Course outline

Contents

1. Staff contact details

Contact details and consultation times for course convenor

Name: Dr Alexander Green
Office location: Ainsworth Building (J17), Room 507
Email: alex.green@unsw.edu.au

Consultation concerning this course is available immediately after the classes. Face to face consultation is preferred.

Contact details and consultation times for additional lecturers/demonstrators/ lab staff

Name: Dr Erik van Voorthuysen
Office location: Ainsworth Building (J17), Room 507
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Consultation concerning this course is available immediately after the classes. Face to face consultation is preferred.

Name: Mr Albert Chau
Email: z5019250@student.unsw.edu.au

Consultation concerning this course is available immediately after the classes. Face to face consultation is preferred.

2. Course details

Credit Points

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

The UNSW website states “The normal workload expectations of a student are approximately 25 hours per semester for r

Contact hours

	Day	Time	Location
Lectures	Wednesday	2pm – 4pm	Old Main Building
Demonstrations	Wednesday	4pm – 6pm	Willis Annex UG Lab

Summary of the c ourse

This course focuses on making certain that a complex design—whether mechanical, mechatronic or aerospace—can also 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 even hits the factory floor. The remaining 30% of costs are determined by operational decisions, including machine selection, process planning, scheduling, routing and so on.

Topics include an overview of transformation processes and related cost and quality drivers, design for manufacturing related methodologies including quality function deployment (QFD), concurrent design, lifecycle design, value analysis, value engineering, robust design, axiomatic design and tolerance analysis. The course also introduces basic jig and fixture design for different levels of automation and manufacturing processes as well as an introduction to metrology for manufacturing engineers. Modern CAD/CAM systems contain sophisticated functionality and modules that automate some of the analysis and design functions with respect to process planning and even jig design. We have planned for an industry expert to give a guest lecture on this topic.

The course will combine lectures with practical case studies that require the theory taught to be applied to actual product designs and prototypes. Students have the option to bring their own examples and case studies into the course or alternatively select one of the recently developed designs provided in class.

Aims of the c ourse

The course aims to develop you into a skilled and all-rounded design engineer able to carry out and manage the key design processes in parallel and concurrently.

Design is inherently complex and a systematic, yet flexible, agile and interdisciplinary approach is required to bring 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, even your own designs and plans, to apply these methodologies and become proficient at them.

Student learning outcomes

This course is designed to address the learning outcomes below 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.	Ability to integrate this information and design intent 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 to meet customer as well as OEM requirements.	PE1.4, 1.6 PE2.1, 2.2, 2.3, 2.4 PE3.1, 3.2, 3.3, 3.4, 3.5, 3.6
5.	Understand the principles of manufacturing economics as it applies to material transformation processes as well as assembly processes and to apply economic analysis to develop cost and production estimates for your design.	PE1.

Tutorials are designed to provide you with feedback and discussion on the assignments, and to investigate problem areas in greater depth to ensure that you understand the application.

4. Course schedule

Date	Lecture / Tutorial Topic	Assessments
01/Mar/17	Design Theory, QFD, Developing Functional Requirements, V-Model design theory, Axiomatic Design, Concurrent Design	
08/Mar/17	Economics, Costing, Value Engineering, Quality, and Process Capability	
15/Mar/17	Computer Aided Manufacturing (CAM)	CAM and Costing
22/Mar/17	Process and Material Selection Methods	
29/Mar/17	Primary Processes	
05/Apr/17	Secondary Processes	Quiz #1
12/Apr/17	Design for Assembly (DFA), Design for Manufacturing (DFM)	Assignment Part 1
19/Apr/17	Mid-Semester Break	
26/Apr/17	Rapid Prototyping, Plastics and Composites, EDM, Laser, Waterjet, PCB and Electronics Manufacturing	Rapid Prototyping
03/May/17	Jigs, Fixtures, and Joining	
10/May/17	Metrology, limits, fits and tolerancing	
17/May/17	Surface Engineering	Quiz #2
24/May/17	Revision	Assignment Part 2

5. Assessment

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Presentation

All non-electric submissions should have a standard School cover sheet, which is available from this course's Moodle page.

All submissions are expected to be neat and clearly set out. Your results are the pinnacle of all your hard work and should be treated with due respect. Presenting results 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.

It is always worth submitting late assessment tasks when possible. Completion of the work, even late, may be taken into account in cases of special consideration.

Where there is no special consideration granted, the 'deadline for absolute fail' in the table above indicates the time after which a submitted assignment will not be marked, and will achieve a score of zero for the purpose of determining overall grade in the course.

Marking

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 UNSW myExperience 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: restructure of the assessments, purchase of a physical machine, and additional summarised resources.

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 assessmen4.2(i)2.6(s)3dks t(k)ring5 r1 m.6(-- 0 c45m.6(-- 0.9(3(t)-6.6.5(y)8-6.7(p( )1m)-5.9(4 Tw -12(u)a6

Appendix A: Engineers Australia (EA) Competencies

Stage 1 Competencies for Professional Engineers

	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