Second Edition

Principles and Practice of Engineering

Architectural Engineering Sample Questions and Solutions



Edited by Mark McAfee



PRINCIPLES AND PRACTICE OF ENGINEERING

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SECOND EDITION

SPONSORED BY

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News and Updates On www.aeinstitute.org

For news and updates about the Architectural Engineering Institute, including errata for this publication, visit the AEI Web site at **www.aeinstitute.org**.

News and Updates On www.ncees.org

For news and updates about the examinations—including current exam specifications standards, exam policies, calculators approved for use during the examination, exam-day policies, scoring, and other information, visit the NCEES Web site at **www.ncees.org**.

NCEES—The Exam Developer

The Council:

- was established to assist and support its member licensing boards, which are located in each of the states as well as in the District of Columbia, Guam, Puerto Rico, and the Virgin Islands.
- develops the examinations required of candidates for licensure as professional engineers. These examinations measure a candidate's ability to demonstrate minimum competency in the practice of engineering and are administered by each NCEES member licensing board.
- follows the guidelines established in the Standards for Educational and Psychological Testing published by the American Psychological Association. These procedures maximize the fairness and quality of the examinations. To ensure that the procedures are followed, NCEES uses experienced testing specialists who have the expertise to guide the development of examinations using current testing techniques.
- relies on committees composed of professional engineers from throughout the nation to prepare the examinations. These licensed engineers—who come from diverse professional backgrounds including government, industry, private consulting, and academia—supply the content expertise that is essential in developing examinations.

Licensing Requirements

Licensure protects the public because it requires candidates to demonstrate certain qualifications before being allowed to practice as an engineering professional.

Eligibility

While examinations offer one means of measuring professional competency, most licensing boards also screen candidates based on education and experience. Because these requirements vary by state, we recommend that candidates contact the appropriate board. Board addresses and telephone numbers are listed on the NCEES Web site.

Application Procedures and Deadlines

Exam application procedures are available from the individual boards. Requirements and fees vary among the boards. Applicants are responsible for contacting their board office. Sufficient time must be allotted to complete the application process and assemble required data.

Description of Examinations

Exam Schedule

The Principles and Practice of Engineering (PE) examination in architectural engineering is offered once each year. The NCEES Web site lists exam dates for the next 10 years. You should contact your board for specific locations of exam sites.

Exam Content

The PE Architectural Engineering exam is an 8-hour, no-choice examination consisting of 80 multiple-choice questions. The examination is administered in two 4-hour sessions, each containing 40 questions.

Because there is no penalty for marking incorrect responses, candidates are advised to answer each question on the examination. Only one response should be marked for each question. No credit is given where two or more responses are marked.

This book presents a complete sample examination. Correct responses require reasoning and calculation demonstrating competent engineering judgment. Because they illustrate the general content covered in the examination, these questions should be helpful in preparing for the examination. Solutions are presented for all questions in this book, although the solution presented may not be the only way to solve a particular question. The intent is to demonstrate the typical effort required to solve each question. No representation is made or intended as to future exam questions, content, or subject matter.

Exam Development and Specifications

To be a valid measure of professional engineering competency, the PE examination must test knowledge pertaining to the specific tasks performed by professional engineers. NCEES ensures this by conducting regular surveys of licensed practitioners. The information gathered from these surveys:

- directs the exam development process
- is used to develop the exam content outline that is presented in the next section of this book
- determines the percentage of questions devoted to each subject area in the exam content outline.

Scoring Procedure

One of the most critical considerations in developing and administering examinations is establishing passing scores that reflect a standard of minimum competency. NCEES defines minimum competency as

the minimum level of knowledge and skills a person must demonstrate in order to practice engineering and be in responsible charge in a manner that protects the health, safety, and welfare of the public.

Before setting a minimum passing score for a new exam or for the first exam after a change in the specifications or standards, NCEES conducts studies involving a representative panel of engineers familiar with the examinee population. This panel uses procedures widely recognized and accepted for occupational licensing purposes and develops a written standard of minimum competency that clearly articulates what skills and knowledge are required of licensed engineers. Panelists then take the examination, evaluating the difficulty level of each question in the context of the minimum competency standard. Finally, NCEES reviews the panel's work and sets the passing score for the initial exam. For subsequent exams, an equating method is used to set the passing score. The passing (raw) score is never disclosed.

NCEES does not use a fixed-percentage pass rate. The key issue is whether an individual candidate is competent to practice, **not** whether the candidate is better or worse than other candidates. To avoid the confusion that might arise from fluctuations in the passing score, exam results are reported simply as *pass* or *fail*. Some licensing jurisdictions may choose to report exam results of failing candidates as a scaled score.

The legal authority for making licensure decisions rests with the individual licensing boards and not with NCEES.

Exam Policies and Procedures

A breach of an examination could lead to the licensure of people who are not competent to practice engineering. This puts the health, safety, and welfare of the public at risk. Therefore, NCEES takes measures necessary to protect the integrity of the exam process. This includes, for example, restricting cell phones, certain calculators, pencils, loose sheets of paper, and recording devices; controlling access into and out of the exam site; and monitoring activity in and around the exam room. Violating exam policies could result in such measures as dismissal from the exam, cancellation of exam results, and, in some cases, criminal action.

Be sure that you understand the policies outlined in the Candidate Agreement, and read all instructions from your board or testing service before exam day so that you know exactly what the expectations for examinees are.