GENERAL

pe civil sample questions and solutions

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Introduction

Becoming a licensed professional engineer (PE) is a milestone that opens doors to advanced career opportunities, higher salaries, and the ability to sign off on critical projects. For civil engineers, the PE Civil exam is the gateway to that professional status. While many candidates focus on studying theory, they often overlook the power of practice questions and detailed solutions. **PE civil sample questions and solutions** provide a realistic preview of the exam's format, help identify knowledge gaps, and build confidence through repeated exposure to problem solving scenarios.

In this comprehensive guide, we'll walk you through the exam's structure, highlight the most common content areas, and present a curated collection of sample questions with step by step solutions. We'll also share proven study strategies, resource recommendations, and tips for turning practice into performance. Whether you're a first time test taker or a seasoned engineer looking to refresh your skills, this article will equip you with the tools you need to excel.

Understanding the PE Civil Exam

Exam Format and Timing

The PE Civil exam is a 4 hour, multiple choice test consisting of 80 questions. The questions are divided into two 2 hour sessions, each containing 40 questions. Candidates must answer all questions within the allotted time, and there is no penalty for guessing. The exam covers a broad range of civil engineering topics, so a well balanced study plan is essential.

Key Content Areas

The exam is divided into five main content areas, each weighted differently:

- Structural Design (30%) – Includes analysis and design of beams, columns, slabs, and foundations.
- Transportation (20%) – Covers traffic flow, geometric design, and pavement analysis.
- Water Resources (15%) – Focuses on hydraulics, hydrology, and flood control.
- Construction Management (15%) – Includes cost estimation, scheduling, and contract law.
- Geotechnical (10%) – Deals with soil mechanics, foundation design, and slope stability.
- Environmental (10%) – Covers water quality, solid waste, and environmental regulations.

While the weighting can vary slightly from state to state, these categories represent the core knowledge base that all candidates must master.

Why Sample Questions Matter

Real World Context

Unlike textbook problems, PE exam questions are designed to mimic the real challenges engineers face on the job. They often incorporate multiple concepts, require quick calculations, and demand concise, correct answers. By working through **PE civil sample questions and solutions**, you'll learn how to translate theoretical knowledge into practical problem solving.

Identifying Weaknesses

Practice questions expose gaps in your understanding before the actual exam. When you encounter a question you can’t solve, you know precisely which topic needs more review. This targeted approach saves time and improves overall performance.

Building Test Day Confidence

Familiarity with the exam’s structure and question style reduces anxiety. Repeated exposure to timed practice tests helps you manage pacing, develop effective guessing strategies, and maintain focus under pressure.

Sample Questions With Detailed Solutions

Below, we provide a representative set of questions from each content area. Each question is followed by a comprehensive solution that explains the reasoning and calculations step by step.

Structural Design Sample

Solution:

1. **Compute maximum bending moment (Mmax):**For a simply supported beam with a UDL, \\(M_{\\text{max}} = \\frac{wL^2}{8}\\).

\\(w = 20\\ \\text{kN/m} = 20,000\\ \\text{N/m}\\), \\(L = 12\\ \\text{m}\\).

\\(M_{\\text{max}} = \\frac{20,000 \\times 12^2}{8} = \\frac{20,000 \\times 144}{8} = \\frac{2,880,000}{8} = 360,000\\ \\text{N·m}\\).

2. **Relate bending stress to section modulus:**\\(\\sigma = \\frac{M}{Z}\\). We require \\(\\sigma \\leq 250\\ \\text{MPa} = 250 \\times 10^6\\ \\text{Pa}\\).

3. **Solve for Z:** \\(Z = \\frac{M}{\\sigma} = \\frac{360,000\\ \\text{N·m}}{250 \\times 10^6\\ \\text{Pa}}\\).

Convert N·m to N·mm: \\(360,000\\ \\text{N·m} = 360,000,000\\ \\text{N·mm}\\).

Thus, \\(Z = \\frac{360,000,000}{250 \\times 10^6} = \\frac{360,000,000}{250,000,000} = 1.44\\ \\text{m}^3\\) (or \\(1,440\\ \\text{cm}^3\\)).

Therefore, the beam must have a minimum section modulus of 1.44 /m³ to stay below yield.

Transportation Sample

Solution:

1. **Compute design life:**The AASHTO method relates design life (L) to the annual traffic volume (V) and intensity factor (IF) by \\(L = \\frac{V_{\\text{ref}}}{V \\times IF}\\), where \\(V_{\\text{ref}}\\) is a reference volume (commonly 10,000 /vph). However, for simplicity, we use the simplified formula \\(L = \\frac{10,000}{V \\times IF}\\).

Given \\(V = 25,000\\) and \\(IF = 0.5\\).

\\(L = \\frac{10,000}{25,000 \\times 0.5} = \\frac{10,000}{12,500} = 0.8\\ \\text{years}\\).

This result indicates that with the current traffic intensity, the pavement would not last the desired 20 years. Therefore, to achieve a 20 year life, the design must either reduce traffic volume, increase pavement thickness, or use more durable materials.

In practice, engineers would adjust the design parameters or use a more detailed fatigue analysis to meet the target life.

Water Resources Sample

Solution:

1. **Compute cross sectional area (A):**\\(A = b \\times d = 6 \\times 2 = 12\\ \\text{m}^2\\).

2. **Compute wetted perimeter (P):** For a rectangular channel, \\(P = b + 2d = 6 + 2 \\times 2 = 10\\ \\text{m}\\).

3. **Compute hydraulic radius (R):** \\(R = \\frac{A}{P} = \\frac{12}{10} = 1.2\\ \\text{m}\\).

4. **Apply Manning's equation:** \\(Q = \\frac{1}{n} A R^{2/3} S^{1/2}\\). Assume a slope \\(S = 0.001\\) (typical value).

Compute \\(R^{2/3}\\): \\(1.2^{2/3} \\approx 1.2^{0.6667} \\approx 1.12\\).

Compute \\(S^{1/2}\\): \\(\\sqrt{0.001} \\approx 0.0316\\).

Now, \\(Q = \\frac{1}{0.025} \\times 12 \\times 1.12 \\times 0.0316\\).

\\(\\frac{1}{0.025} = 40\\).

Thus, \\(Q = 40 \\times 12 \\times 1.12 \\times 0.0316 \\approx 40 \\times 12 \\times 0.0354 \\approx 40 \\times 0.4248 \\approx 16.99\\ \\text{m}^3/\\text{s}\\).

Therefore, the discharge is approximately 17 /m³/s.

Construction Management Sample

Solution:

1. **Compute contingency:** 10% of $3,500,000 = $350,000.

2. **Compute subtotal:** $3,500,000 + $350,000 = $3,850,000.

3. **Compute profit:** 5% of $3,850,000 = $192,500.

4. **Compute total bid:** $3,850,000 + $192,500 = $4,042,500.

Thus, the contractor should submit a bid of $4,042,500.

Geotechnical Sample

Solution:

1. **Compute footing area (A):** \\(A = 4 \\times 4 = 16\\ \\text{m}^2\\).

2. **Compute allowable bearing pressure:**Typically, a factor of safety (FS) of 3 is used. Allowable pressure = \\(\ \frac{q_{\\text{ult}}}{FS} = \\frac{250}{3} \\approx 83.33\\ \\text{kPa}\\).

3. **Compute maximum allowable load:** \\(P_{\\text{allow}}

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