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About NCEES
NCEES is a nonprofit organization made up of the U.S. engineering and surveying licensing boards in all 50 states, U.S. territories, and the District of Columbia. We develop and score the exams used for engineering and surveying licensure in the United States. NCEES also promotes professional mobility through its services for licensees and its member boards.

Engineering licensure in the United States is regulated by licensing boards in each state and territory. These boards set and maintain the standards that protect the public they serve. As a result, licensing requirements and procedures vary by jurisdiction, so stay in touch with your board (ncees.org/licensing-boards).

Exam Format
The FE exam contains 110 questions and is administered year-round via computer at approved Pearson VUE test centers. A 6-hour appointment time includes a tutorial, the exam, and a break. You’ll have 5 hours and 20 minutes to complete the actual exam.

Beginning July 1, 2017, in addition to traditional multiple-choice questions with one correct answer, the FE exam will use common alternative item types such as

- Multiple correct options—allows multiple choices to be correct
- Point and click—requires examinees to click on part of a graphic to answer
- Drag and drop—requires examinees to click on and drag items to match, sort, rank, or label
- Fill in the blank—provides a space for examinees to enter a response to the question

To familiarize yourself with the format, style, and navigation of a computer-based exam, view the demo on ncees.org/ExamPrep.

Examinee Guide
The NCEES Examinee Guide is the official guide to policies and procedures for all NCEES exams. During exam registration and again on exam day, examinees must agree to abide by the conditions in the Examinee Guide, which includes the CBT Examinee Rules and Agreement. You can download the Examinee Guide at ncees.org/exams. It is your responsibility to make sure you have the current version.

Scoring and reporting
Exam results for computer-based exams are typically available 7–10 days after you take the exam. You will receive an email notification from NCEES with instructions to view your results in your MyNCEES account. All results are reported as pass or fail.

Updates on exam content and procedures
Visit us at ncees.org/exams for updates on everything exam-related, including specifications, exam-day policies, scoring, and corrections to published exam preparation materials. This is also where you will register for the exam and find additional steps you should follow in your state to be approved for the exam.
PRACTICE EXAM
35. In the resistor circuit shown below, the equivalent resistance \( R_{eq} \) (\( \Omega \)) at Terminals a-b is most nearly:

- A. 22
- B. 20
- C. 4
- D. 2

36. Refer to the figure below.

The value (k\( \Omega \)) of \( R \) needed to make \( i_1 \) equal 1.25 mA is most nearly ____________.

Answer to the nearest integer.
37. The circuit shown in Figure 1 is presented as the Norton equivalent circuit in Figure 2. The value of $R_N$ ($\Omega$) is most nearly:

- A. 50
- B. 60
- C. 100
- D. 120
38. Consider the following circuit:

![Circuit Diagram]

The Thevenin equivalent resistance (Ω) at Points A–B is most nearly:

○ A. 8
○ B. 12
○ C. 20
○ D. 26

39. Two waveforms are represented by the following equations:

\[
\begin{align*}
  i_1 &= 10 \cos (\omega t) - 7 \cos (3\omega t) - 3 \sin (5\omega t) \\
  i_2 &= 10 \sin (\omega t) + 3 \cos (3\omega t) + 7 \cos (5\omega t)
\end{align*}
\]

How do their RMS values compare?

○ A. RMS values of \(i_1(t)\) and \(i_2(t)\) are non-zero and equal.
○ B. RMS value of \(i_1(t)\) is larger than that of \(i_2(t)\).
○ C. RMS value of \(i_1(t)\) is smaller than that of \(i_2(t)\).
○ D. RMS values of \(i_1(t)\) and \(i_2(t)\) are each zero.
40. Consider the following circuit in the time domain:

![Circuit Diagram](image1)

Label the circuit below with component values that yield the equivalent circuit in the frequency (phasor) domain.

![Circuit Diagram](image2)

**Component Values**

- \(10\)
- \(j10\)
- \(-j10\)
- \(-0.1\)
- \(8.66 + j5\)
36.  If \( i_1 = 1.25 \text{ mA} \), then the total resistance \( i_1 \) can see must be \( \frac{10 \text{ V}}{1.25 \text{ mA}} = 8 \text{ k}\Omega \)

\[
4,000 + \frac{R(4,000 + 4,000)}{R + 4,000 + 4,000} = 8,000 \text{ \Omega}
\]

\[
\frac{8,000R}{8,000 + R} = 4,000 \text{ \Omega}
\]

\[
8,000R = 4,000R + 32 \text{ M}\Omega
\]

\[
R = 32 \text{ M}\Omega /4 \text{ k}\Omega
\]

\[
= 8 \text{ k}\Omega
\]

**THE CORRECT ANSWER IS: 8**

37.  \( R_N \) is the total resistance seen at the load end with the voltage source set equal to zero (replaced by short circuit).

\[
R_N = 60 \text{ \Omega} + (50 \text{ \Omega} \text{ in parallel with } 200 \text{ \Omega})
\]

\[
R_N = 60 + 40 = 100 \text{ \Omega}
\]

**THE CORRECT ANSWER IS: C**

38.  With the 12-V source zeroed (short), \( R_{Th} = 8 + 12 \parallel 6 = 8 + 4 = 12 \text{ \Omega} \)

Alternate Solution:

\[
R_{eq} = \frac{V_{oc}}{I_{sc}}
\]

\[
V_{oc} = 12 \left( \frac{12}{6 + 12} \right) = 8
\]

\[
I_{sc} = \frac{12}{6 + \left( \frac{8 \cdot 12}{8 + 12} \right)} \left( \frac{12}{8 + 12} \right) = 0.666
\]

\[
R_{eq} = \frac{8}{0.666} = 12 \text{ \Omega}
\]

**THE CORRECT ANSWER IS: B**
39. Refer to Effective or RMS Values in the Electrical and Computer section of the FE Reference Handbook.

\[ X_{\text{rms}} = \sqrt{X_{\text{dc}}^2 + \sum_{n=1}^{\infty} X_n^2} \]

for \( i_1 \) \( X_{\text{rms}} = \sqrt{0^2 + \left( \frac{10}{\sqrt{2}} \right)^2 + \left( \frac{-7}{\sqrt{2}} \right)^2 + \left( \frac{-3}{\sqrt{2}} \right)^2} = 8.89 \)

for \( i_2 \) \( X_{\text{rms}} = \sqrt{0^2 + \left( \frac{10}{\sqrt{2}} \right)^2 + \left( \frac{3}{\sqrt{2}} \right)^2 + \left( \frac{7}{\sqrt{2}} \right)^2} = 8.89 \)

Thus both waveforms have the same rms value.

THE CORRECT ANSWER IS: A
40. Refer to the Electrical and Computer Engineering Section of the *FE Reference Handbook*.

Time domain:

\[
\begin{align*}
10 \cos (50t + 30^\circ) \ V & \quad 2 \text{ mF} \\
& \quad 10 \Omega
\end{align*}
\]

From the sinusoidal source, \( \omega = 50 \text{ rad/sec} \)

\[
Z_C = \frac{1}{j\omega C} = -j \frac{1}{50(0.002)} = -j10 \ \Omega
\]

\[Z_R = R = 10 \ \Omega\]

\[V_S = V_M \angle \phi = 10 \angle 30^\circ \ V\]

\[
\therefore \text{ in Frequency (Phasor) domain}
\]

\[
\begin{align*}
8.66 + j5 \ V & \quad -j10 \text{ mF} \\
& \quad 10 \Omega
\end{align*}
\]

THE CORRECT ANSWER IS SHOWN ABOVE.