

Analog Digital Practice Test (Sample)

Study Guide



Everything you need from our exam experts!

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Introduction

Preparing for a certification exam can feel overwhelming, but with the right tools, it becomes an opportunity to build confidence, sharpen your skills, and move one step closer to your goals. At Examzify, we believe that effective exam preparation isn't just about memorization, it's about understanding the material, identifying knowledge gaps, and building the test-taking strategies that lead to success.

This guide was designed to help you do exactly that.

Whether you're preparing for a licensing exam, professional certification, or entry-level qualification, this book offers structured practice to reinforce key concepts. You'll find a wide range of multiple-choice questions, each followed by clear explanations to help you understand not just the right answer, but why it's correct.

The content in this guide is based on real-world exam objectives and aligned with the types of questions and topics commonly found on official tests. It's ideal for learners who want to:

- Practice answering questions under realistic conditions,
- Improve accuracy and speed,
- Review explanations to strengthen weak areas, and
- Approach the exam with greater confidence.

We recommend using this book not as a stand-alone study tool, but alongside other resources like flashcards, textbooks, or hands-on training. For best results, we recommend working through each question, reflecting on the explanation provided, and revisiting the topics that challenge you most.

Remember: successful test preparation isn't about getting every question right the first time, it's about learning from your mistakes and improving over time. Stay focused, trust the process, and know that every page you turn brings you closer to success.

Let's begin.

How to Use This Guide

This guide is designed to help you study more effectively and approach your exam with confidence. Whether you're reviewing for the first time or doing a final refresh, here's how to get the most out of your Examzify study guide:

1. Start with a Diagnostic Review

Skim through the questions to get a sense of what you know and what you need to focus on. Your goal is to identify knowledge gaps early.

2. Study in Short, Focused Sessions

Break your study time into manageable blocks (e.g. 30 - 45 minutes). Review a handful of questions, reflect on the explanations.

3. Learn from the Explanations

After answering a question, always read the explanation, even if you got it right. It reinforces key points, corrects misunderstandings, and teaches subtle distinctions between similar answers.

4. Track Your Progress

Use bookmarks or notes (if reading digitally) to mark difficult questions. Revisit these regularly and track improvements over time.

5. Simulate the Real Exam

Once you're comfortable, try taking a full set of questions without pausing. Set a timer and simulate test-day conditions to build confidence and time management skills.

6. Repeat and Review

Don't just study once, repetition builds retention. Re-attempt questions after a few days and revisit explanations to reinforce learning. Pair this guide with other Examzify tools like flashcards, and digital practice tests to strengthen your preparation across formats.

There's no single right way to study, but consistent, thoughtful effort always wins. Use this guide flexibly, adapt the tips above to fit your pace and learning style. You've got this!

Questions

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1. **What term describes the long-term behavior of a circuit once transient effects have died out?**
 - A. **Transient Behavior**
 - B. **Steady-State Behavior**
 - C. **Equilibrium Response**
 - D. **Final Condition**

2. **Variations of voltage or current over time are referred to as which of the following?**
 - A. **Voltage**
 - B. **Current**
 - C. **Waveforms**
 - D. **Signals**

3. **Compare SAR, flash, and sigma-delta ADC architectures in terms of speed, resolution, and typical use.**
 - A. **SAR: moderate speed/resolution, power-efficient; Flash: very fast, high power, lower resolution per diode; Sigma-Delta: high resolution, lower speed, oversampling.**
 - B. **SAR: fastest; Flash: highest resolution; Sigma-Delta: lowest power.**
 - C. **SAR: low speed; Flash: high power; Sigma-Delta: high speed.**
 - D. **All have identical performance.**

4. **Define the term 'effective number of bits' (ENOB) in ADC performance, and how it relates to SNR.**
 - A. **$ENOB = (SNR - 1.76)/6.02$; $SNR = 6.02 \cdot ENOB + 1.76$.**
 - B. **$ENOB = SNR / 6.02$; $SNR = ENOB * 6.02$.**
 - C. **$ENOB = \sqrt{SNR}$; $SNR = ENOB^2 * 6.02$.**
 - D. **ENOB is unrelated to SNR.**

5. **In a transfer function, zeros in the s-domain primarily influence which aspect of the time-domain response?**
 - A. **Zeros primarily scale the DC gain.**
 - B. **Zeros affect natural decay rates.**
 - C. **Zeros affect phase at high frequencies.**
 - D. **Zeros influence the transient shape and overshoot.**

- 6. Two-level digital representation typically enables processing of what kind of information?**
- A. Binary Information**
 - B. Analog Information**
 - C. Multilevel Information**
 - D. Continuous Information**
- 7. The mathematical tool used to describe first-order circuits.**
- A. First-Order Differential Equation**
 - B. Second-Order Differential Equation**
 - C. Algebraic Equation**
 - D. Integral Equation**
- 8. In a CE amplifier, how does emitter degeneration affect input impedance?**
- A. The input impedance remains roughly r_{π} .**
 - B. The input impedance decreases due to feedback.**
 - C. The input impedance becomes purely resistive.**
 - D. The input impedance increases due to feedback.**
- 9. In a differential pair, what is the role of the tail current source, and how does it affect common-mode rejection ratio (CMRR)?**
- A. The tail current fixes the total differential current; a stable tail current helps CMRR by keeping common-mode changes from altering the total current.**
 - B. The tail current only biases one transistor and has no effect on CMRR.**
 - C. The tail current defines output impedance but does not affect CMRR.**
 - D. The tail current is used only for startup; CMRR decreases with stable tail current.**
- 10. In which field is time-domain stability of feedback loops a central concern?**
- A. Control Systems**
 - B. Electrical Engineering**
 - C. Computer Science**
 - D. Mechanical Engineering**

Answers

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

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Explanations

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1. What term describes the long-term behavior of a circuit once transient effects have died out?

- A. Transient Behavior**
- B. Steady-State Behavior**
- C. Equilibrium Response**
- D. Final Condition**

Steady-state behavior is what you get after all the transient effects have died out. When a circuit powers up or a switching event occurs, reactive elements like inductors and capacitors store energy, producing a transient response that typically fades away because resistive losses dissipate that energy over time. After those initial effects fade, the circuit settles into a predictable pattern determined by the input: a DC input yields steady constant voltages and currents, while an AC input produces a steady sinusoidal response with fixed amplitude and phase relative to the input. This ongoing, repeatable behavior is what engineers mean by steady-state. Transients describe that short-term, changing response before settling; Final Condition and Equilibrium Response aren't standard terms used to describe this long-run behavior in circuit analysis, even though the idea of a settled state is similar.

2. Variations of voltage or current over time are referred to as which of the following?

- A. Voltage**
- B. Current**
- C. Waveforms**
- D. Signals**

When voltage or current changes over time, the pattern it follows is called a waveform. A waveform describes the shape of that variation as time progresses—whether it's a smooth sine wave, a sharp square wave, or a ramping triangle—capturing key characteristics like amplitude and frequency. This term is more precise than the others because it directly references how the quantity evolves over time, rather than the quantity's instantaneous value at a single moment or a broader idea like information being carried. A signal is related, since many waveforms carry information, but the explicit term for the changing pattern itself is waveform.

3. Compare SAR, flash, and sigma-delta ADC architectures in terms of speed, resolution, and typical use.

A. SAR: moderate speed/resolution, power-efficient; Flash: very fast, high power, lower resolution per diode; Sigma-Delta: high resolution, lower speed, oversampling.

B. SAR: fastest; Flash: highest resolution; Sigma-Delta: lowest power.

C. SAR: low speed; Flash: high power; Sigma-Delta: high speed.

D. All have identical performance.

Trade-offs between speed, resolution, and power drive which ADC architecture fits a given use. A SAR (successive approximation register) converts bits with a binary-search approach; the number of comparison cycles grows with the bit count, so speed is moderate and power consumption stays fairly low, making it a versatile, power-efficient choice for microcontrollers and mixed-signal front-ends. Flash ADCs use a complete ladder of comparators in parallel, so a conversion can happen in one shot and at very high speed; however, the number of comparators grows exponentially with resolution, which drives up power, area, and cost, so these are typically high-speed but power-hungry with practical resolutions limited by circuitry. Sigma-delta ADCs oversample and shape quantization noise, then filter digitally to achieve very high effective resolution, but at the cost of slower conversion rates because the oversampling and decimation filter determine the throughput. This combination explains why each description fits: moderate speed and power efficiency for SAR, very fast but high power for flash, and high resolution with lower speed for sigma-delta.

4. Define the term 'effective number of bits' (ENOB) in ADC performance, and how it relates to SNR.

A. $ENOB = (SNR - 1.76)/6.02$; $SNR = 6.02 \cdot ENOB + 1.76$.

B. $ENOB = SNR / 6.02$; $SNR = ENOB * 6.02$.

C. $ENOB = \sqrt{SNR}$; $SNR = ENOB^2 * 6.02$.

D. ENOB is unrelated to SNR.

ENOB tells you how many bits a perfect ADC would need to achieve the same signal-to-noise ratio as the real converter. For an ideal N-bit ADC with a full-scale sine input, the SNR is approximately $6.02 \cdot N + 1.76$ dB. If you know the measured SNR, you can convert to ENOB with $ENOB = (SNR - 1.76) / 6.02$, and you can also express the forward relation as $SNR = 6.02 \cdot ENOB + 1.76$. This is why the chosen formula is correct: it faithfully maps the real-world SNR to an equivalent number of bits. For example, an SNR of 90 dB corresponds to $ENOB \approx (90 - 1.76)/6.02 \approx 14.7$ bits. The other forms either omit the 1.76 dB offset or use incorrect algebra, so they don't match the standard relationship between ENOB and SNR.

5. In a transfer function, zeros in the s-domain primarily influence which aspect of the time-domain response?

- A. Zeros primarily scale the DC gain.**
- B. Zeros affect natural decay rates.**
- C. Zeros affect phase at high frequencies.**
- D. Zeros influence the transient shape and overshoot.**

Zeros in the s-domain shape how the time-domain response behaves in the short term. They come from the numerator of the transfer function and change how the different exponential terms (the effects of the poles) are weighted when you transform back to time. Because of that, zeros mainly affect the transient portion of the response—how quickly the output rises, whether it overshoots the final value, and the overall curvature as the system settles. The long-term steady-state level, on the other hand, is set by the poles (and the gain). Zeros can also shift phase, especially at higher frequencies, but the most noticeable impact in the time domain is on the transient shape and any overshoot.

6. Two-level digital representation typically enables processing of what kind of information?

- A. Binary Information**
- B. Analog Information**
- C. Multilevel Information**
- D. Continuous Information**

Two-level digital representation uses two distinct states to encode information, which naturally processes binary information. In digital hardware, signals are treated as either 0 or 1 (for example, low vs. high voltage), allowing reliable logic operations, storage, and communication. The simplicity of distinguishing two levels makes the system robust to noise and small variations, unlike analog information, which is continuous in amplitude, or multilevel/continuous information, which require more than two levels to represent and process. So the form that fits a two-level scheme is binary information.

7. The mathematical tool used to describe first-order circuits.

A. First-Order Differential Equation

B. Second-Order Differential Equation

C. Algebraic Equation

D. Integral Equation

Describing a first-order circuit requires a first-order differential equation because there is a single energy storage element (a capacitor or an inductor) whose stored energy makes the circuit's state evolve in time. The governing relationship is set by how that stored quantity changes with time and interacts with the resistive elements. Take a simple RC circuit with an input source. The capacitor voltage is the state variable, and the current through the capacitor is $i_C = C dv_C/dt$. The resistor current is $i_R = (v_{in} - v_C)/R$. Since the same current flows, $i_C = i_R$, which leads to $C dv_C/dt = (v_{in} - v_C)/R$. Rearranging gives a first-order differential equation: $dv_C/dt + (1/RC) v_C = (1/RC) v_{in}$. This equation fully describes how the circuit's voltage evolves over time in response to the input. Similarly, an RL circuit yields a first-order differential equation: $L di/dt + R i = v_{in}$, which describes how the current changes with time due to a single energy storage element (the inductor). Why not the other options? A second-order differential equation would come from having two energy storage elements (like a resistor, inductor, and capacitor combination that leads to two dynamic states). An algebraic equation describes a static, time-invariant situation with no dynamics. An integral equation isn't the standard starting point for modeling the time evolution of a basic first-order circuit, though its solutions may involve integrals; the fundamental description remains a first-order differential equation.

8. In a CE amplifier, how does emitter degeneration affect input impedance?

A. The input impedance remains roughly r_{π} .

B. The input impedance decreases due to feedback.

C. The input impedance becomes purely resistive.

D. The input impedance increases due to feedback.

Emitter degeneration raises the input impedance of a common-emitter stage through local negative feedback. When you add an unbypassed emitter resistor, the base sees not just the intrinsic base-emitter resistance r_{π} but also a voltage drop across R_e that grows with emitter current. In small-signal terms, the emitter current is about $(\beta+1)$ times the base current, so the voltage across R_e is $(\beta+1) i_b R_e$. The input voltage is $V_{in} = i_b r_{\pi} + (\beta+1) i_b R_e$, giving $Z_{in} = V_{in}/i_b = r_{\pi} + (\beta+1) R_e$. Since R_e provides additional resistance seen from the input, the impedance increases as R_e grows. This increase comes from the negative feedback: changes in base current produce emitter voltage changes that oppose the input signal, reducing transconductance and raising input impedance. In midband, with purely real components, Z_{in} is largely real, though/parasitics can introduce a small reactive part.

9. In a differential pair, what is the role of the tail current source, and how does it affect common-mode rejection ratio (CMRR)?

- A. The tail current fixes the total differential current; a stable tail current helps CMRR by keeping common-mode changes from altering the total current.**
- B. The tail current only biases one transistor and has no effect on CMRR.**
- C. The tail current defines output impedance but does not affect CMRR.**
- D. The tail current is used only for startup; CMRR decreases with stable tail current.**

In a long-tailed differential pair, the tail current source sets the total current flowing through the two transistors and provides a high-impedance path at the common node. As the input voltage difference between the two bases changes, the current is steered from one transistor to the other, but the sum of the two collector currents stays nearly constant because the tail current source fixes it. When you apply a common-mode signal (both inputs move together), this fixed total current means the outputs won't chase the common-mode change very much, so the device's response to common-mode input is small. That is why a stable tail current helps achieve better common-mode rejection: the common-mode variations don't translate into large output changes. If the tail current source isn't high impedance (not a good current source), common-mode changes can tug on the total current, causing both outputs to shift together and degrading CMRR. A robust tail current thus keeps the sum of the currents constant, suppressing the common-mode path while preserving strong differential behavior.

10. In which field is time-domain stability of feedback loops a central concern?

- A. Control Systems**
- B. Electrical Engineering**
- C. Computer Science**
- D. Mechanical Engineering**

Time-domain stability of feedback loops is a central concern in control systems because this field focuses on how a system responds over time when you feed back the output to influence the input. The key goal is to ensure the output follows a reference and remains bounded in the presence of disturbances, rather than oscillating wildly or growing without limit. Analyzing stability in the time domain looks at how quickly and smoothly the system settles, using ideas like settling time, overshoot, and damped response. While other engineering disciplines may use feedback, control systems are dedicated to designing and guaranteeing stable, well-behaved time responses of dynamic systems.

Next Steps

Congratulations on reaching the final section of this guide. You've taken a meaningful step toward passing your certification exam and advancing your career.

As you continue preparing, remember that consistent practice, review, and self-reflection are key to success. Make time to revisit difficult topics, simulate exam conditions, and track your progress along the way.

If you need help, have suggestions, or want to share feedback, we'd love to hear from you. Reach out to our team at hello@examzify.com.

Or visit your dedicated course page for more study tools and resources:

<https://analogdigital.examzify.com>

We wish you the very best on your exam journey. You've got this!

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