

Creative Problem Solving and Engineering Design

Edward Lumsdaine, Monika Lumsdaine, J. William Shelnutt

lumsdain@mtu.edu or lumsdaine@chartermi.net

McGraw-Hill, © 1999; ISBN 0-07-236058-5; softcover, 480 pages

This book incorporates a strong focus on innovative thinking, teamwork, and communications in engineering design. It responds to the needs of industry for engineers who have these foundational skills and to the ABET Criteria 2000 which require that students are able to work on multidisciplinary teams and understand the global context of engineering. It includes many guidelines, practical examples, and hands-on activities, so that students not only learn the theoretical knowledge but are able to apply it in concurrent engineering and innovation in the workplace. The book can be used for a broad range of courses and applications:

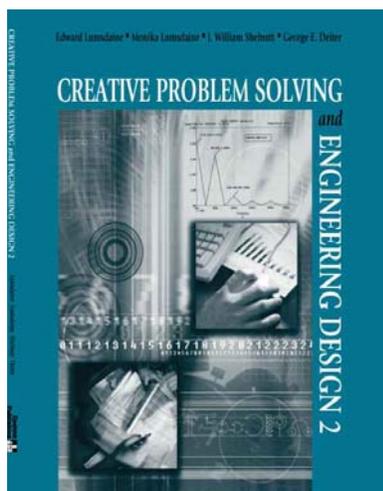
- First-year courses such as “Introduction to the Engineering Profession” to begin developing the skills that will form the foundation for everything that follows;
- Creative problem-solving courses for sophomore or junior level engineering students or for multidisciplinary and multi-level project teams (such as design competition projects);
- Senior capstone design courses in all engineering and technology disciplines, either taught on-campus or via distance learning. A typical syllabus is shown on the back of this flyer, with content using the extended version referenced below.
- As a valuable resource for engineers just starting to work in environments where teamwork is emphasized or where rapid technological change is occurring.

With this book, students are provided with detailed instructions, examples, and formats for preparing a complete dossier of design documentation. This not only guides their decision making as they progress through their team design projects but assures that they meet the stakeholder requirements and stay on track. The teams are encouraged to develop optimum solutions as well as a final report that they can present with pride to their project sponsors and future employers.

Benefits and Resources for Design Faculty

Faculty members can concentrate on teaching the twelve steps to “quality by design”—the process helps to prevent dysfunctional teams or substandard written and oral presentations. Also,

1. PowerPoint slides are available upon request for most chapters; contact lumsdaine@chartermi.net.
2. The course text can be customized by combining part or all of *Creative Problem Solving and Engineering Design* with material from other authors or the instructor’s class notes—see example below.
3. For other products, workshops, and ordering information, see www.InnovationToday.biz.



Creative Problem Solving and Engineering Design 2

Edward Lumsdaine, Monika Lumsdaine, J. William Shelnutt,
and George E. Dieter

McGraw-Hill, 2005, ISBN 0-07-320288-6
720 pages, softcover

- Part 1 — Foundational Skills and Mental Models
- Part 2 — The Creative Problem Solving Process
- Part 3 — Application in Engineering Design
- Part 4 — Selected Chapters on “Design for X”

THE 12 STEPS TO QUALITY BY DESIGN

Step 12 – Communicate results	DP-12, A, B, C
Step 11 – Evaluate/review design	DP-11
Step 10 – Testing; production design	DP-10
Step 9 – Tolerance level design	DP- 9
Step 8 – Parametric/system level design	DP- 8, A, B, C, D
Step 7 – Develop concepts/best options	DP- 7, A, B, C
Step 6 – Plan design process	DP- 6, A, B, C
Step 5 – Analyze problem & context	DP- 5
Step 4 – Identify design specs	DP- 4
Step 3 – Identify user needs	DP- 3
Step 2 – Identify constraints	DP- 2
Step 1 – Identify forces driving design	DP- 1

The DP numbers refer to the formats of the design project documentation given in the textbook.

SYLLABUS FOR A DISTANCE-LEARNING CAPSTONE DESIGN COURSE

Topics (2 Videotaped Lectures per Week)	Associated Documentation*	PowerPoint	Text Ch.
1. Course intro, requirements; project descriptions	Class schedule, logistics handouts	24/26 slides*	1
2. Need identification; constraints; design journal	DP-1, DP-2, DP-3	21 slides	2,13
3. HBDI; project assignments	HBDI results, info packet	33 slides	3
4. Teamwork and communication	Assignment to projects and teams	39 slides	4,5
5. Creative problem solving, Part 1	DP-4 (customer survey if relevant)	30 slides	3,7
6. Creative problem solving, Part 2		30 slides	8,9,10,12
7. Design documentation I	DP-5, DP-6B, DP-6C	15 slides	5,13,17
8. How to give an effective oral presentation	DP-6A	33 slides	5
9. <u>Oral team presentations of project proposal</u>	DP-6A		17
10. Innovation in the workplace	Schedule at convenience of instructor	48 slides	18
11. Project planning and scheduling	DP-6	<i>pending</i>	15
12. Overcoming mental blocks; idea generation	Different design concepts (3 or more)	24/30 slides*	6, 8, 9
13. The Pugh method for optimizing concepts	DP-7, DP-7B (Round 1)	33 slides	11
14. The product design process. Steps 7 and 8	Peer Contrib. Rating Form I, DP-8A	24 slides	4,14
15. <u>Oral team presentation of progress reports</u>	DP-8, DP-8D		17
16. Information sources and patent searching	DP-7, DP-7B, DP-7C (Round 2)	21 slides	4D**
17. Economic decision making	DP-7B, DP-7C (revised)	<i>pending</i>	16
18. QFD and design specifications	Analysis, DP-8A (updated)	42 slides	Appendix
19. Design documentation II		18 slides	5,14,17
20. <u>Exam</u>	Review of main concepts in textbook		1-18
21. Prototyping and prototype testing	DP-10, DP-11	38 slides	7D
22. Product liability		35 slides	15D
23. Ethics		30 slides	15D
24. Ethics; DFX I		36 slides	6D,9D
25. DFX II, DFM I	DP-8B, DP-8C (final)	30 slides	6D,9D
26. DFM II	DP-9 and safety description	33 slides	9D,12D
27. <u>Design Day: final oral team presentation, poster</u>	DP-12, DP-12A, DP-12B, DP-12C		17
28. Course evaluation; team report; design journal	Peer Contribution Rating Form II		5,17

* Student/faculty PowerPoint slides—the student version is used to make handouts excluding answer pages.

** “D” chapter numbers refer to chapters from George E. Dieter’s book in the extended edition of the course textbook.