UNSW AUSTRALIA

Course Outline

Semester 1 2016

Never Stand Still | Engineering | Mechanical and Manufacturing Engineering

MANF3100

PRODUCT AND MANUFACTURING DESIGN

Contents

1. Staff Contact Details

Contact details and consultation times for course convenor

Mr Corey Martin
Office: Ainsworth Building (J17), Room 507
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Consultation concerning this course is available immediately after the classes. Face-to-face consultation outside this time is available by appointment only.

Contact details and consultation times for additional lecturers

Dr Alex Green
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Dr Jason Held
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Dr Erik van Voorthuysen
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2. Course details

Credit Points:

This is a 6 unit-of-credit (UoC) course, and involves 4 hours per week (h/w) of face-to-face contact.

The UNSW website states “The normal workload expectations of a student are approximately 25 hours per semester for each UoC, including class contact hours, other learning activities, preparation and time spent on all assessable work. Thus, for a full-time enrolled student, the normal workload, averaged across the 16 weeks of teaching, study and examination periods, is about 37.5 hours per week.”

This means that you should aim to spend about 9 h/w on this course. The additional time should be spent in making sure that you understand the lecture material, completing the set assignments, further reading, and revising for any examinations.

There is no parallel teaching in this course.

Contact Hours

	Day	Time	Location
Lectures	Tuesday	10am - 12pm	Old Main Building 230 (K-K15-230)
Demonstrations	Tuesday	12pm – 2pm	Ainsworth Building 204 (K-J17-204)

Summary of the Course

This course focuses on making certain that a complex design, whether mechanical or mechatronic can be successfully manufactured, from a quality as well as cost perspective.

The key concept is the ability to translate functional requirements of a design into detailed subsystem-, equipment- and ultimately component-level specifications. These design-related specifications are then further developed into process specifications and ultimately support process selection and planning.

Whereas the course has a strong focus on processing and transformation technology, the economic analysis of manufacturing processes is also an important part of the course. The reason for this is that around 70% of manufacturing costs, including material, processing and assembly, are determined by design specifications before the product is manufactured. The remaining 30% of costs are determined by operational decisions including machine selection, process planning, scheduling, routing and so on.

Aims of the Course

The course aims to develop you into a skilled and proficient design engineer who is able to carry out and manage key design processes in parallel and concurrently, whilst understanding the business environment and needs.

Design is inherently complex and a systematic, yet a flexible, agile and interdisciplinary approach is required to bring a product to the market successfully and in less time. The course teaches this approach, based on global best-practice methodologies, and incorporates case studies and projects to apply these methodologies.

This course is designed to address the below learning outcomes and the corresponding Engineers Australia Stage 1 Competency Standards for Professional Engineers as shown. The full list of Stage 1 Competency Standards may be found in Appendix A.

After successfully completing this course, you should be able to:

Learning Outcome		EA Stage 1 Competencies
1.	Understand and apply systematic design principles including: • Quality Function Deployment (QFD) • VDI-2206 and 2221 Design Standards • Axiomatic and robust design principles • Value analysis and value engineering methods.	PE1.1, 1.2, 1.3, 1.5, 1.6 PE2.1, 2.2, 2.3, 2.4
2.	Analyze and characterize manufacturing transformation processes in terms of key technical and economic drivers and factors.	PE1.1 PE2.2, 2.3, 2.4 PE 3.1, 3.4
3.	Be able to integrate information and design into CAD/CAM systems.	PE1.1, 1.3, 1.5 PE2.2
4.	Develop an engineering design or prototype into a design that can be effectively and efficiently manufactured using appropriate product design as well as transformation process selection decisions to meet customer requirements.	PE1.4, 1.6 PE2.1, 2.2, 2.3, 2.4 PE 3.1, 3.2, 3.3, 3.4, 3.5, 3.6

3. Teaching strategies

Lectures in the course are designed to cover the terminology and core concepts and theories in the area of design for manufacturing. Examples are taken directly from industry to show how the theory is applied in practice.

The demonstrations and assignments are designed to allow you to apply and deepen your knowledge in product design and you will be encouraged to actively participate in class and group discussions throughout the semester.

4. Course schedule

Date	Topics	Assessment Task
01-Mar-16	The Economic Case for Manufacturing Process Selection Design Theory, QFD, Developing Functional Requirements, V-Model design theory, Axiomatic Design, Concurrent Design	
08-Mar-16	Process and Material Selection Methods Process Information Maps, Identifying Critical Process Parameters	
15-Mar-16	Design for Assembly (DFA), Design for Manufacturing (DFM), Design for Reliability, Design for Sustainability	Assignment – Part I due
22-Mar-16	Introduction to CAD/CAM with SolidWorks and SolidCam	
29-Mar-16	MID-SEMESTER BREAK (No Classes)	
05-Apr-16	Economics of Industrial Machinery and Process Equipment, Component and Assembly Costing Methods Value Analysis, Value Engineering, Robust Design, Process Capability	
12-Apr-16	Casting and Forming, Machining Processes	Quiz #1
19-Apr-16	Plastics and Composites, Rapid Prototyping, EDM, laser, waterjet, PCB & Electronic Manufacturing	
26-Apr-16	Introduction to measurement and error Limits and fits: Stack type functional requirements, fit type functional requirements	Assignment – Part II due
03-May-16	Types and design of jigs and fixtures, dof, locating principles, clamping and holding mechanisms and actuators Joining and Assembly Processes	
10-May-16	Surface Engineering, Measurement of surface finish, concentricity	Quiz #2
17-May-16	Linear measurement methods and standards Angular measurement, squareness, tapers	
24-May-16	Product Commercialisation	
31-May-16		Assignment – Part III due

5. Assessment

Assessment Overview

You are assessed by way of assignments, quizzes, and presentations.

There is no end-of-semester examination. Quizzes involve both calculations and descriptive material.

The parts of the course contribute towards the overall grade as follows:

ASSESSMENT	WEIGHTING	LEARNING OUTCOMES ASSESSED	MARKS RETURNED
Quizzes (x2)	20%	1, 2	Within 2 weeks of due date
Assignment – Part I	10%	1, 2	Within 2 weeks of due date
Assignment – Part II	30%	1, 2, 3, 4	Within 2 weeks of due date
Assignment – Part III	40%	1, 2, 3, 4	Within 2 weeks of due date
TOTAL	**100%**		

The assessments are designed to bolster your understanding of the material being presented and focus on the key learning points. The quizzes will test the understanding of the sections being presented while the assignments will allow you to apply the concepts learnt in the course.

Assignments

The assignments will be posted on Moodle. The assignments support the learning outcomes by incorporating an appropriate mix of analysis techniques, design methodologies, fact based data analysis that support the design of appropriate solutions. The assignments also support collaborative teamwork and integration of different ideas and components into an overall coherent product development strategy.

Presentation

All submissions should have a standard School cover sheet which is available from this subject's Moodle page.

All submissions are expected to be neat and clearly set out. Your results are the pinnacle of all your hard work. Presenting them clearly gives the marker the best chance of understanding your method; even if the numerical results are incorrect.

Submission

Late submissions will be penalised 5 marks per calendar day (including weekends). An extension may only be granted in exceptional circumstances. Where an assessment task is worth less than 20% of the total course mark and you have a compelling reason for being unable to submit your work on time, you must seek approval for an extension from the course convenor ***before the due date***. Special consideration for assessment tasks of 20% or greater must be processed through student.unsw.edu.au/special-consideration.

6. Expected Resources for students

Textbooks:

None prescribed.

Reference books:

1. Manufacturing Process Selection Handbook: From Design to Manufacture, Swift K.G., Booker J.D., 2013, Burlington, Elsevier Science, ISBN 9780080993607 – available from our library electronically
2. Applied Metrology for Manufacturing Engineering, Grous A, 2011, ISTE, John Wiley & Sons, Inc, ISBN 9781848211889
3. Low-cost Jigs, Fixtures & Gages, for limited production, Boyes W.E. ed., Society of Manufacturing Engineers, 1986, Dearborn, Michigan
4. Fundamentals of Modern Manufacturing, Groover M.P., 2nd ed., 2002 John Wiley

7. Course evaluation and development

Feedback on the course is gathered periodically using various means, including the Course and Teaching Evaluation and Improvement (CATEI) process, informal discussion in the final class for the course, and the School's Student/Staff meetings. Your feedback is taken seriously, and continual improvements are made to the course based, in part, on such feedback.

In this course, recent improvements resulting from student feedback include restructuring the demonstrations, reducing the number of quizzes.

8. Academic honesty and plagiarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. *Plagiarism at UNSW is defined as using the words or ideas of others and passing them off as your own.*

Plagiarism is a type of intellectual theft. It can take many forms, from deliberate cheating to accidentally copying from a source without acknowledgement. UNSW has produced a website with a wealth of resources to support students to understand and avoid plagiarism: student.unsw.edu.au/plagiarism The Learning Centre assists students with understanding academic integrity and how not to plagiarise. They also hold workshops and can help students one-on-one.

You are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting and the proper referencing of sources in preparing all assessment tasks.

If plagiarism is found in your work when you are in first year, your lecturer will offer you assistance to improve your academic skills. They may ask you to look at some online resources, attend the Learning Centre, or sometimes resubmit your work with the problem fixed. However more serious instances in first year, such as stealing another student's work or paying someone to do your work, may be investigated under the Student Misconduct Procedures.

Repeated plagiarism (even in first year), plagiarism after first year, or serious instances, may also be investigated under the Student Misconduct Procedures. The penalties under the procedures can include a reduction in marks, failing a course or for the most serious matters (like plagiarism in an honours thesis) even suspension from the university. The Student Misconduct Procedures are available here:
www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf

Further information on School policy and procedures in the event of plagiarism is available on the intranet.

9. Administrative Matters

All students are expected to read and be familiar with School guidelines and polices, available on the intranet. In particular, students should be familiar with the following:

- Attendance, Participation and Class Etiquette
- UNSW Email Address
- Computing Facilities
- Assessment Matters (including guidelines for assignments, exams and special consideration)
- Academic Honesty and Plagiarism
- Student Equity and Disabilities Unit
- Health and Safety
- Student Support Services

Corey Martin
February 2016

Appendix A: Engineers Australia (EA) Professional Engineer Competency Standards

	Program Intended Learning Outcomes
PE1: Knowledge and Skill Base	PE1.1 Comprehensive, theory-based understanding of underpinning fundamentals
	PE1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing
	PE1.3 In-depth understanding of specialist bodies of knowledge
	PE1.4 Discernment of knowledge development and research directions
	PE1.5 Knowledge of engineering design practice
	PE1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice
PE2: Engineering Application Ability	PE2.1 Application of established engineering methods to complex problem solving
	PE2.2 Fluent application of engineering techniques, tools and resources
	PE2.3 Application of systematic engineering synthesis and design processes
	PE2.4 Application of systematic approaches to the conduct and management of engineering projects
PE3: Professional and Personal Attributes	PE3.1 Ethical conduct and professional accountability
	PE3.2 Effective oral and written communication (professional and lay domains)
	PE3.3 Creative, innovative and pro-active demeanour
	PE3.4 Professional use and management of information
	PE3.5 Orderly management of self, and professional conduct
	PE3.6 Effective team membership and team leadership