GENERAL

pe exam control systems sample questions

Published: September 3, 2026 | Index ID: #-

Introduction

For engineers aspiring to become licensed professionals, the **PE exam** is a pivotal milestone. Among its many subject areas, the **control systems** discipline often presents a challenging mix of theory, analysis, and practical application. While the exam covers a broad spectrum—from classical control theory to modern digital techniques—one of the most effective ways to prepare is to work through **sample questions**that mirror the real test environment. In this article, we dive deep into why sample questions matter, what types of problems you'll encounter, and how to tackle them with confidence.

What Is the PE Exam?

The **PE exam**is a two day, multiple choice test administered by the National Council of Examiners for Engineering and Surveying (NCEES). Engineers must pass this exam to earn the title of Professional Engineer (PE), which unlocks new career opportunities and demonstrates a commitment to ethical practice and public safety. The exam is divided into a morning session covering general engineering topics and an afternoon session focused on a chosen discipline, such as Mechanical, Electrical, or Control Systems.

Control Systems in the PE Exam

Control systems are integral to modern engineering: from HVAC units to autonomous vehicles, from robotics to process industries. The PE exam's control systems section tests your ability to:

- Model physical processes using differential equations or transfer functions.
- Analyze system stability, transient response, and frequency characteristics.
- Design controllers—PID, lead lag, state space, or digital—to meet specified performance criteria.
- Apply system identification techniques to real world data.
- Understand the nuances of digital versus analog control, including sampling, quantization, and computational constraints.

Because the exam emphasizes practical problem solving, sample questions are indispensable for building the intuition needed to navigate real test items.

Why Sample Questions Are Essential

Here's why working through **PE exam control systems sample questions**should be a cornerstone of your study plan:

1. Familiarity with Format – The PE exam follows a strict structure: multiple-choice items with time constraints. Sample questions help you acclimate to the pacing and question style.
2. Identification of Core Concepts – Repeated exposure to similar question themes highlights the most frequently tested topics.
3. Skill Reinforcement – Practicing calculations and reasoning solidifies your grasp of control theory.
4. Confidence Building – Knowing what to expect reduces anxiety and improves performance on exam day.
5. Targeted Review – By analyzing mistakes, you can pinpoint weak areas and adjust your study focus

accordingly.

Types of Control Systems Questions

Linear Control Systems

Linear questions typically involve transfer functions, Bode plots, Nyquist criteria, or root locus analysis. You may be asked to determine system stability, calculate settling time, or design a compensator to achieve a specific phase margin.

Nonlinear Control Systems

These items explore concepts such as linearization, Lyapunov stability, or feedback linearization. You might need to analyze the behavior of a pendulum or a chemical reactor near an operating point.

Digital Control Systems

Digital control questions assess your understanding of discrete time systems, Z transforms, sampling theory, and the effects of quantization. Common tasks include designing a digital PID controller or converting an analog controller to a digital implementation.

System Identification

Here, you'll be presented with data sets or time domain responses and asked to deduce a system's model—often a transfer function or state space representation—using techniques like least squares or frequency domain fitting.

Stability Analysis

These problems test your ability to apply Routh–Hurwitz, Nyquist, or Lyapunov methods to determine whether a system will remain bounded under various conditions.

Control Design

Design questions require you to create controllers that satisfy performance specifications such as overshoot, rise time, bandwidth, or disturbance rejection. You may need to choose between PID, lead lag, or state feedback strategies.

Sample Questions

Linear Control Systems Sample

1. Consider a unity feedback system with the open loop transfer function G(s) = 10/(s(s+5)). What is the system's steady state error for a unit step input?
2. Given the transfer function G(s) = (s+2)/(s^2+3s+2), sketch the root locus and determine the range of proportional gain K that yields a stable closed loop system.

Nonlinear Control Systems Sample

1. A robotic arm's dynamics are described by ;ƒ + 0.5;ƒ + 2;, Ò Rà Linearize the system about the equilibrium point ;, Ò 0, ;ƒ = 0. What is the resulting linear state space model?
2. For the system x0r Ò …ã" Ò RÂ &÷ ÷6R `eedback control law u = kx that stabilizes the origin. Determine the range of k that ensures local asymptotic stability.

Digital Control Systems Sample

1. Sample a continuous time system with Ts = 0.1 s. The continuous transfer function is G(s) = 1/(s+1). Derive the equivalent discrete time transfer function using zero order hold.
2. A digital controller uses the difference equation y[n] = 0.8y[n-1] + 0.2x[n]. What is the system's steady state

gain for a unit step input?

System Identification Sample

1. Given the impulse response data: h[0] = 0.5, h[1] = 0.3, h[2] = 0.2, estimate the first order transfer function H(z) = K/(1 - a z-1) using least squares fitting.
2. From a step response curve that reaches 90% of final value in 5 seconds, estimate the dominant pole of the system assuming a first order behavior.

Stability Analysis Sample

1. Apply the Routh–Hurwitz criterion to the characteristic equation s^3 + 6s^2 + 11s + 6 = 0. Determine if the system is stable.
2. For the system with transfer function G(s) = (s+1)/(s^2 + 2s + 5), use the Nyquist plot to assess stability when a proportional gain K = 2 is applied.

Control Design Sample

1. Design a PID controller for a plant G(s) = 1/(s(s+1)) to achieve a settling time of less than 2 seconds and an overshoot of less than 5% for a step input.
2. Using state feedback, design a controller that places the closed loop poles at -5 ± j3 for the system ‹ = Ax + Bu, where A = [[0, 1], [-2, -3]] and B = [[0], [1]].

How to Approach Sample Questions

Reading the Question

Begin by carefully reading the problem statement. Identify the type of system (continuous, discrete, linear, nonlinear) and the specific objective—be it stability, performance, or modeling.

Identifying Key Concepts

Mark any keywords: “steady state error,” “root locus,” “Nyquist,” “zero order hold,” “least squares,” “Lyapunov.” These clues point directly to the theory you need to apply.

Calculations

When solving, write down the governing equations step by step. For transfer function problems, start by simplifying the expression. For state space questions, write the matrices explicitly. Keep your algebra tidy to avoid mistakes.

Common Pitfalls

- Misinterpreting the sign of a pole or zero.
- Ignoring the effect of sampling time in digital control.
- Assuming linearity where the system is inherently nonlinear.
- Overlooking units or dimensional consistency.

Tips for Mastering Control Systems

Study Resources

Leverage a mix of textbooks (e.g., “Feedback Control of Dynamic Systems” by Franklin, Powell, and Emami Jolai) and online courses that offer interactive simulations.

Practice Exams

Regularly complete full-length practice exams. Time yourself exactly as on test day and review every answer, even the correct ones, to reinforce learning.

Time Management

Allocate roughly 30–45 seconds per question during the afternoon session. If a problem seems too time consuming, skip it and return later if time permits.

Collaboration

Join study groups or forums where you can discuss challenging items. Explaining concepts to peers solidifies your own understanding.

Conclusion

Mastering the **control systems** portion of the **PE exam** hinges on a deep grasp of theory, hands on practice, and strategic preparation. By engaging with a wide array of **sample questions**, you not only sharpen your analytical skills but also build the confidence needed to tackle the exam's real challenges. Keep reviewing, keep practicing, and soon you'll find that the once daunting control systems section becomes a familiar landscape you can navigate with precision and poise.

Baca Juga (Artikel Terkait)

- **advanced engineering electromagnetics solution manual edition hardcover by balanis constantine a published by wiley**
  URL: http://www.denniswildberger.com/advanced-engineering-electromagnetics-solution-manual-edition-hardcover-by-balanis-constantine-a-published-by-wiley.pdf
- **advanced engineering electromagnetics solutions manual**
  URL: http://www.denniswildberger.com/advanced-engineering-electromagnetics-solutions-manual.pdf
- **advanced engineering electromagnetics wiley 1989 grading**
  URL: http://www.denniswildberger.com/advanced-engineering-electromagnetics-wiley-1989-grading.pdf
- **advanced engineering fluid mechanics by biswas**
  URL: http://www.denniswildberger.com/advanced-engineering-fluid-mechanics-by-biswas.pdf

Tags: #exam #control #systems #sample #questions