its initial shape. This property is essential for applications where materials must endure repeated loading and unloading without permanent deformation. In contrast, toughness refers to a material's ability to absorb energy and plastically deform without fracturing, while malleability describes a material's capacity to deform under compressive stress, often resulting in a change in shape without breaking. Stiffness relates to a material's resistance to elastic deformation when a force is applied. These properties serve different purposes in material selection and engineering design but do not specifically relate to the ability to regain shape after being deformed, which is why elasticity is the correct answer.

4. What is the primary reason for conducting field surveys?

A. To gather environmental data

B. To collect primary data for analysis

C. To monitor wildlife

D. To establish land ownership

The primary reason for conducting field surveys is to collect primary data for analysis. This involves obtaining direct measurements and observations from the environment or specific sites, which can then be used to inform various types of projects or research. The data collected is crucial for making accurate assessments and decisions in fields such as construction, land use planning, environmental science, and many others. Primary data collected through surveys is typically more reliable and up-to-date than secondary data, allowing for a more precise understanding of the conditions being studied. While gathering environmental data and monitoring wildlife can certainly be components of field surveys, these activities often serve specific purposes within a broader context of various assessments. Establishing land ownership is also important but is typically a legal aspect rather than the fundamental goal of a survey. Thus, the collection of primary data for analysis remains the central aim of field surveys in the context of surveying principles and practices.

5. What indicates a diaphragm discontinuity irregularity?

A. A uniform stiffness throughout the diaphragm

B. Changes in effective diaphragm stiffness of more than 50%

C. Discontinuities that are less than 50%

D. All diaphragms are continuous

A diaphragm discontinuity irregularity is indicated by changes in the effective diaphragm stiffness of more than 50%. This substantial variation signifies that the diaphragm's structural capacity to resist lateral forces is compromised and may lead to uneven load distribution or potential failure under lateral loads, such as those experienced during an earthquake. Uniform stiffness throughout a diaphragm would suggest a well-designed and consistent structural behavior, which is desirable for stability. Similarly, discontinuities that are less than 50% do not typically signify critical irregularities, as they might not significantly affect the performance of the diaphragm. The option stating that all diaphragms are continuous does not take into account the varying conditions and configurations encountered in real-world applications, as some diaphragms can indeed have discontinuities that affect their structural integrity. Thus, the choice that highlights a significant change in effective stiffness directly points to potential weaknesses in that diaphragm.

6. Define "control points" in the context of surveying.

A. Temporary markers for construction sites

B. Fixed points of known geometric coordinates used as reference points

C. Points used for planning survey boundaries

D. Locations of significant geographic features

"Control points" in the context of surveying refer to fixed points of known geometric coordinates that serve as reference points for the surveying process. These points are crucial for establishing a reliable framework for all measurements taken in a survey. They are typically determined through precise geodetic surveys and can be used to ensure that all additional points surveyed are accurate and consistent. Control points provide a basis for both horizontal and vertical control, allowing surveyors to maintain uniformity across a range of measurements and projects. When other surveys are conducted, these established control points help in correlating data, ensuring that any new measurements can be integrated correctly into existing spatial data systems. While other options refer to different elements of surveying or construction, they do not capture the fundamental essence of what control points represent. Temporary markers primarily serve short-term purposes, planning survey boundaries refers more to administrative aspects, and significant geographic features may have their own relevance but do not serve the same functional role in providing a mathematical basis for surveying work as control points do.

7. Which of the following describes diaphragm irregularity?

A. A diaphragm with continuous stiffness

B. A diaphragm that does not experience any load variation

C. A diaphragm having abrupt discontinuities or stiffness variations

D. A diaphragm with less than 50% gross area openings

Diaphragm irregularity refers to a structural condition in which there are notable variations in the stiffness of the diaphragm or where abrupt discontinuities are present. This means that the diaphragm is not uniform in its capacity to resist lateral loads due to changes in stiffness, which can arise from different materials, thicknesses, or connected elements. In structural engineering, especially in the context of seismic design, irregularities in diaphragm behavior can lead to unequal distribution of forces during events like earthquakes. A diaphragm with abrupt discontinuities may not perform effectively, as it could allow for excessive deformations or lead to undesirable stress concentrations. Understanding diaphragm irregularity is crucial for ensuring stability and integrity in designs. The other options do not accurately describe diaphragm irregularity. A diaphragm with continuous stiffness indicates a uniform distribution of forces, which is the opposite of irregularity. A diaphragm that does not experience any load variation suggests a constant loading scenario, again contrasting with the concept of irregularity, which is characterized by changes in behavior under load. Lastly, a diaphragm with less than 50% gross area openings does not specifically define irregularity, as it could still have a uniform stiffness distribution. Therefore, identifying abrupt discontinuities or stiffness variations is key to understanding diaphragm irregularity.

8. Which equipment would be best for establishing a horizontal plane in surveying?

A. GPS Receiver

B. Dumpy Level

C. Total Station

D. Electronic Distance Measuring Device

The dumpy level is specifically designed for establishing a horizontal plane in surveying. Its function is to ensure that the line of sight remains level, providing an accurate reference for measuring elevations and making horizontal measurements across a terrain. The dumpy level consists of a telescope mounted on a tripod, which can be adjusted to the desired height and oriented horizontally. Surveyors use it to align the instrument and obtain level readings on stakes or other reference points, thereby ensuring precise and reliable results in various surveying tasks. While other equipment such as a total station and electronic distance measuring devices can assist in gathering data and mapping, their primary functions are more complex and not solely focused on establishing a horizontal plane. The GPS receiver is excellent for determining positions and coordinates over a large area but does not inherently establish a horizontal reference in the manner that a dumpy level does. Thus, the dumpy level stands out as the most suitable tool for the specific purpose of creating a horizontal plane in surveying contexts.

9. What determines the type of azimuth used in a surveying project?

A. The type of terrain being surveyed

B. The reference plane or point of measurement

C. The tools available for measurement

D. The weather conditions during the survey

The type of azimuth used in a surveying project is primarily determined by the reference plane or point of measurement. In surveying, an azimuth is an angular measurement that specifies direction in a horizontal plane, typically expressed in degrees. Standard reference points such as magnetic north or true north can influence the azimuth calculation. When establishing the azimuth, surveyors use established coordinate systems or reference points as a foundation. For example, if true north is taken as the reference, the azimuth measured would be relative to true north, whereas if magnetic north is used, the azimuth will vary based on the magnetic declination at that location. The other factors, while they can influence the surveying process or accuracy, do not determine the type of azimuth itself. Terrain might affect visibility or the method of measurement, available tools could impact precision or convenience, and weather conditions might influence the operational conditions, but they do not change the fundamental reference from which azimuths are defined and measured.

10. Which concept refers to the ability of a structure to deform under load and return to its original shape?

A. Elasticity

B. Ductility

C. Flexibility

D. Rigidity

The concept that refers to the ability of a structure to deform under load and return to its original shape is elasticity. This property is fundamental in materials science and structural engineering, as it determines how materials behave when subjected to various forces and loads. When a material is elastic, it means that it can stretch or compress when a load is applied, but once that load is removed, it will revert to its original dimensions without permanent deformation. Understanding elasticity is crucial for engineers and designers when creating structures, as they must account for how materials will react under stress to ensure stability and safety. Structures that exhibit good elasticity can absorb and dissipate energy from forces such as wind, earthquake loads, or other dynamic forces, which contributes to their durability and longevity. In contrast, ductility refers to the ability of a material to undergo significant plastic deformation before rupture, while flexibility is more about how easily a structure can bend rather than its ability to return to its original shape. Rigidity is the opposite of elasticity; it refers to a material's resistance to deformation. Hence, elasticity is the correct concept here as it directly addresses the ability to return to the original form post-deformation.