



# FE Review Course Manual

A Companion to the  
*FE Review Manual*, Third Edition

**Student Handouts**



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### FE REVIEW COURSE MANUAL: Student Handouts

#### Third Edition

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PPI  
1250 Fifth Avenue, Belmont, CA 94002  
(650) 593-9119  
[www.ppi2pass.com](http://www.ppi2pass.com)

# Table of Contents

Preface and Acknowledgments .....	4
Introduction .....	5
Review Materials .....	5
Review Course Objectives .....	5
Lectures .....	7
Homework .....	7
Study Materials.....	8
Additional Suggestions.....	8
Syllabus .....	9
Lesson I: Introduction.....	I-1
Lesson 1: Math 1 .....	1-1
Lesson 2: Math 2 .....	2-1
Lesson 3: Math 3 .....	3-1
Lesson 4: Engineering Economics .....	4-1
Lesson 5: Biology.....	5-1
Lesson 6: Chemistry.....	6-1
Lesson 7: Statics.....	7-1
Lesson 8: Dynamics .....	8-1
Lesson 9: Fluid Mechanics.....	9-1
Lesson 10: Thermodynamics .....	10-1
Lesson 11: Heat Transfer .....	11-1
Lesson 12: Material Properties/Science .....	12-1
Lesson 13: Mechanics of Materials.....	13-1
Lesson 14: Direct Current Electricity.....	14-1
Lesson 15: Alternating Current Electricity .....	15-1
Lesson 16: Electronics .....	16-1
Lesson 17: Computers.....	17-1
Lesson 18: Ethics .....	18-1

## Preface and Acknowledgments

Over the years, we at PPI have heard from hundreds of instructors and students of Fundamentals of Engineering (FE, or EIT) exam review courses. Many of them have told us how helpful the *FE Review Manual* (FERM) has been to them in planning and delivering their lessons and in studying for the exam. These individuals have also traded teaching and studying tips with us and given us valuable suggestions on how we could make FERM and its companion products more useful to them in their classes.

Now we've taken what we've learned over the years and put together the *FE Review Course Manual*. We developed these materials to give students still more help in getting the most out of their review course. The 18 lessons in this manual are derived from the *FE Review Manual* and are focused on those aspects of engineering that are most important for the FE morning and afternoon "other disciplines" exams, concentrating on the morning breadth and afternoon general exams. The *FE Review Course Manual: Student Handouts* allows student to focus on the review course lesson and minimizes notes taking during class time.

We would like to thank Gregg C. Wagener, PE, who was an integral part of the development and content generation for the original *FE Review Instructor's Manual* (FEIM), the source of much of the material used here. Thanks also to James Monroe, PE, for sharing with us the wisdom and advice incorporated into the introduction; Dennis Dahlquist, PE, for his input during the initial phases of the project; Roland Huit, PE, for his technical review and beta test of the material; Phyllis Mak, who helped us interpret the contents of the *FE Review Instructor's Manual* into this new format; Michael R. Lindeburg, PE, for authoring and maintaining FERM and its companion products throughout their various editions; and all the contributors, technical reviewers, and alert readers who have helped us keep improving FERM throughout the years.

On the PPI staff, the *FE Review Course Manual* benefited from the hard work of Sarah Hubbard (director of product development and implementation), Cathy Schrott (director of production), Megan Synnestvedt (editorial project manager), Jenny King (editorial project manager), Tyler Hayes (copy editor), Scott Marley (copy editor), Tom Bergstrom (illustrator), and Kate Hayes (typesetter). This manual would not have been possible without their perseverance.

We're not done making this among the most useful tools you have for preparing for the FE exam. We welcome your feedback and appreciate being notified of any error you find. Please submit your comments and changes through our online form at [www.ppi2pass.com/errata](http://www.ppi2pass.com/errata).

# Introduction

The *FE Review Course Manual* presents a comprehensive review of the material covered by the Fundamentals of Engineering (FE) morning breadth exam and the afternoon “other disciplines” exam specifications. This review is just as appropriate for college seniors and recent graduates as it is for seasoned engineers.

The Student Handouts contain a brief introduction, reproductions of all the slides for each lesson, and space to take notes.

These 18 lessons provide the framework for class lectures and often point to where in the *FE Review Manual* you can find more detailed information on the material. Other sources cited throughout the Visual Aids include *1001 Solved Engineering Fundamentals Problems* (EFPRB), *Core Engineering Concepts for Students and Professionals* (CORE), and *FE Review Instructor's Manual* (FEIM). The slides give the highlights of the material in each lesson, but do not list everything that will be covered during the lectures. Space is included for taking additional notes.

Each lesson is from one to five hours long, with each hour including approximately ninety minutes of instruction time and ten minutes of administrative and break time.

The subjects in the *FE Review Course Manual* are ordered in a logical, progressive way. The lessons are themselves grouped into topic blocks that contain related material. (These blocks may be presented in a different order in some courses.)

The most coverage in the lectures is given to those subjects most likely to be tested on the exam. The coverage of some subjects is necessarily brief, while other subjects are not covered at all. These omissions are intentional.

## Review Materials

The *FE Review Course Manual* is designed to be used with the following review materials.

- *FE Review Manual* (FERM)
- *NCEES Fundamentals of Engineering Supplied-Reference Handbook*

You should bring both books to each lecture. The *NCEES Fundamentals of Engineering Supplied-Reference Handbook* (aka NCEES Handbook) is available as a free download at [www.ncees.org](http://www.ncees.org).

For additional study and review prior to the exam, you may want a copy of *1001 Solved Engineering Fundamentals Problems*, and obtain access to additional practice problems and sample exams through PPI's online Exam Cafe product ([www.ppi2pass.com/examcafe](http://www.ppi2pass.com/examcafe)). If you are considering taking one of the afternoon discipline-specific exams, PPI also has a corresponding review product for each exam. These discipline-specific review books each include more than 100 practice problems and two complete afternoon sample exams.

## Review Course Objectives

The purpose of an FE review course is simple: to give you the skills needed to approach exam problems in the most efficient way possible. This does not mean that every student will be able to solve, gracefully and confidently, every problem that appears on the exam. You should come away from the course not only with some idea of where to begin solving a problem, but also with an understanding of when to skip a problem because time is short or the problem type is unfamiliar.

You should use the problems in FERM as the basis for learning efficient solving approaches. Example problems are provided in the *FE Review Course Manual* to illustrate key points. The more problems you work, the better.

Indeed, some review courses consist almost entirely of sample problems in the exam topics, while including discussions of the concepts only as necessary. The *FE Review Course Manual* is not organized

this way. Although this approach has its advantages, it can leave students without a grasp of important concepts and unable to tackle problems that aren't quite like the ones they've studied. No course can cover every kind of problem that may appear on the exam, so it's better to focus not on problem types but on the concepts behind them.

This review course should

- **help you organize your study**

Ultimately, most of the work has to be done by you outside class time. It isn't enough to absorb material passively in class. FERM, the *FE Review Course Manual*, and the homework assignments provide a framework for study and the accountability that will help you prepare for the exam.

- **remind you of what you know**

Most of the material should not be new to you. But you may not have dealt with certain topics for some time, or in your present employment. The review and homework assignments are meant to bring the concepts into recent memory, so you can rapidly respond to exam problems.

- **help you know what *not* to do**

In the FE exam, time management is everything. One of the most useful things you can learn is how to identify which problems you shouldn't waste your time on. It's important not to spend a long time working on problems in your weak subject areas when you could be earning points in your strong subject areas. You should just guess and move on.

- **give you the feedback that you can't get from a book**

In studying for the FE exam, discussion runs a close second to problem solving in importance. In a class you can ask questions and interact with other students. Although most instructors discourage conversation during class, you should make time to connect with other students. If this is done during class time, just be sure to keep your voice down and your conversation on the subject matter being presented.

By corollary, an FE review course will NOT

- attempt a comprehensive presentation of the material in a particular lecture topic
- dissect practice problems or discuss specifics that have little likelihood of appearing on the FE exam
- bring real-life problems or topics into the classroom
- present remedial topics
- focus on minutia

Your chances of passing the FE exam are most directly tied to the time you spend solving problems. The time you spend reading or listening to lectures is far less important.

## Lectures

Review course students often (and incorrectly) expect a lecture in the style of a university engineering course. The *FE Review Course Manual* is the basis of a fast-paced training course, not a comprehensive presentation of the material, and it assumes a certain level of background knowledge and expertise. The instructor will not perform mathematical derivations, will not justify underlying theory, and will not explain how things are done in practice. Rather, the instructor will explain how the FE exam treats the material, how the FE exam applies the material to exam problems, and the ways in which the scope of the FE exam is narrower than that found in either practice or academics.

The content of lectures will be balanced between presentation of theory and application to exam-like problems. It is important to grasp the theory because it will enable you to apply the knowledge to a broad range of problems. You should not rely on seeing practice problems during your review that are the same

types as those you will see on the FE exam. Rather, your goal should be to learn how to apply the theory in a variety of situations is the objective.

The FE exam covers material that is both qualitative and computational. If you are to pass, you will need both computational skills and knowledge of the principles involved in calculations.

Lectures cover the basics of each topic and little more. The lectures emphasize breadth over depth—and then trust you will pursue the topics more deeply on your own if you need to or want to. This means that your instructors need to trust that you have developed, over your college and/or professional careers, the level of analytical sophistication required to study technical material beyond what is presented in lecture.

## Homework

Homework is the backbone of the review course. It develops the skills you need in order to succeed on the FE exam. All other activities relating to the course should be subordinate to completing your homework assignments, which consist of practice problems.

The diagnostic problems assigned for each lesson should be solved prior to class. These can be used as a tool to assess strengths and weaknesses. Be sure to review the sections of the *FE Review Manual* (FERM) for the subjects you are weak in. Preparation for each lesson also includes completing homework problems from FERM. The NCEES Handbook should be the only reference used in solving homework problems.

Your instructor will outline the policy for submitting and grading homework assignments. This will include how to submit your work (hard copy or electronically), when assignments are due, and if they will be returned. Most instructors will not return assignments, so keep a copy yourself. Though you should check your own work against the published solutions, your instructor may be able to address individual questions to homework problems, if you submit them early enough.

Homework should be completed prior to the lesson, or lecture, it pertains to. The recommended instructions to students relating to homework is, first, to briefly (five minutes) review the Review Course Student Handouts relating to the lesson; then to briefly (five minutes again) review the relevant chapters in FERM; and only then to read and diagnose the first assigned practice problem using only the NCEES Handbook as a solution aid. If a solution is not evident, then you should review the Student Handouts, lecture notes, and FERM for clues to how to approach the problem. At this point you may have an idea as to how to proceed or may recognize that the problem should be skipped.

Because many students benefit from a realistic sample exam, the sample exam included in FERM is a required part of the course. Use it near the end of the course to practice the skills and techniques you have learned and to check your understanding of the material.

## Study Materials

The FE exam is a supplied-reference exam. You will receive a copy of the NCEES Handbook when you enter the exam room. You will not be allowed to bring your own copy into the exam. The NCEES Handbook will be the only reference you may use during the FE exam. You should become familiar with the contents and format of the NCEES Handbook before the FE exam and should use it as your only reference when solving homework problems or taking the sample exam.

## Additional Suggestions

- Get involved, ask questions, and speak up when you don't follow the lecture. There are no stupid questions.
- Your instructor works on the assumption that silence means everyone understands. It is your responsibility to let the instructor know when you don't understand.
- The Student Handouts are meant to be complete enough so that you do not have to write furiously throughout lectures in order to keep up, but not so complete that you do not have to pay attention to attend lecture at all. Taking notes helps most students remember the material—do not underestimate the connection between the brain and the hand. Add to and personalize the Student Handouts during lecture and throughout your study.

- Writing the solutions to sample problems is one of the most useful things you can do to remember concepts. Do not erase mistakes, just cross them out. Your solutions will then become valuable learning tools when you review them and see what errors you made and how you could have avoided or corrected them.
- Good luck on the exam! But remember: Luck is worth maybe plus 10 points if it's good and maybe minus 10 points if it's bad. With the FE exam, as with life, luck is no substitute for preparation.
- Contact your instructor (via email) and PPI (through the web comments form at **[www.ppi2pass.com/mycomments](http://www.ppi2pass.com/mycomments)**) after the exam and relate their experience, especially about those questions that were particularly difficult to understand or solve. We're always interested in hearing your feedback.



# Syllabus

Required Texts:

- *FE Review Manual*, 3<sup>rd</sup> edition (FERM)
- *NCEES Fundamentals of Engineering Supplied-Reference Handbook*

lesson number	lesson topic	diagnostic exam problems	FERM chapter	sample problems	FE-style problems
I	Introduction	NA	How to Use This Book	NA	NA
1	Math 1	DE III: 1, 2, 3, 10	Chapter 4	1–5	1–7
			Chapter 5	2	1, 2, 10–13, 24–28
2	Math 2	DE III: 4–8	Chapter 5	1, 3, 4, 5, 6	3–9, 14–23, 29–32
			Chapter 6	1–3	1–21
3	Math 3	DE III: 9, 11, 12, 13, 14, 15	Chapter 7	1–5	1–25
			Chapter 8	1–3	1–20
			Chapter 9	NA	1
4	Engineering Economics	DE XV: 1–15	Chapter 51	1–6	1–20
			Chapter 52	1–5	1–18
			Chapter 53	1–6	1–14
5	Biology	DE X: 1–15	Chapter 33	1, 2	1–9
			Chapter 34	1, 2	1–6
			Chapter 35	1, 2	1–5
			Chapter 36	1, 2	1–6
6	Chemistry	DE XI: 1–15	Chapter 37	1–5	1–24
			Chapter 38	1–9	1–15
			Chapter 39	1–5	1–14
7	Statics	DE IV: 1–15	Chapter 10	1–5	1–23
			Chapter 11	1–4	1–10
			Chapter 12	1–5	1–12
			Chapter 13	1–6	1–18
8	Dynamics	DE V: 1–15	Chapter 14	1–6	1–16
			Chapter 15	1–7	1–14
			Chapter 16	1–5	1–17
			Chapter 17	1–7	1–17
9	Fluid Mechanics	DE VII: 1–15	Chapter 22	1–2	1–11
			Chapter 23	1–7	1–10
			Chapter 24	1–5	1–27
			Chapter 25	1–4	1–22

lesson number	lesson topic	diagnostic exam problems	FERM chapter	sample problems	FE-style problems
10	Thermodynamics	DE VIII: 1–15	Chapter 26	1–5	1–22
			Chapter 27	1–5	1–19
			Chapter 28	1–5	1–27
			Chapter 29	1–6	1–14
			Chapter 30	1–2	1–3
11	Heat Transfer		Chapter 31	1–2	1–13
12	Material Science	DE XII: 1–15	Chapter 40	1–3	1–8
			Chapter 41	1–3	1–11
			Chapter 42	1–3	1–18
13	Mechanics/ Strength of Materials	DE VI: 1–15	Chapter 18	1–5	1–18
			Chapter 19	1–4	1–18
			Chapter 20	1–5	1–15
			Chapter 21	1–2	1–10
14a	Electricity and Magnetism	DE XIII: 1–8	Chapter 43	1–3	1–5
14b	Direct Current Electricity		Chapter 44	1–7	1–32
15	Alternating Current Electricity	DE XIII: 9–14	Chapter 45	1–5	1–17
16	Electronics	DE XIII: 15	Chapter 46	4	2–5
17	Computers	DE XIV: 1–8	Chapter 48	4	4–19, 27
18	Ethics	DE XVI: 1–15	Chapter 54	1–11	1–31
I	Introduction	NA	How to Use This Book	NA	NA

FERM Sample Exam: Work all problems

Homework problems are to be completed prior to class. The NCEES Handbook should be the only reference used in completing homework assignments. FERM should be reviewed for problems that were solved incorrectly.