Mechanical and Manufacturing Engineering

Department of Mechanical and Manufacturing Engineering

The department was first established after the Second World War, although the course in mechanical engineering began in 1907 as a Faculty stream. An industrial engineering degree was added in the late 1950s. In 1988 an extensive review of the curriculum led to the undergraduate courses being restructured into a new, single degree course in mechanical and manufacturing engineering with students having the option to choose specialisations in their last year. A 1995 review of the department by a team from the US and UK ranked its research and teaching at the highest international standards. In 1996, the five-year combined degree in mechatronics commenced. Mechanical and manufacturing engineering applies human and material resources to the design, construction, operation and maintenance of machines (supported increasingly by sophisticated computer technology) to move people, goods and materials; generate energy; produce goods and services; and control pollution and dispose of wastes. It interacts with all other branches of engineering including the medical sciences.

First-year students acquire a flexible, broad scientific training in mathematics, computing and physics and an introduction to engineering.

Second-year students continue with mathematics and are introduced to engineering design plus basic mechanical engineering sciences (thermodynamics, fluid mechanics, mechanics and machine dynamics), materials and electromechanical system modelling.

Third year students continue engineering science, engineering design, manufacturing studies and control systems.

Fourth year includes a major project and electives in advanced engineering; in manufacturing, bioengineering, applied mechanics, fluids, energy, mechatronics and management. Students planning to enter industry directly after graduating can choose how best to prepare for their careers, bearing in mind that many design and research engineers move into management. Many students participate in industry challenges such as the Formula SAE-A competition, or other build and demonstrate projects that are world competitive.

In laboratory, research and design work students have access to specialised facilities for materials testing, wind tunnels, engine test cells and a heavy engineering workshop for the manufacture of testing facilities and experimental equipment.

Engineering design, which draws on the Faculty's extensive computer facilities and computational mechanics, is now established as an area of study and research in conjunction with computer science.

Graduate research programs are available in aspects of mechanical, mechatronics, manufacturing and bioengineering. The department is internationally regarded in fluid mechanics, advanced automotive engineering technology, machine dynamics, mechatronics and biomedical engineering.

Department of Mechanical and Manufacturing Engineering: undergraduate course structures

To meet the Faculty requirement of 400 points for the BE, students must pass specified core subjects and a prescribed number of electives. Prerequisites are designed to meet these requirements.

Study abroad students may take units of most 12.5 point subjects as 6.25 point subjects.

Bachelor of Engineering (BE)

The recommended or standard course structures are listed below. When setting the timetable every effort will be made to avoid clashes between the times of classes associated with these sets of subjects. Students should be aware however, that if it proves to be impossible to achieve a timetable without clashes in these sets of subjects, the Faculty reserves the right to modify course structures in order to eliminate the conflicts. Students will be advised during the enrolment period of the semester if the recommended courses need to be varied. Where the courses include elective subjects these should be chosen so that timetable clashes are avoided. In particular, students in combined degrees should plan their courses so that the subjects chosen in the other faculty do not clash with those recommended for the engineering component.

Note: Students must not undertake Science Mathematics in place of 431-201 Engineering Analysis A and 431-202 Engineering Analysis B without first obtaining departmental course advice.

First year		Points
Semester 1		
433-151	Introduction to Programming (Advanced) *(p.16)*	12.5
or		
433-171	Introduction to Programming *(p.17)*	12.5
436-105	Engineering Communications *(p.6)*	12.5
620-121	Mathematics A (Advanced) *(p.4)*	12.5
or		
620-141	Mathematics A *(p.5)*	12.5
640-141	Physics A *(p.2)*	12.5
Semester 2		
431-101	Fundamentals of Electrical Engineering *(p.11)*	12.5
620-123	Applied Mathematics (Advanced) *(p.4)*	12.5
or		
620-143	Applied Mathematics *(p.5)*	12.5
436-121	Introduction to Mechanical Engineering *(p.6)*	12.5
Elective		12.5

Second year		Points
Semester 1		
431-201	Engineering Analysis A *(p.11)*	12.5
436-285	Engineering Design and Materials 1 *(p.7)*	12.5
436-284	Organisational Engineering *(p.7)*	12.5
436-202	Mechanics 1 *(p.6)*	12.5
Semester 2		
431-202	Engineering Analysis B *(p.12)*	12.5
436-201	Thermofluids 1 *(p.6)*	12.5
436-204	Systems Modelling *(p.7)*	12.5
436-286	Engineering Design & Materials 2 *(p.8)*	12.5

Third year		Points
Semester 1		
436-351	Thermofluids 2 *(p.8)*	12.5
436-353	Mechanics 2 *(p.9)*	12.5
436-382	Control Systems 1 *(p.9)*	12.5
436-384	Engineering Design & Processes 1 *(p.9)*	12.5
Semester 2		
436-352	Thermofluids 3 *(p.8)*	12.5
436-354	Mechanics 3 *(p.9)*	12.5
436-311	Engineering Design & Processes 2 *(p.8)*	12.5
620-370	Statistics for Mechanical Engineers *(p.12)*	12.5

Fourth year		Points
Year-long		
436-492	Major Project and Professional Practice *(p.12)*	25
Semester 1		
436-431	Mechanics 4 *(p.10)*	12.5
436-432	Thermofluids 4 *(p.10)*	12.5
436-470	Control Systems 2 *(p.12)*	12.5
Semester 2		
Electives from the list below (choose three to make a total of 37.5 points).		
436-466	Renewable Energy *(p.11)*	12.5
436-415	Quality Engineering *(p.9)*	12.5
436-414	Optimisation *(p.9)*	12.5
436-460	Advanced Engineering Materials *(p.11)*	12.5
436-465	Advanced Fluid Mechanics *(p.11)*	12.5
436-421	Power Generation Systems *(p.10)*	12.5
436-439	Dynamics of Rotors *(p.11)*	12.5
436-443	Production Engineering *(p.11)*	12.5
436-461	Advanced Mechanics of Solids *(p.11)*	12.5
325-209	Human Resource Management *(p.2)*	12.5
436-436	Advanced Computational Mechanics *(p.10)*	12.5
436-419	Computational Biomechanics *(p.10)*	12.5
436-459	Advanced Control and Automation *(p.11)*	12.5

Bachelor of Engineering (Engineering Management) Mechanical

The recommended or standard course structure for the first two years of the Mechanical stream of the Bachelor of Engineering (Engineering Management) are listed below. Course structures for later years of the course will be published in the *Handbook* as they become available (i.e. the third year structure will be published in 2007). When setting the timetable every effort will be made to avoid clashes between the times of classes associated with these sets of subjects. Students should be aware however, that if it proves to be impossible to achieve a timetable without clashes in these sets of subjects, the Faculty reserves the right to modify course structures in order to eliminate the conflicts. Students will be advised during the enrolment period of the semester if the recommended courses need to be varied. Where the courses include elective subjects these should be chosen so that timetable clashes are avoided. In particular, students in combined degrees should plan their courses so that the subjects chosen in the other faculty do not clash with those recommended for the engineering component.

Note: Students must not undertake Science Mathematics in place of 431-201 Engineering Analysis A and 431-202 Engineering Analysis B without first obtaining departmental course advice.

First year		Points
Semester 1		
436-105	Engineering Communications *(p.6)*	12.5
325-101	Managing People and Organisations *(p.1)*	12.5
620-141	Mathematics A *(p.5)*	12.5
or		
620-121	Mathematics A (Advanced) *(p.4)*	12.5
306-107	Accounting Reports and Analysis *(p.1)*	12.5
Semester 2		
436-121	Introduction to Mechanical Engineering *(p.6)*	12.5
316-130	Quantitative Methods 1 *(p.1)*	12.5
431-101	Fundamentals of Electrical Engineering *(p.11)*	12.5
620-143	Applied Mathematics *(p.5)*	12.5
or		
620-123	Applied Mathematics (Advanced) *(p.4)*	12.5

Second year		Points
Semester 1		
431-201	Engineering Analysis A *(p.11)*	12.5
436-202	Mechanics 1 *(p.6)*	12.5
436-285	Engineering Design and Materials 1 *(p.7)*	12.5
421-258	Engineering Business Management *(p.10)*	12.5
Semester 2		
431-202	Engineering Analysis B *(p.12)*	12.5
436-201	Thermofluids 1 *(p.6)*	12.5
436-286	Engineering Design & Materials 2 *(p.8)*	12.5
436-204	Systems Modelling *(p.7)*	12.5

Third year		Points
Semester 1		
436-284	Organisational Engineering *(p.7)*	12.5
436-351	Thermofluids 2 *(p.8)*	12.5
436-353	Mechanics 2 *(p.9)*	12.5
436-384	Engineering Design & Processes 1 *(p.9)*	12.5
Semester 2		
436-311	Engineering Design & Processes 2 *(p.8)*	12.5
436-352	Thermofluids 3 *(p.8)*	12.5
436-354	Mechanics 3 *(p.9)*	12.5
Commerce subject*		12.5

*Commerce subject must be a level-200 or 300 and the pre-requisites met where necessary

Bachelor of Arts/Bachelor of Engineering (BA/BE)

The recommended or standard course structures are listed below. When setting the timetable every effort will be made to avoid clashes between the times of classes associated with these sets of subjects. Students should be aware however, that if it proves to be impossible to achieve a timetable without clashes in these sets of subjects, the Faculty reserves the right to modify course structures in order to eliminate the conflicts. Students will be advised during the enrolment period of the semester if the recommended courses need to be varied. Where the courses include elective subjects these should be chosen so that timetable clashes are avoided. In particular, students in combined degrees should plan their courses so that the subjects chosen in the other faculty do not clash with those recommended for the engineering component.

Note: Students must not undertake Science Mathematics in place of 431-201 Engineering Analysis A and 431-202 Engineering Analysis B without first obtaining departmental course advice.

First year		Points
Semester 1		
436-105	Engineering Communications *(p.6)*	12.5
433-151	Introduction to Programming (Advanced) *(p.16)*	12.5
or		
433-171	Introduction to Programming *(p.17)*	12.5
620-121	Mathematics A (Advanced) *(p.4)*	12.5
or		
620-141	Mathematics A *(p.5)*	12.5
Arts subject as required		12.5
Semester 2		
436-121	Introduction to Mechanical Engineering *(p.6)*	12.5
431-101	Fundamentals of Electrical Engineering *(p.11)*	12.5
620-123	Applied Mathematics (Advanced) *(p.4)*	12.5
or		
620-143	Applied Mathematics *(p.5)*	12.5
Arts subject as required		12.5

Second year		Points
Semester 1		
436-202	Mechanics 1 *(p.6)*	12.5
436-285	Engineering Design and Materials 1 *(p.7)*	12.5
431-201	Engineering Analysis A *(p.11)*	12.5
Arts subject as required		12.5
Semester 2		
436-201	Thermofluids 1 *(p.6)*	12.5
436-286	Engineering Design & Materials 2 *(p.8)*	12.5
431-202	Engineering Analysis B *(p.12)*	12.5
Arts subject as required		12.5

Third year		Points
Semester 1		
436-353	Mechanics 2 *(p.9)*	12.5
Arts subjects as required		37.5
Semester 2		
436-354	Mechanics 3 *(p.9)*	12.5
436-204	Systems Modelling *(p.7)*	12.5
620-370	Statistics for Mechanical Engineers *(p.12)*	12.5
Arts subject as required		12.5

Fourth year		Points
Semester 1		
436-384	Engineering Design & Processes 1 *(p.9)*	12.5
436-351	Thermofluids 2 *(p.8)*	12.5
436-382	Control Systems 1 *(p.9)*	12.5
Arts subject as required		12.5
Semester 2		
436-311	Engineering Design & Processes 2 *(p.8)*	12.5
436-352	Thermofluids 3 *(p.8)*	12.5
Arts subjects as required		25

Fifth year		Points
Year-long		
436-492	Major Project and Professional Practice *(p.12)*	25
Semester 1		
Mechanical Elective Group 1		12.5
Arts subjects as required		25
Mechanical Elective Group 1 (Select one)		
436-431	Mechanics 4 *(p.10)*	12.5
436-432	Thermofluids 4 *(p.10)*	12.5
436-470	Control Systems 2 *(p.12)*	12.5
Semester 2		
Arts subjects as required		37.5

Bachelor of Engineering/Bachelor of Commerce (BE/BCom)

The recommended or standard course structures are listed below. When setting the timetable every effort will be made to avoid clashes between the times of classes associated with these sets of subjects. Students should be aware however, that if it proves to be impossible to achieve a timetable without clashes in these sets of subjects, the Faculty reserves the right to modify course structures in order to eliminate the conflicts. Students will be advised during the enrolment period of the semester if the recommended courses need to be varied. Where the courses include elective subjects these should be chosen so that timetable clashes are avoided. In particular, students in combined degrees should plan their courses so that the subjects chosen in the other faculty do not clash with those recommended for the engineering component.

Note: Students must not undertake Science Mathematics in place of 431-201 Engineering Analysis A and 431-202 Engineering Analysis B without first obtaining departmental course advice.

First year		Points
Semester 1		
436-105	Engineering Communications *(p.6)*	12.5
433-151	Introduction to Programming (Advanced) *(p.16)*	12.5
or		
433-171	Introduction to Programming *(p.17)*	12.5
316-102	Introductory Microeconomics *(p.1)*	12.5
620-121	Mathematics A (Advanced) *(p.4)*	12.5
or		
620-141	Mathematics A *(p.5)*	12.5

First year

		Points
Semester 2		
436-121	Introduction to Mechanical Engineering *(p.6)*	12.5
316-101	Introductory Macroeconomics *(p.1)*	12.5
431-101	Fundamentals of Electrical Engineering *(p.11)*	12.5
620-123	Applied Mathematics (Advanced) *(p.4)*	12.5
or		
620-143	Applied Mathematics *(p.5)*	12.5

Second year

		Points
Semester 1		
436-285	Engineering Design and Materials 1 *(p.7)*	12.5
436-202	Mechanics 1 *(p.6)*	12.5
431-201	Engineering Analysis A *(p.11)*	12.5
316-130	Quantitative Methods 1 *(p.1)*	12.5
Semester 2		
431-202	Engineering Analysis B *(p.12)*	12.5
436-286	Engineering Design & Materials 2 *(p.8)*	12.5
316-205	Introductory Econometrics *(p.1)*	12.5
436-201	Thermofluids 1 *(p.6)*	12.5

Third year

		Points
Semester 1		
325-201	Organisational Behaviour *(p.1)*	12.5
436-353	Mechanics 2 *(p.9)*	12.5
Commerce subjects as required		25
Semester 2		
436-354	Mechanics 3 *(p.9)*	12.5
436-204	Systems Modelling *(p.7)*	12.5
Commerce subjects as required		25

Fourth year*

		Points
Semester 1		
436-351	Thermofluids 2 *(p.8)*	12.5
436-382	Control Systems 1 *(p.9)*	12.5
436-384	Engineering Design & Processes 1 *(p.9)*	12.5
Commerce subjects as required		12.5
Semester 2		
436-352	Thermofluids 3 *(p.8)*	12.5
436-311	Engineering Design & Processes 2 *(p.8)*	12.5
Commerce subjects as required		25

*For students who followed the recommended course outline in 2006. All other students should seek departmental course advice.

Fifth year*

		Points
Year-long		
436-492	Major Project and Professional Practice *(p.12)*	25
Semester 1		
Mechanical Elective Group 1		12.5
Commerce subjects as required		25
Semester 2		
Mechanical Elective Group 2		12.5
Commerce subjects as required		25
Mechanical Electives Group 1 (Select two)		
436-432	Thermofluids 4 *(p.10)*	12.5
436-470	Control Systems 2 *(p.12)*	12.5
436-431	Mechanics 4 *(p.10)*	12.5
Mechanical Electives Group 2 (Select one)		
436-466	Renewable Energy *(p.11)*	12.5
436-415	Quality Engineering *(p.9)*	12.5
436-414	Optimisation *(p.9)*	12.5
436-436	Advanced Computational Mechanics *(p.10)*	12.5
436-460	Advanced Engineering Materials *(p.11)*	12.5
436-465	Advanced Fluid Mechanics *(p.11)*	12.5
436-421	Power Generation Systems *(p.10)*	12.5
436-439	Dynamics of Rotors *(p.11)*	12.5
436-443	Production Engineering *(p.11)*	12.5
436-461	Advanced Mechanics of Solids *(p.11)*	12.5
436-419	Computational Biomechanics *(p.10)*	12.5
436-459	Advanced Control and Automation *(p.11)*	12.5

*For students who followed the recommended course outline in 2006. All other students should seek departmental course advice.

Bachelor of Laws/Bachelor of Engineering (Mechanical) (LLB/BE)

The recommended or standard course structures are listed below. When setting the timetable every effort will be made to avoid clashes between the times of classes associated with these sets of subjects. Students should be aware however, that if it proves to be impossible to achieve a timetable without clashes in these sets of subjects, the Faculty reserves the right to modify course structures in order to eliminate the conflicts. Students will be advised during the enrolment period of the semester if the recommended courses need to be varied. Where the courses include elective subjects these should be chosen so that timetable clashes are avoided. In particular, students in combined degrees should plan their courses so that the subjects chosen in the other faculty do not clash with those recommended for the engineering component.

Note: Students must not undertake Science Mathematics in place of 431-201 Engineering Analysis A and 431-202 Engineering Analysis B without first obtaining departmental course advice.

First year

		Points
Semester 1		
620-121	Mathematics A (Advanced) *(p.4)*	12.5
or		
620-141	Mathematics A *(p.5)*	12.5
436-105	Engineering Communications *(p.6)*	12.5
730-111	Legal Method and Reasoning *(p.1)*	12.5
730-112	Principles of Public Law *(p.1)*	12.5
Semester 2		
436-121	Introduction to Mechanical Engineering *(p.6)*	12.5
620-123	Applied Mathematics (Advanced) *(p.4)*	12.5
or		
620-143	Applied Mathematics *(p.5)*	12.5
730-113	Dispute Resolution *(p.1)*	12.5
730-114	Torts *(p.1)*	12.5

Second year

		Points
Semester 1		
436-202	Mechanics 1 *(p.6)*	12.5
433-151	Introduction to Programming (Advanced) *(p.16)*	12.5
or		
433-171	Introduction to Programming *(p.17)*	12.5
730-213	Obligations *(p.2)*	12.5
730-212	Legal Theory *(p.2)*	12.5
Semester 2		
431-101	Fundamentals of Electrical Engineering *(p.11)*	12.5
436-201	Thermofluids 1 *(p.6)*	12.5
730-215	Contracts *(p.2)*	12.5
730-214	Constitutional Law *(p.2)*	12.5

Third year

		Points
Semester 1		
431-201	Engineering Analysis A *(p.11)*	12.5
436-285	Engineering Design and Materials 1 *(p.7)*	12.5
436-353	Mechanics 2 *(p.9)*	12.5
730-365	Administrative Law *(p.3)*	12.5
Semester 2		
431-202	Engineering Analysis B *(p.12)*	12.5
436-204	Systems Modelling *(p.7)*	12.5
436-286	Engineering Design & Materials 2 *(p.8)*	12.5
730-368	Criminal Law and Procedure *(p.4)*	12.5

Fourth year

		Points
Semester 1		
436-351	Thermofluids 2 *(p.8)*	12.5
436-384	Engineering Design & Processes 1 *(p.9)*	12.5
730-366	Property *(p.3)*	12.5
Law subject as required		12.5
Semester 2		
436-354	Mechanics 3 *(p.9)*	12.5
436-311	Engineering Design & Processes 2 *(p.8)*	12.5
730-367	Trusts *(p.3)*	12.5
Law subject as required		12.5

Fifth year

		Points
Semester 1		
436-382	Control Systems 1 *(p.9)*	12.5
Law subjects as required		37.5
Semester 2		
436-352	Thermofluids 3 *(p.8)*	12.5
620-370	Statistics for Mechanical Engineers *(p.12)*	12.5
730-453	Remedies *(p.4)*	12.5
730-454	Legal Ethics *(p.4)*	12.5

Sixth year

		Points
Year-long		
436-492	Major Project and Professional Practice *(p.12)*	25

Sixth year		Points
Semester 1		
Mechanical Elective Group 1 (from Group 1 below)		12.5
Law subjects as required		25
Mechanical Electives Group 1 (select one)		
436-431	Mechanics 4 *(p.10)*	12.5
436-432	Thermofluids 4 *(p.10)*	12.5
436-470	Control Systems 2 *(p.12)*	12.5
Semester 2		
Law subjects as required		37.5

Bachelor of Engineering/Bachelor of Science (BE/BSc)

The courses shown below are based on a structure being adopted by all faculties, in which most subjects carry 12.5 points.

The mathematics, statistics and physics listed in the following structure will gain credit towards the BSc. Students wanting to pursue engineering mathematics will receive no such credit.

The recommended or standard course structures are listed below. When setting the timetable every effort will be made to avoid clashes between the times of classes associated with these sets of subjects. Students should be aware however, that if it proves to be impossible to achieve a timetable without clashes in these sets of subjects, the Faculty reserves the right to modify course structures in order to eliminate the conflicts. Students will be advised during the enrolment period of the semester if the recommended courses need to be varied. Where the courses include elective subjects these should be chosen so that timetable clashes are avoided. In particular, students in combined degrees should plan their courses so that the subjects chosen in the other faculty do not clash with those recommended for the engineering component.

First year		Points
Semester 1		
436-105	Engineering Communications *(p.6)*	12.5
433-151	Introduction to Programming (Advanced) *(p.16)*	12.5
or		
433-171	Introduction to Programming *(p.17)* [a]	12.5
620-121	Mathematics A (Advanced) *(p.4)*	12.5
or		
620-141	Mathematics A *(p.5)*	12.5
640-141	Physics A *(p.2)*[b]	12.5
Semester 2		
436-121	Introduction to Mechanical Engineering *(p.6)*	12.5
620-122	Mathematics B (Advanced) *(p.4)*	12.5
or		
620-142	Mathematics B *(p.5)*	12.5
620-123	Applied Mathematics (Advanced) *(p.4)*	12.5
or		
620-143	Applied Mathematics *(p.5)*	12.5
640-142	Physics B *(p.3)*[c]	12.5

a. Students planning to undertake computer science as the science major in the combined degree will be required to complete 433-172 Algorithmic Problem Solving or 433-152 Algorithmic Problem Solving (Advanced) for science points prior to commencing second-year computer science subjects.

b. 640-141 Physics A, 640-142 Physics B and 640-251 Instrumentation for Scientists may be substituted by 431-101 Fundamentals of Electrical Engineering and three other science subjects. Students choosing this alternative will need to complete an extra science subject as an overload, a summer subject or by extending their course. These students must seek course advice from a science adviser.

c. See footnote b above

Second year		Points
Semester 1		
436-202	Mechanics 1 *(p.6)*	12.5
436-285	Engineering Design and Materials 1 *(p.7)*	12.5
620-231	Vector Analysis *(p.7)*	12.5
640-251	Instrumentation for Scientists *(p.5)*[a]	12.5
Semester 2		
436-286	Engineering Design & Materials 2 *(p.8)*	12.5
436-201	Thermofluids 1 *(p.6)*	12.5
620-232	Mathematical Methods *(p.7)*	12.5
620-160	Experimental Design & Data Analysis *(p.5)*	12.5

a. see footnote b above

Third year		Points
Semester 1		
436-384	Engineering Design & Processes 1 *(p.9)*	12.5
436-353	Mechanics 2 *(p.9)*	12.5
620-331	Applied Partial Differential Equations *(p.10)*	12.5
Science subject as required		12.5
Semester 2		
436-311	Engineering Design & Processes 2 *(p.8)*	12.5
436-204	Systems Modelling *(p.7)*	12.5
Science subjects as required		25

Fourth year*		Points
Semester 1		
436-351	Thermofluids 2 *(p.8)*	12.5
436-284	Organisational Engineering *(p.7)*	12.5
436-382	Control Systems 1 *(p.9)*	12.5
Science subject/s as required		12.5
Semester 2		
436-352	Thermofluids 3 *(p.8)*	12.5
436-354	Mechanics 3 *(p.9)*	12.5
Science subjects as required		25

* For students who followed the recommended course outline in 2006. All other students should seek departmental course advice.

Fifth year*		Points
Year-long		
436-492	Major Project and Professional Practice *(p.12)*	25
Semester 1		
436-431	Mechanics 4 *(p.10)*	12.5
436-432	Thermofluids 4 *(p.10)*	12.5
436-470	Control Systems 2 *(p.12)*	12.5
Semester 2		
Mechanical 400-level elective		12.5
Science subjects as required		25
Mechanical 400-level electives (Select one)		
436-466	Renewable Energy *(p.11)*	12.5
436-415	Quality Engineering *(p.9)*	12.5
436-414	Optimisation *(p.9)*	12.5
436-436	Advanced Computational Mechanics *(p.10)*	12.5
436-460	Advanced Engineering Materials *(p.11)*	12.5
436-465	Advanced Fluid Mechanics *(p.11)*	12.5
436-421	Power Generation Systems *(p.10)*	12.5
436-443	Production Engineering *(p.11)*	12.5
436-439	Dynamics of Rotors *(p.11)*	12.5
436-461	Advanced Mechanics of Solids *(p.11)*	12.5
436-419	Computational Biomechanics *(p.10)*	12.5
436-459	Advanced Control and Automation *(p.11)*	12.5

*For students who followed the recommended course outline in 2006. All other students should seek departmental course advice.

Bachelor of Engineering (Mechatronics)/Bachelor of Computer Science (BE/BCS)

The recommended or standard course structures are listed below. When setting the timetable every effort will be made to avoid clashes between the times of classes associated with these sets of subjects. Students should be aware however, that if it proves to be impossible to achieve a timetable without clashes in these sets of subjects, the Faculty reserves the right to modify course structures in order to eliminate the conflicts. Students will be advised during the enrolment period of the semester if the recommended courses need to be varied. Where the courses include elective subjects these should be chosen so that timetable clashes are avoided. In particular, students in combined degrees should plan their courses so that the subjects chosen in the other faculty do not clash with those recommended for the engineering component.

Note: Students must not undertake Science Mathematics in place of 431-201 Engineering Analysis A and 431-202 Engineering Analysis B without first obtaining departmental course advice.

First year		Points
Semester 1		
436-105	Engineering Communications *(p.6)*	12.5
431-102	Digital Systems 1: Fundamentals *(p.11)*	12.5
433-151	Introduction to Programming (Advanced) *(p.16)*	12.5
or		
433-171	Introduction to Programming *(p.17)*	12.5
620-121	Mathematics A (Advanced) *(p.4)*	12.5
or		
620-141	Mathematics A *(p.5)*	12.5
Semester 2		
436-121	Introduction to Mechanical Engineering *(p.6)*	12.5

First year

		Points
431-103	Electrical Circuits 1 *(p.11)*	12.5
433-152	Algorithmic Problem Solving (Advanced) *(p.17)*	12.5
or		
433-172	Algorithmic Problem Solving *(p.17)*	12.5
620-123	Applied Mathematics (Advanced) *(p.4)*	12.5
or		
620-143	Applied Mathematics *(p.5)*	12.5

Second year

		Points
Semester 1		
436-285	Engineering Design and Materials 1 *(p.7)*	12.5
431-201	Engineering Analysis A *(p.11)*	12.5
431-204	Digital Systems 2: System Design *(p.12)*	12.5
436-202	Mechanics 1 *(p.6)*	12.5
Semester 2		
436-286	Engineering Design & Materials 2 *(p.8)*	12.5
436-204	Systems Modelling *(p.7)*	12.5
431-202	Engineering Analysis B *(p.12)*	12.5
436-201	Thermofluids 1 *(p.6)*	12.5

Third year

		Points
Semester 1		
433-252	Software Engineering Principles & Tools *(p.17)*	12.5
436-353	Mechanics 2 *(p.9)*	12.5
431-210	Electrical Circuits 2 *(p.12)*	12.5
436-382	Control Systems 1 *(p.9)*	12.5
Semester 2		
433-254	Software Design *(p.17)*	12.5
436-354	Mechanics 3 *(p.9)*	12.5
620-370	Statistics for Mechanical Engineers *(p.12)*	12.5
433-253	Algorithms and Data Structures *(p.17)*	12.5

Fourth year

		Points
Semester 1		
433-332	Operating Systems *(p.18)*	12.5
433-341	Software Engineering Process & Practice *(p.19)*	12.5
436-384	Engineering Design & Processes 1 *(p.9)*	12.5
436-351	Thermofluids 2 *(p.8)*	12.5
Semester 2		
433-255	Logic and Computation *(p.18)*	12.5
433-353	Networks and Communications *(p.19)*	12.5
Elective		12.5
436-311	Engineering Design & Processes 2 *(p.8)*	12.5

Fifth year

		Points
Year-long		
436-492	Major Project and Professional Practice *(p.12)*	25
or		
433-465	Major Project & Professional Practice *(p.22)*	25
Semester 1		
436-470	Control Systems 2 *(p.12)*	12.5
Electives		25
Semester 2		
Electives		37.5

Note: Electives taken in the last three semesters of the course must include 37.5 points of BCS electives and 37.5 points of BE electives taken from the subjects listed below. At least one management subject, as well as 436-431 OR BOTH 436-352 and 436-432 must be included.

BCS Electives (a total of 37.5 points to be taken for the course)

431-467	Digital Systems 4: High Speed Systems *(p.16)*	12.5
433-303	Artificial Intelligence *(p.18)*	12.5
433-313	Computer Design *(p.18)*	12.5
433-330	Theory of Computation *(p.18)*	12.5
433-342	Software Engineering Methods *(p.19)*	12.5
433-351	Database Systems *(p.19)*	12.5
433-361	Programming Language Implementation *(p.19)*	12.5
433-371	Interactive System Design *(p.20)*	12.5
433-380	Graphics and Computation *(p.20)*	12.5
433-385	Modelling, Analysis and Visualisation *(p.20)*	12.5

Management Electives (choose at least one):

325-201	Organisational Behaviour *(p.1)*	12.5
325-203	Managing Operations *(p.1)*	12.5
325-209	Human Resource Management *(p.2)*	12.5
325-211	Principles of Marketing *(p.2)*	12.5
325-302	Strategic Marketing *(p.3)*	12.5

Fifth year

		Points
325-308	Industrial Relations *(p.4)*	12.5
436-284	Organisational Engineering *(p.7)*	12.5
436-414	Optimisation *(p.9)*	12.5
436-415	Quality Engineering *(p.9)*	12.5

Engineering electives (must include 436-431 or both 436-352 and 436-432)

431-328	Digital Systems 3: Circuits and Systems *(p.13)*	12.5
431-331	Electronic Circuit Design 2 *(p.13)*	12.5
433-483	Computer Vision and Image Processing *(p.23)*	12.5
436-352	Thermofluids 3 *(p.8)*	12.5
436-431	Mechanics 4 *(p.10)*	12.5
436-432	Thermofluids 4 *(p.10)*	12.5
436-443	Production Engineering *(p.11)*	12.5
436-459	Advanced Control and Automation *(p.11)*	12.5
436-419	Computational Biomechanics *(p.10)*	12.5
436-421	Power Generation Systems *(p.10)*	12.5
436-436	Advanced Computational Mechanics *(p.10)*	12.5
436-439	Dynamics of Rotors *(p.11)*	12.5
436-460	Advanced Engineering Materials *(p.11)*	12.5
436-461	Advanced Mechanics of Solids *(p.11)*	12.5
436-465	Advanced Fluid Mechanics *(p.11)*	12.5

Subject descriptions

306-107 Accounting Reports and Analysis
See full subject details on page 1.

316-101 Introductory Macroeconomics
See full subject details on page 1.

316-102 Introductory Microeconomics
See full subject details on page 1.

316-130 Quantitative Methods 1
See full subject details on page 1.

316-205 Introductory Econometrics
See full subject details on page 1.

325-201 Organisational Behaviour
See full subject details on page 1.

325-203 Managing Operations
See full subject details on page 1.

325-209 Human Resource Management
See full subject details on page 2.

325-211 Principles of Marketing
See full subject details on page 2.

325-302 Strategic Marketing
See full subject details on page 3.

325-304 Managing in Contemporary Organisations
See full subject details on page 3.

325-308 Industrial Relations
See full subject details on page 4.

421-629 Energy Efficiency Technology
See full subject details on page 14.

431-101 Fundamentals of Electrical Engineering
See full subject details on page 11.

431-102 Digital Systems 1: Fundamentals
See full subject details on page 11.

431-103 Electrical Circuits 1
See full subject details on page 11.

431-201 Engineering Analysis A
See full subject details on page 11.

431-202 Engineering Analysis B
See full subject details on page 12.

431-210 Electrical Circuits 2
See full subject details on page 12.

433-171 Introduction to Programming
See full subject details on page 17.

433-252 Software Engineering Principles & Tools
See full subject details on page 17.

433-253 Algorithms and Data Structures
See full subject details on page 17.

433-254 Software Design
See full subject details on page 17.

433-255 Logic and Computation
See full subject details on page 18.

433-303 Artificial Intelligence
See full subject details on page 18.

433-313 Computer Design
See full subject details on page 18.

433-332 Operating Systems
See full subject details on page 18.

433-340 Software Engineering Project
See full subject details on page 18.

433-341 Software Engineering Process & Practice
See full subject details on page 19.

433-343 Professional Issues in Computing
See full subject details on page 19.

433-351 Database Systems
See full subject details on page 19.

433-353 Networks and Communications
See full subject details on page 19.

433-361 Programming Language Implementation
See full subject details on page 19.

433-380 Graphics and Computation
See full subject details on page 20.

433-465 Major Project & Professional Practice
See full subject details on page 22.

436-105 Engineering Communications

Credit points: 12.5

Coordinator: Dr K Gross

Contact: Seventeen hours of lectures, seven hours of tutorials, 14 hours of project work and 10 hours practice classes *(Semester 1, repeat Summer).*

Description: Students successfully completing this unit should have the ability to construct 2-D geometric models of 3-D objects and phenomena, communicate their descriptions in standard drafting format and read and understand drawings prepared in accordance with Australian Standards. They should be proficient in visualising 3-D objects and phenomena; in applying analytical and computer techniques in geometrical modelling; in graphic communication; have developed effective study skills and learning practices; and have had practice at oral and written communication of technical material.

Topics covered include projection systems, 3-D geometry principal and auxiliary views; sketching, computational geometry and computer graphics; and written technical communication and oral presentation.

Assessment: One 3-hour end of semester examination (45%). A 10-page project (40%); tutorial sessions (7%) for engineering graphics and oral presentations and assignments for other engineering communication skills (8%) due throughout the semester.

436-121 Introduction to Mechanical Engineering

Note: Students may only gain credit for one of 436-121 or 436-101 Engineering Mechanics and Materials.

Credit points: 12.5

Coordinator: Prof M Good

Contact: Thirty-six hours of lectures and 24 hours of tutorials *(Semester 2, repeat Summer).*

Description: Upon completion, students should be able to calculate forces and moments in mechanisms and structures under load, determine torque and power transmission capacities of drive trains, solve problems involving basic kinematics and kinetics of simple spring-mass systems and acquire a basic understanding of the structure and mechanical properties of metals.

Topics include application of vector algebra to engineering systems, forces, moments, couples and resultants; properties of sections, analysis of machine components, friction, wedges and screws, power transmission systems; velocity and acceleration vectors, dynamics of simple systems and the concepts of momentum, impulse and conservation energy; atomic structure and bonding, structure of crystals, elastic deformation, plastic deformation and strengthening, fast fracture, fatigue, and creep.

Assessment: One 3-hour end of semester examination (85%) and two assignments of up to 1500 words each (15%) due throughout the semester.

436-201 Thermofluids 1

Credit points: 12.5

Coordinator: Prof.M Chong

Prerequisites: Students will be expected to be familiar with material covered in 100-level mathematics.

Contact: Thirty-four hours of lectures and 14 hours of tutorials and laboratory *(Semester 2).*

Description: Unit 1, Fluid Mechanics: Students should develop a fundamental understanding of basic principles of fluid statics and dynamics; gain experience in practical methodologies applied to the solution of engineering flow problems; have an ability to perform force and stability analysis in fluid statics; analyse control volumes analysis for continuity, energy and momentum balances; perform dimensional analysis; and understand fluid resistance, drag and lift.

Topics include fluid statics, static forces on submerged structures, stability of floating bodies; fluid dynamics; streamlines; pathlines and streaklines; conservation of mass, momentum and energy; Euler's equation and Bernoulli's equation; control volume analysis; dimensional analysis; incompressible flow in pipes and ducts; boundary layers; flow around immersed bodies; and drag and lift.

Unit 2, Thermodynamics: Students should develop an understanding of laws of thermodynamics and thermodynamic property relationships and how to apply these principles to engineering systems; understand non-flow and steady flow processes; understand second law limitations; formulate equations for process performance and cycle efficiency; and carry out combustion analysis.

Topics include heat and work, ideal non-flow and flow processes; laws of thermodynamics; Carnot's principle; Clausius inequality; direct and reversed heat engines; thermal efficiencies; properties of pure substances; change of phase; representation of properties; steam and air tables; and vapour equation of state, ideal gases.

Assessment: One 3-hour end of semester written examination (80%), laboratory work (5 experiments with reports, each up to 5000 words, scheduled throughout the semester) (20%).

436-202 Mechanics 1

Credit points: 12.5

Coordinator: Dr.J.Krodkiewski

Prerequisites: Students will be expected to be familiar with material covered in 436-121 Introduction to Mechanical Engineering (prior to 2005 436-101 Engineering Mechanics and Materials) and 100-level mathematics.

Contact: Thirty-six hours of lectures and 12 hours of tutorial and laboratory work *(Semester 1).*

Description: Unit 1, Mechanics of Materials: On completion of this unit, students should be able to understand elastic and inelastic behaviour; and determine stresses and deformations in common structural elements.

Topics covered include two-dimensional stress and strain analysis; principal values; Mohr's circle; failure criteria; inelastic behaviour; basic properties of beams, symmetric bending; flexure by McAulay's method, superposition, indeterminacy; torsion of round bars; stresses in cylindrical pressure vessels; and the compressive behaviour of short and long columns.

Unit 2, Dynamics of Machines: On completion of this unit students should understand principles of the two-dimensional mechanics of a rigid body. Be able to carry out dynamic analysis of planar mechanical system.

Topics covered include dynamics of a particle in terms of inertial frames (work, kinetic energy, power, equations of motion), plane dynamics of a rigid body (kinetic energy, moments of inertia, equations of motion), dynamics of plane mechanisms (constraints, mobility, degrees of freedom, equations of motion).

Assessment: One 3-hour end of semester written examination (80%), together with three assignments not exceeding 1400 words each due throughout the semester (20%)

436-204 Systems Modelling

Note: This subject requires code to be written in a version of C programming language and the use of Matlab. Students may avail themselves of a pre-semester week of language tuition.

Credit points: 12.5

Coordinator: Dr. A.Ooi

Prerequisites: Students will be expected to have a working knowledge of the material covered in 100-level mathematics, 433-171 Introduction to Programming (or equivalent), 431-101 Fundamentals of Electrical Engineering, 436-202 Mechanics 1 and 431-201 Engineering Analysis A (prior to 2001, 421-204 Engineering Analysis A) or equivalent.

Contact: Thirty-two hours of lectures and 16 hours of tutorials, assignments and laboratory work *(Semester 2).*

Description: Unit 1, Computational Mechanics: Upon completion students should be able to formulate algorithms into working computer programs in C language in order to solve engineering problems, and be aware of numerical errors inherent in many computational schemes.

Topics covered include fundamentals of numerical modelling; approximation and errors; roots of equations; numerical solution of linear algebraic equations; curve fitting and splines; interpolation and extrapolation; numerical differentiation and integration; pre- and post-computational analysis; and graphical representation of results.

Unit 2, Electro-mechanical Machine Behaviour: Upon completion students should be familiar with the concepts and terminology of electrical power engineering; be able to describe the construction of common electrical and mechanical power sources; understand the operating characteristics of common electrical and mechanical devices used for motive power; be able to construct time and frequency, domain models of simple electrical, mechanical, pneumatic and hydraulic engineering components and systems; and be able to compute time and frequency-domain responses of linear dynamical systems.

Topics covered include DC and AC power supplies and distribution systems; inverters, transformers and rectifiers; principles and operation of single and multi-phase AC machines, induction motors, and DC machines; solid-state control of machines, principles and operation of electro-hydraulic and electro-pneumatic servo valves and actuators, system modelling; and unified approach to modelling electrical, mechanical and thermal systems, block diagrams, transfer function and state-space representations, computation of transient, steady-state time responses, harmonic frequency responses and use of Matlab for system response calculations.

Assessment: Two 2-hour end-of-semester examinations, tutorial tests and assignments to be submitted throughout the semester. Unit 1: Computational Mechanics - Examination 30%; tutorial tests and assignments not exceeding 60 pages or equivalent 20%. Unit 2: Electro-mechanical Machine Behaviour - Examination 35%, tutorial tests and assignments not exceeding 50 pages or equivalent 15%.

Students will have to obtain a mark of at least 40% in each of the units in order to pass the subject.

436-284 Organisational Engineering

Note: Students may only gain credit for one of 436-284, 436-203 Manufacturing Studies 1, 436-363 Manufacturing Studies 2 or 436-383 Design & Industrial Psychology.

Credit points: 12.5

Coordinator: Dr Alan Smith

Prerequisites: Students will be expected to be familiar with material covered in level 100 mathematics.

Contact: Unit 1: 12 hours of lectures and 12 hours of tutorial/practice classes. Unit 2: 16 hours of lectures and 8 hours of tutorial/practice classes *(Semester 1).*

Description: This subject provides an introduction to management for manufacturing, mechatronics and mechanical engineers, focused around the achievement of organisational goals, and covering the major topics of strategy, systems, structure and resources, particularly people and money.

Unit 1, Industrial Psychology: Upon completion of this unit, students should have gained knowledge of human behaviour in work organisations; be able to identify relationships among organisational variables including formal structure, interpersonal relations, groups, managers and motivation theory; and be able to transfer their knowledge and skills to the behavioural problems of the future employers.

Topics covered include individual and group behaviour in organisations, particularly in small organisations; motivation, leadership and morale; organisational culture, group dynamics, conflict and its resolution; power, politics and ethics; and organisational change.

Unit 2, Engineering Economics: Upon completion, students should understand how engineers contribute to business (including costing and financial management); have acquired knowledge for measuring economic performance of people; be aware of competitive methods; and be able to assess equipment purchase proposals, cost a design and comprehend the principal ingredients required to manufacture and manage efficiently.

Topics covered include theory of perfectly competitive markets, theory of the firm, consumer theory, methods of competing and increasing gross margin; recording of business transactions, break-even calculations, sources of income, capital and operating expenditure; preparation of budgets and performance measurements, analysis and interpretation of financial statements (financial position, financial performance, funds movement), cash budgets; organisation charts and corporate structure; operation of service departments, decision making and personal communications; and costing of designs and services, criteria for equipment purchase and management information systems.

Assessment: Two examinations of 2 hours at the end of semester (70%), syndicate participation and presentations held throughout the semester (15%), four individual assignments each up to 1000 words excluding computations, tables, graphs, etc. due throughout the semester (15%). All components of assessment must be satisfactorily completed to pass the subject.

436-285 Engineering Design and Materials 1

Note: Students who have passed either 436-220 Engineering Design and Materials 1 OR 436-221 Engineering Design and Materials 2, MUST NOT enrol in this subject and must seek departmental course advice.

Credit points: 12.5

Coordinator: Dr C Burvill

Prerequisites: Students will be expected to be familiar with material covered in: 436-121 Introduction to Mechanical Engineering (prior to 2005, 436-101 Engineering Mechanics and Materials); 100-level mathematics and 436-105 Engineering Communciations.

Contact: Twenty-four hours of lectures and twenty-four hours of tutorials, guided design exercises and laboratory work *(Semester 1).*

Description: Unit 1, Engineering Design: Upon completion, students should comprehend fundamental concepts of engineering design through various stages of the design process; problem formulation and structuring, ideation, decision making and communication; have developed an awareness of the integrative nature of engineering design through the experience of balancing a range of factors, including uncertainties related to the environment; and have observed the close interrelation between the properties of engineering materials and the design process. Topics covered include general approach to design problems; invention, analysis, decision making; goal, objectives, criteria and constraints; strategies for synthesis and decision making; technical, ergonomic and economic factors; appraisal of benefit and cost; fault and failure analysis; probability, uncertainty, and assessment of risk; and interfacing geometric and mathematical models, sensitivity analyses, combinatorial search.

Unit 2, Engineering Materials: Upon completion, students should have further developed their understanding of the behaviour of materials, aided by laboratory exercises based on topics covered in 436-121 Introduction to Mechanical Engineering (prior to 2005 436-101 Engineering Mechanics and Materials). Topics covered include fast fracture, fatigue, creep, diffusion, phase equilibrium and diagrams, and phase transformation.

Assessment: Unit 1: One 2-hour end-of-semester examination (50%). Four assignments of equal weight due throughout the semester not exceeding 25 pages or equivalent per student. (50%).

Unit 2: One 2-hour end-of-semester examination of (80%). Three laboratory reports, each up to 2500 words plus up to 10 pages of supporting material (figures and tables), due throughout the semester (20%).

Completion and submission of satisfactory laboratory and assignments is a prerequisite for admission to the written examinations.

436-286 Engineering Design & Materials 2

Note: Students who have passed either 436-220 Engineering Design & Materials 1 OR 436-221 Engineering Design & Materials 2, MUST NOT enrol in this subject and must seek departmental course advice.

Credit points: 12.5

Coordinator: Mr J Weir

Prerequisites: Students will be expected to be familiar with material covered in: 436-121 Introduction to Mechanical Engineering (prior to 2005, 436-101 Engineering Mechanics and Materials); 100-level mathematics; 436-202 Mechanics 1 and 436-285 Engineering Design and Materials 1.

Contact: Twenty-four hours of lectures and twenty-four hours of tutorials, guided design exercises and laboratory work *(Semester 2).*

Description: Unit 1, Engineering Design: Upon completion, students should have gained practice in the skill of designing simple engineering components for structural integrity and be confident with practical work formulated in a graded progression from well delineated problems to dealing with complex and/or vaguely defined design tasks. Topics covered include failure modes for engineering systems, failure predictors for engineering components under multi-axial stress conditions; rational assessment of safety factors and maximum credible accident; integrity of structures and machines, design against failure; modeling of complex load-bearing systems in terms of simple engineering components; design of elements of structures and machines from first principles; design to resist fatigue, axial tension and compression, combined torsion, bending and internal pressure (only common metallic materials are considered); design of bolted and welded joints; and approaches to uncertainty in design problems, including those related to the environment.

Unit 2, Engineering Materials: Upon completion, students should be able to appreciate the interrelationship between the structure, processing and properties of materials and of key factors in the selection of appropriate materials for specific applications. Topics covered include metals, ceramics, polymers, composites, corrosion and oxidation.

Assessment: Unit 1: One 2-hour end-of-semester examination (50%). Seven assignments will be completed throughout the semester not exceeding 25 pages or equivalent per student (1 @ 12.5% and 6 @ 6.25% each).

Unit 2: One 2-hour end-of-semester examination (80%). Two laboratory reports, each up to 2500 words plus up to 10 pages of supporting material (figures and tables), due throughout the semester (20%).

Completion and submission of satisfactory laboratory and assignments is a prerequisite for admission to the written examinations.

436-311 Engineering Design & Processes 2

Credit points: 12.5

Coordinator: Mr J Weir

Prerequisites: Students will be expected to be familiar with material covered in 436-286 Engineering Design and Materials 2, (or prior to 2006 436-220 Engineering Design and Materials 1) and 436-384 Engineering Design and Processes 1.

Contact: Thirty-one hours of lectures and case studies, 12 hours of practical work in Engineering Design and five hours of tutorials and laboratory work *(Semester 2).*

Description: Unit 1, Engineering Design: Upon completion of this unit, students should have gained an appreciation of methods for synthesising solutions to open-ended design problems at an intermediate level of complexity in mechanical and manufacturing engineering; a deep understanding of the concepts and methods of designing for system and component integrity under conditions of fatigue and wear; and a deep understanding of information-based techniques for the management of engineering design.

Topics covered include general concepts of function, integrity, value, quality, efficient use of resources in the synthesis of solutions to design problems; gears and gear design; design for fatigue: characteristics of fatigue fracture, 2-D and 3-D stress conditions, cumulative damage hypothesis, Weibull distribution; design for wear: surface phenomena and tribology in design, application to bearings and seals; quantitative measures of reliability; and management of the design process: initial appreciation, information flows and networks, characteristics of manufacturing processes affecting product design.

Unit 2, Manufacturing Processes: Upon completion of this unit, students should understand the basic principles, objectives and performance characteristics of some major methods of shaping components; understand the variables affecting the performance of the various processes and the process capabilities; and, be able to predict main forming parameters, such as loads, pressures and work of deformation for simple deformation.

Topics covered include principles, performance characteristics and process selection of manufacturing processes. Metals: metal forming as a system; metal forming processes including sheet metal forming, drawing forging, net shape manufacturing; process modelling; casting and moulding processes; and ceramics and powder metallurgy: pressing, plastic forming, injection moulding and casting; drying and firing.

Assessment: Two 2-hour end-of-semester examinations (55%); tests, continuous assessment throughout the semester of group and individual projects, assignments and laboratory reports not exceeding 16000 words (40 pages excluding computations, tables, graphs, diagrams) (45%). All components of assessment must be satisfactorily completed to pass the subject.

436-351 Thermofluids 2

Credit points: 12.5

Coordinator: Dr.A.Ooi

Prerequisites: Students will be expected to be familiar with the material of 436-201 Thermofluids 1 and 200-level mathematics.

Contact: Unit 1: Twenty hours of lectures, four hours of tutorials and laboratory work. Unit 2: Sixteen hours of lectures, eight hours of tutorials and laboratory work *(Semester 1).*

Description: Unit 1, Fluid Dynamics: On completion of this unit students should be able to analyse inviscid flow of an incompressible fluid for simple boundary conditions and know where the concepts are applicable in practice; appreciate the application of Laplace's equation to a number of phenomena including fluid flow; be able to use complex velocity potential analysis to solve a variety of inviscid flow problems including incompressible flow past airfoils; and know the basic characteristics of pumps and fans and their classification and how to match these with operating systems.

Topics covered include basic introduction to inviscid flow with and without vorticity; concepts and analysis using stream function and velocity potential; incompressible viscous flow past bodies with vortex shedding; and basic equations of pumps and fans and their classification and characteristics.

Unit 2, Thermodynamics: On completion of this unit students should have an understanding of the fundamentals of heat transfer under steady and unsteady conditions; appreciate the application of Laplace's equation to heat conduction; understand the principles of thermodynamic plant design including heat and mass transfer; and have a working knowledge of heat exchangers and regenerators.

Topics covered include thermal conduction in steady and unsteady conditions; convection, Reynolds analogy and dimensional analysis; free and forced convection; radiation heat transfer; heat and mass transfer, boiling and condensation; and heat exchangers and regenerators, heat exchanger applications.

Assessment: One 3-hour end-of-semester examination. Tutorial tests and assignments to be submitted throughout the semester. Unit 1 Fluid Mechanics: Examination 35%; laboratory 5% and assignments not exceeding 30 pages or equivalent 15%. Unit 2 Thermodynamics: Examination 35%, one assignment not exceeding 15 pages 5%, laboratory oral examination (15 minutes) 5%.

436-352 Thermofluids 3

Credit points: 12.5

Coordinator: Dr M Brear

Prerequisites: Students will be expected to be familiar with the material of 436-351 Thermofluids 2 and 200-level mathematics.

Contact: Unit 1: Twenty hours of lectures, four hours of tutorials and laboratory work. Unit 2: Sixteen hours of lectures, eight hours of tutorials and laboratory work *(Semester 2).*

Description: Unit 1, Aerodynamics: Upon completion, students should be familiar with further theory of airfoils and gas dynamics in subsonic and supersonic flow; be able to apply shock expansion theory to the solution of flow in a variety of situations including prediction of lift and drag of two-dimensional bodies in supersonic flow; be able to apply Ackeret or linear theory to thin airfoils; and be aware of viscous effects, boundary layer and shock wave interactions.

Topics covered include theories of thin airfoils; gas dynamics in subsonic and supersonic flow; shock expansion theory; and boundary layer and shock wave interactions.

Unit 2, Thermodynamics: Upon completion, students should understand the principles of combustion in single and two phase fluids; comprehend the benefits and costs (including some environmental and management implications) of refinements in plant design and/or working fluid; and appreciate the complexity of real plant performance evaluation.

Topics covered include cycles of simple and compound compressors; gas turbines, influence of reheat, intercooling and design parameters; refrigeration, vapour compression and absorption cycles and gas liquefaction; steam plant, with superheating, regeneration and feed water heating; and spark ignition and diesel engines and their fuels.

Assessment: One 3-hour end of semester examination. Tutorial tests, assignments and laboratory reports not exceeding 30 pages due throughout the semester. The weighting of assessment components is: Unit 1 Aerodynamics: Examination 35%. Tutorial tests, assignments and laboratory reports 15%. Unit 2 Thermodynamics: Examination 35%. Tutorial tests, assignments and laboratory reports 15%.

436-353 Mechanics 2

Credit points: 12.5

Coordinator: Dr C Burvill

Prerequisites: Students will be expected to be familiar with the material of 436-202 Mechanics 1 and 200-level mathematics.

Contact: Unit 1: Eighteen hours of lectures, six hours of tutorial and laboratory work. Unit 2: Seventeen hours of lectures, seven hours of tutorial and laboratory work *(Semester 1).*

Description: Unit 1, Stress Analysis: Upon completion of this unit, students should understand the principles of energy methods as applied to solving a variety of problems in elasticity, including statically indeterminate ones; comprehend the nature of inelastic deformation and its basic governing laws together with their application to simple manufacturing processes; and understand the techniques of experimental stress analysis.

Topics covered include energy methods in stress analysis, stationary potential and complementary energy theorems, virtual work, Castigliano's first and second theorems, method of Rayleigh-Ritz, statically indeterminate systems, suddenly applied loads, impact stresses, inelastic behaviour, yield criteria, constitutive relations, work hardening, basic problems in inelastic deformation, thermal stresses and experimental stress analysis.

Unit 2, Mechanics of Rigid Bodies: Upon completion of this unit students should be able to understand the principles of three-dimensional mechanics of rigid body and carry out kinematic analysis of mechanical systems.

Topics covered include motion of particles in terms of inertial frames, motion of particles in terms of translating and rotating frames, matrix of directional cosines, Euler's angles, angular velocity and angular acceleration, Coriolis statement, motion of a rigid body, kinetics of a system of particles, linear and angular momentum, inertia constants, parallel axes theorem, principal axes, Euler equations, and modified Euler equations.

Assessment: One 3-hour examination at the end of semester (80%). Two assignments each up to 1000 words (20%) due throughout the semester.

436-354 Mechanics 3

Credit points: 12.5

Coordinator: Dr K Brown

Prerequisites: Students will be expected to be familiar with the material of 436-353 Mechanics 2 and 200-level mathematics.

Contact: Unit 1: Eighteen hours of lectures and six hours of tutorials and laboratory. Unit 2: Thirteen hours of lectures and 11 hours of tutorials and laboratory *(Semester 2).*

Description: Unit 1, Stress Analysis: Upon completion of this unit, students should be able to model a variety of mechanical engineering structures as a number of elementary components and stress analyse each component to determine failure loads and deflections of the complete structure.

Topics covered include engineering plasticity, design of pressure vessels and pipes, thick-walled cylinders, shrink fitting, duplex pressure vessels, inelastic deformation, residual stresses, membrane theory of shells of revolution, yielding, rotating shells, local bending stresses, stress analysis of rotating discs with and without holes, shrink fitting, initial and ultimate yielding, fracture mechanics and fatigue, and introduction to the finite element method.

Unit 2, Dynamics of Mechanical Systems: Upon completion, students should be able to formulate physical and mathematical models for three-dimensional dynamic analysis of mechanical systems, solve the mathematical models by means of analytical and numerical methods and assess stability of their solutions.

Topics covered include constraints, mobility, generalised coordinates, number of degrees of freedom, driving forces, virtual displacement, generalised force, impressed forces and constraint forces, principle of virtual work, Lagrange equations of motion, kinetic energy function, potential energy function, collisions of unconstrained and constrained bodies, and analysis of mathematical models.

Assessment: One 3-hour examination at the end of semester (80%).

Unit 1: assignment of up to 1000 words (10%).

Unit 2: assignment of up to 1000 words (5%) and 2 laboratory reports (5%) due throughout the semester.

436-382 Control Systems 1

Credit points: 12.5

Coordinator: Dr M Brear

Prerequisites: Students will be expected to be familiar with material covered in 436-204 Systems Modelling or 431-221 Fundamentals of Signals and Systems.

Contact: Thirty-six hours of lectures, 12 hours of tutorials and practical work *(Semester 1).*

Description: Upon completion students should be familiar with the concepts and terminology of classical linear control design including lead, lag and lag-lead controllers and PID control; know how to draw and analyse Nyquist plots and the root locus; be familiar with the basics of digital controlling including quantisation, ADC, DAC, Z-transforms and design by emulation; understand the principles of filtering and amplification; including filter design, signal conditioning, sensor characteristics and non-linear effects; be able to perform and analyse Fast Fourier Transforms and Discrete Fourier Transforms; and understand how to program PLCs.

Assessment: One 3-hour end-of-semester examination (70%); two assignments each up to 15 pages (20%) and one laboratory report of up to 15 pages (10%), to be submitted throughout the semester.

436-384 Engineering Design & Processes 1

Note: Students may only gain credit for one of 436-384 Engineering Design & Processes 1 or 436-203 Manufacturing Studies 1.

Credit points: 12.5

Coordinator: Mr J Weir

Prerequisites: Students will be expected to be familiar with material covered in 436-285 Engineering Design and Materials 1 (or prior to 2006 436-221 Engineering Design & Materials 2).

Contact: Twenty-nine hours of lectures and case studies, 12 hours of practical work in engineering design and seven hours of tutorials and laboratory work *(Semester 1).*

Description: Unit 1, Engineering Design: Upon completion of this unit, students should be skilled in synthesising solutions to open-ended design problems at an intermediate level of complexity in mechanical engineering, skilled in the management of design projects requiring the solution of such problems; have gained an appreciation of computer-based methods in concurrent design; and have gained a deep understanding of the concepts and methods of designing for quality, of managing variability and of integrating design with downstream manufacturing operations. Students who choose to can also gain a deep understanding of concepts and methods employed in assessing and moderating environmental impacts in the context of the wider design process. Topics include concurrent design of systems and products; computer-based techniques for geometric modelling, materials selection, service simulations and representation of manufacturing knowledge; management of variability in product geometry and performance; tolerance technology in 1-D, 2-D and 3-D applications, techniques for robust design; quality assurance in engineering design; and life cycle design, quality function deployment, causal networks and failure modes and effects analyses, ISO 9001 and traceability of critical decisions. Unit 2, Manufacturing Processes: Upon completion of this unit, students should understand the basic principles, objectives and performance characteristics of some major methods of shaping components; understand the variables affecting the performance of the various processes and the process capabilities; and be able to develop cutting analyses for 'classical' and practical turning operations. Topics covered include principles, performance characteristics and process selection of manufacturing processes. Metals: machining as a means of shaping components, chip formation and mechanics of cutting; prediction of force, torque power, chip flow and surface finish for single point turning operations; finishing operations and fabrication methods.

Assessment: Two 2-hour end-of-semester examinations (55%); tests, continuous assessment throughout the semester of group and individual projects, assignments and laboratory reports not exceeding 16,000 words (40 pages excluding computations, tables, graphs, diagrams) (45%). All components of assessment must be satisfactorily completed to pass the subject.

436-414 Optimisation

Credit points: 12.5

Coordinator: Assoc Prof S Halgamuge

Prerequisites: 200-level Mathematics and 620-370 Statistics for Mechanical Engineers or equivalent.

Contact: Twenty-four lectures and 24 hours of tutorial/projects/practice classes *(Semester 2).*

Description: Upon completion, students should be able to model and solve a range of decision-making problems in Mechanical, Biomedical and Mechatronic engineering by applying the techniques of mathematical programming, stochastic modelling and Optimisation.

Topics covered include modeling and optimization methods in Artificial Intelligence, decision theory, basics of Convex Optimisation, queuing models and Markov processes.

Assessment: One 3-hour end-of-semester examination (70%); one written project report of up to 6,000 words with no more than 10 pages of supporting material (appendices, diagrams, tables etc) due towards the end of the semester (30%).

436-415 Quality Engineering

Credit points: 12.5

Coordinator: Dr A Smith

Prerequisites: 620-370 Statistics for Mechanical Engineers or equivalent.

Contact: Thirty lectures and 18 hours of tutorial/practice class work *(Semester 2).*

Description: Upon completion of this subject, students should be able to understand what constitutes a quality system (both generally and with respect to international standards); develop strategies for implementing a quality system and its components; identify quality costs and use them for the economic analysis of quality projects; understand and quantify the relationships between process capability and tolerances; design a 'single' attribute or variables sampling scheme to meet stated requirements, analyse and assess all common types of sampling schemes; design, analyse and interpret 'Shewhart-type' process control charts and CUSUMS for process control.

Topics covered include total quality management, productivity and cost relationships; quality systems and their components, including international standards; interaction between quality and design functions; alternate systems approaches, including leading international concepts; quality control: the control function in quality; theory of sampling; the operating characteristic curve; the use of statistical distributions; sampling scheme design and analysis; quality improvement: process variability - measures and interaction with design; process capability and improvement studies; control charting; state of statistical stability; computerisation of process monitoring; cumulative sum techniques for quality studies; experimental design for quality improvement.

Assessment: One 3-hour examination at the end of semester (70%), 3 assignments and 1 lab report not exceeding 2200 words each excluding appendices, computations, diagrams, tables and computer output due throughout the semester (30%).

436-419 Computational Biomechanics

Credit points: 12.5

Coordinator: Prof Marcus Pandy

Prerequisites: 620-143 Applied Mathematics or equivalent, 436-202 Mechanics 1.

Contact: Thirty-six hours of lectures and 12 hours of tutorials *(Semester 2).*

Description: On completion of this subject students should gain an understanding of the structure and function of the skeletal, muscular, and sensory systems of the human body. Students should also be able to formulate simple, integrative models of the human neuromusculoskeletal system; and to use computational models of the human body to analyse muscle function during activities like standing, walking, running and jumping.

Assessment: Two 1-hour quizzes distributed throughout the semester, each valued at 5% of the total grade for the subject. Four homework assignments distributed throughout the semester, each valued at 10% of the total grade. One final exam of 2-hour duration valued at 50% of the total grade.

436-421 Power Generation Systems

Credit points: 12.5

Coordinator: Prof Harry Watson

Prerequisites: 436-432 Thermofluids 4 (or knowledge of equivalent thermodynamics content).

Contact: Forty hours of lectures and 8 hours of laboratory classes *(Semester 2).*

Description: Upon completion, students should be able to analyse and design a range of energy conversion equipment and to appreciate the directions in which the technology and operating economics will evolve towards energy sustainability through improved performance and alternative fuels' application.

The content of this course will compromise the selections from steam turbines, boiler design and control characteristics; cycle optimisation; economics of plant operation; gas turbines; cycle performance; stationary and aircraft gas turbines; working with fluids in open and closed cycles; component matching and off-design operation; engines; ideal air and fuel-air cycles; effect of fuel composition dissociation and heat transfer on efficiency; characteristics of spark ignition and diesel engines; advanced engine simulation abnormal combustion; unsteady gas dynamics; isentropic and non-isentropic wave propagation; one-dimensional unsteady compressible flow; pressure exchangers and exhaust systems; turbocharging; compressor and turbine characteristics; turbine performance and turbocharged/engine matching; properties of alternative fossil and bio fuels compared with conventional fuels in engine applications including their storage, supply, combustion, emissions and life cycle environmental impacts.

Assessment: One 3-hour examination at the end of semester (65%). 3 assignments each not exceeding 5 pages (15%) and 2 laboratory reports (20%) each not exceeding 8 pages, including analysis, diagrams and tables, due throughout the semester.

436-431 Mechanics 4

Credit points: 12.5

Coordinator: Dr K Brown

Prerequisites: 436-354 Mechanics 3 or equivalent.

Contact: Forty lectures and eight hours of tutorials and laboratory work *(Semester 1).*

Description: Unit 1, Mechanics of Solids: Upon completion, students should be able to formulate physical and mathematical models of mechanical systems for stress analysis, obtain solutions using analytical and/or numerical methods and have an increased understanding of the stress analysis of complex structures.

Topics covered include mathematical theory of elasticity in three dimensions; reduction to two dimensions; plane stress and plane strain; Airy's stress function and its application to practical problems; finite difference and finite element methods; and torsion.

Unit 2, Dynamics: Upon completion, students should be able to formulate physical and mathematical models of mechanical systems for vibration analysis, obtain solutions using analytical and/or numerical methods and have an increased understanding of vibration analysis of complex structures.

Topics include vibration of discrete and continuous systems; modal analysis; vibration isolation; torsional and bending vibrations; vibration absorbers; and system identification.

Assessment: Two 2-hour examinations (40% each) and a assignment not exceeding 20 pages including computations, diagrams, tables and computer output (20%).

436-432 Thermofluids 4

Credit points: 12.5

Coordinator: Prof H Watson

Prerequisites: 436-352 Thermofluids 3 or equivalent

Contact: Thirty-six hours of lectures and 12 hours of laboratory classes *(Semester 1).*

Description: Upon completion, students should have gained the ability to analyse and design a wide range of fluid mechanical devices and comprehend several fundamental engineering problems through analysing and studying boundary layers and turbulence; and understand the principles of operation and optimisation of combustion and air conditioning equipment for improved performance, including the quality of the air environment or workplace.

Topics covered include wing theory: Prandtl lifting line; three-dimensional effects; aircraft performance; propellers, jets and fans and pumps; waves, ship resistance; model testing; wave resistance, ocean waves; boundary layers: Navier-Stokes equations; Prandtl's assumptions; Laminar solutions; Von Karman's momentum integral equation; transition; turbulence; turbulent boundary layers; turbulent flow in pipes and ducts; mass transfer, air conditioning and refrigeration; applications to heating, cooling, humidification and dehumidification; combustion; equilibrium and rate controlled reactions; ignition, stability and flammability limits; detonation, premixed and diffusion flames; radiation in combustion; and pollution control.

Assessment: One 3-hour end of semester examination (75%). Two assignments of up to 5 pages each (7.5%) and three laboratory reports not exceeding 10 pages each (17.5%) due throughout the semester.

436-436 Advanced Computational Mechanics

Availability: This subject may not be offered every year. Please refer to the Department of Mechanical and Manufacturing Engineering.

Credit points: 12.5

Coordinator: Dr A Ooi

Prerequisites: 431-202 Engineering Analysis B (prior to 2001, 421-205 Engineering Analysis B), 431226 Engineering Analysis B (old) or equivalent.

Contact: Thirty-six hours of lectures and 12 hours of practice classes *(Semester 2).*

Description: Upon completion, students should be able to comprehend a wide variety of numerical computational techniques for solving ordinary and partial differential equations frequently encountered in engineering problems and identify the strengths and weaknesses of the various competing computational methods.

Topics covered include modelling engineering systems using ordinary and partial differential equations; finite difference schemes; and weighted residual methods and spectral methods.

All necessary theories in order for students to be able to use commercial computational fluid dynamics (CFD) software proficiently.

Assessment: One 3-hour end-of-semester examination (60%); two assignments, each not exceeding 50 pages including diagrams, tables, computations and computer output due throughout the semester (20% each).

436-439 Dynamics of Rotors

Credit points: 12.5

Coordinator: Dr Janusz Krodkiewski

Prerequisites: 436-354 Mechanics 3 and 436-431 Mechanics 4 or equivalent

Contact: Thirty-six hours of lectures, six hours tutorials and six hours of laboratory work *(Semester 2).*

Description: Upon completion students should be able to formulate mathematical models of machine sub-systems (shafts, bearings, rigid and elastic elements, foundations); be able to create a mathematical model of a complex rotor-bearing-foundation system including the dynamic properties of its subsystems, unbalanced forces, environmental excitation and accuracy of manufacturing; and be able to carry out analysis of the formulated mathematical models to assess equilibrium position, critical speeds and stability of motion of the rotor system; become familiar with the phenomena produced by the internal and external damping, the gyroscopic effect and lack of symmetry of the cross-section of rotors, non-linearity and anisotropy of supporting structures.

Topics covered include modelling of shafts, rigid and elastic elements, bearings and foundations; composition of mathematical model of rotor systems; condensation techniques; analysis: equilibrium position, response to the external excitation, free vibration, stability of equilibrium position; influence of the internal and external damping; influence of the gyroscopic effect and rotor with non-circular cross-section; passive and active control of vibrations.

Assessment: One end of semester 3-hour written examination (75%), together with one assignment not exceeding 1400 words (15%) and laboratory reports not exceeding 400 words each due throughout semester (10%).

436-443 Production Engineering

Credit points: 12.5

Coordinator: Dr Alan Smith

Prerequisites: 436-384 Engineering Design & Processes 1 (or 436-203 Manufacturing Studies 1 or 436-362 Design/Processes) and 620-370 Statistics for Mechanical Engineers or equivalent.

Contact: Unit 1: 24 lectures and 4 hours of laboratory work; unit 2: 12 lectures and 8 hours of tutorial and laboratory work *(Semester 2).*

Description: Subject consists of two units. The first is principally concerned with analysis of material removal processes in a consistent and predictive manner, and machine tools, the second with dimensional measurement science and its application to the solution of mechanical and manufacturing engineering measurement problems. Topics covered may include for unit 1: principles, performance characteristics and process selection of manufacturing processes; overview of casting, moulding and other forming, bulk deformation processes, material removal, finishing and fabrication; chip formation and mechanics of cutting; turning operations, single point lathe tools; prediction of force, torque power, chip flow and surface finish in turning; tool life characteristics and determination; optimisation analyses for turning; application of the Unified General Mechanics of Machining Approach to drilling, milling or form tools; abrasive processes; specification and inspection of machine tools. Unit 2: length, angle and form tolerances; standards; statistical estimation of measurement error; gauging and measurement systems design; lasers, interferometry and collimation; measurement of surface finish; computer controlled co-ordinate measuring machines.

Assessment: One 3-hour examination at the end of semester (70%), 4 laboratory reports and/or assignments not exceeding 2000 words each excluding appendices, computations, diagrams, tables and computer output due throughout the semester (30%). All components of assessment must be satisfactorily completed to pass the subject.

436-459 Advanced Control and Automation

Credit points: 12.5

Coordinator: Prof Malcolm Good

Prerequisites: Students will be expected to be familiar with material covered in 436-470 Control Systems 2. (Prior to 2005, 436-433 Mechanical Systems)

Contact: Thirty hours of lectures and seminars, and 18 hours of tutorials, practical work and industrial contact *(Semester 2).*

Description: This subject is concerned with multivariable and nonlinear control theory, and applications of control theory in a variety of complex automated systems. On completion, students should have sufficient knowledge and understanding to make effective use of the relevant research literature, have gained practical experience in the design and implementation of advanced control systems using state-of-the-art development tools, and be familiar with a number of industrial applications.

Advanced control topics will be selected from linear quadratic optimal control and estimation, loop shaping methods, feedback linearisation, backstepping, sliding mode and adaptive control, and fuzzy/neural systems. Applications will be drawn from industrial, medical and transport automation (e.g., robots, machine tools, production machines, laboratory automation, automotive and aerospace by-wire systems).

Assessment: One 3-hour end of semester examination (50%) and three assignments of up to 5000 words each (50%) due throughout the semester.

436-460 Advanced Engineering Materials

Credit points: 12.5

Coordinator: Assoc Prof K Xia

Prerequisites: 436-121 Introduction to Mechanical Engineering (prior to 2005 436-101 Engineering Mechanics and Materials), 436-220 Engineering Design and Materials and 436-221 Engineering Design and Materials 2

Contact: Twenty-four lectures and 24 hours of project work *(Semester 2).*

Description: Upon completion, students should be familiar with a selection of advanced materials and related processes; have a basic understanding of the scientific and technological aspects of these materials and processes; and appreciate the use of these advanced materials in engineering applications.

Unit 1- Advanced Metallic Materials: Introduction to advanced materials. Advanced light alloys, Superalloys, Metal matrix composites, Intermetallic alloys, Ultrafine and nano structured materials.

Unit 2 - Advanced Non-Metallic Materials: Polymers, Ceramics, Composites (polymer and metallic based), Biomaterials, and Functional materials.

Assessment: Unit 1: One written report of up to 6000 words with no more than 20 pages of supporting material (appendices, diagrams, tables, computations and computer output) to be submitted in the second half of the semester (40%) and a 15 minute oral presentation of major findings before an audience of students and teaching staff to be held in the final weeks of the semester (10%).

Unit 2: Two written reports, each up to 3000 words, with no more than 10 pages of supporting material (appendices, diagrams, tables, computations and computer output) to be submitted throughout the semester (40%) and a 15 minute oral presentation of major findings before an audience of students and teaching staff to be held in the final weeks of the semester (10%).

436-461 Advanced Mechanics of Solids

Note: This subject may NOT be offered every year. Please refer to the Department of Mechanical and Manufacturing Engineering.

Credit points: 12.5

Prerequisites: 436-431 Mechanics 4 or equivalent.

Contact: Thirty-six hours of lectures and 12 hours of tutorials, assignments and /or laboratories *(Not Offered).*

Description: Students completing this subject should have a deeper understanding of the finite element method and develop advanced analysis skills in the other topics selected.

The content of the subject will comprise a selection from the finite element method and its application to practical problems in stress analysis; bending and buckling of plates and shells, anisotropic elasticity and its application to composite materials; viscoelasticity and engineering plasticity.

Assessment: One 3-hour examination at the end of semester (80%), 2 assignments not exceeding 2000 words each excluding computations, diagrams, tables and computer output due half and three-quarters of the way through the semester (20%).

436-465 Advanced Fluid Mechanics

Credit points: 12.5

Coordinator: Prof M Chong

Prerequisites: 436-432 Thermofulids 4 or equivalent

Contact: Thirty-six hours of lectures and 12 hours of tutorials, assignments and/or laboratories *(Semester 2).*

Description: Upon completion, students should be able to understand and apply theories and techniques which are at the forefront of fluid mechanics research.

Topics include critical point theory, flow pattern topology; vortex dynamics; and theories of turbulence.

Assessment: One 3-hour examination (100%) at the end of semester.

436-466 Renewable Energy

Availability: This subject may not be offered every year. Please refer to the Department of Mechanical and Manufacturing Engineering

Credit points: 12.5

Coordinator: Dr K Brown

Prerequisites: 436-351 Thermofluids 2 or equivalent

Contact: Thirty-two hours of lectures and 16 hours of practice classes *(Not Offered).*

Description: Upon completion students should understand the distribution and variability of the wind as an energy source, and the limitations of wind energy devices in harnessing this energy; and have developed a comprehension of wind turbine design parameters and skill in performance estimation and component design for a range of applications. Students should also understand the distribution of solar energy and the limitations that this places on the performance of solar energy systems; and comprehend the importance of materials and losses in the systems performance and have knowledge and skill in solar systems selection and design methods.

Topics covered include a selection from nature and availability of wind energy; wind turbines, classification, construction and control; performance evaluation methods; power, efficiency, reliability and cost; load matching; nature and availability of solar radiation; radiation estimations and measuring instruments; materials for solar energy utilisation, radiative properties and thermal transport properties; introduction to non-concentrating collectors, design techniques and performance estimation; solar component and solar system operational characteristics; practical applications of solar energy, special solar devices for developing countries; and desalination, photovoltaics and solar water pumping.

Assessment: One 3-hour examination (60%) and practical work not exceeding 20 pages including computations, diagrams, tables and computer output. Each student will make a 10 minute oral presentation on the subject of his or her practical work near the end of the semester (40%).

436-470 Control Systems 2

Credit points: 12.5

Coordinator: Dr Chris Manzie

Prerequisites: Students will be expected to be familiar with material covered in 436-382 Control Systems 1. (Prior to 2005 436-356 Design/Control 2, 436-371 or equivalent).

Contact: Thirty-six hours of lectures and 12 hours tutorials *(Semester 1).*

Description: Upon completion students should understand the concepts of linearisation, and state-space control and estimation, be able to obtain state-space realisations of systems in several canonical forms and assess stability, controllability and observability; be able to design a state feedback control law and a state estimator to achieve desired closed looped-response; understand the effects of sampling rates and quantisation, be able to design simple digital controllers to single-output systems using classical and state space-methods; understand how to implement continuous and discrete controllers in the real world; be familiar with case studies or real world controller-design problems, and be able perform least squares identification on linear systems.

Assessment: Two 1-hour mid-semester tests (7.5% each); two group assignments, each up to 8000 words (10% each) due throughout the semester; one end-of-semester 3-hour examination (65%).

436-492 Major Project and Professional Practice

Credit points: 25

Coordinator: Assoc Prof S Halgamuge

Prerequisites: 436-384 Design and Proecesses 1 and 436-311 Design and Processes 2, or equivalent (prior to 2005, 436-356 Design/Control 2 or 436-371 Mechatronics Design and Laboratory 4).

Contact: Up to thirty-six hours of lectures and seventy-two hours of department-based practical project engineering *(Year long).*

Description: Upon completion, students will have developed the ability to apply the knowledge gained in other subjects to successfully investigate a substantial engineering design or research problem. Experience will be gained in collaborative project work, sourcing and collating information that may be associated with disciplines beyond the scope of prior coursework, developing hypotheses from which engineering decisions will be made, and the reporting contributions arising from project and professional practice activities.

Unit 1: Major Project:

This unit involves undertaking a major project, requiring an independent investigation and the preparation of reports on an approved topic in advanced engineering design or research. Students will present their findings in a conference podium presentation format, held at the end of the project cycle in the latter half of semester two. The emphasis of the project can be associated with either:

- a well-defined project description, often based on a task required by an external, industrial client. Students will be tutored in the synthesis of practical solutions to complex technical problems within a structured working environment, as if they were professional engineering practitioners; or
- a project description that will require an explorative approach, where students will pursue outcomes associated with new knowledge or understanding, within the mechanical science disciplines, often as an adjunct to existing academic research initiatives.

It is expected that the major project will incorporate findings associated with both well-defined professional practice and research principles.

Unit 2: Professional Practice:

Upon completion of this unit, students will have developed an appreciation of the role of technology in society, the responsibilities of engineers with respect to their fellow workers, society and the environment. Topics covered include:

- research methodologies: reviewing literature, preparing and executing a research program, peer review of findings, academic research case studies;
- design processes: conceptual design, integration of design and manufacturing; quality assessment, project management, concurrent engineering;
- engineering profession: historical, sociological and environmental factors in invention and innovation, technology forecasting, patenting, professional ethics, statutory requirements and legal responsibilities, environment considerations, and human relations.

Assessment: All components of assessment must be satisfactorily completed to pass the subject.

Unit 1: Major Project (85% of overall mark).

Two interim reports, each 5%.

Continuous assessment, identifying effort, progress and contributions over the entire project cycle (10%). A professional engineering project report (Final Report) of no more than 10,000 words (40 pages), excluding appendices of supporting material that can include diagrams, tables, computations and computer output (40%). A summary of the important findings contained in the Final Report. The format of the summary will follow a specified research paper template (5%). Technical oral examination of no more than one hour duration. Technical oral examination includes a formal presentation followed by questions from an academic supervisor and academic examiner (10%).

Major Project Exhibition:

a. Lay-person oral examination of no more than 20 minutes duration (5%).

b. Static display materials (e.g. poster, computer demonstration, prototype) (5%).

Unit 2: Professional Practice (15% of overall mark). Two assignments based on lecture material (one per semester) not exceeding 1000 words per student (10%). Debate participation and public speaking (5%).

436-494 Directed Studies A

Availability: This subject may not be offered every year, please refer to the Department of Mechanical and Manufacturing Engineering.

Credit points: 12.5

Prerequisites: Selected 300-level subjects to be announced annually.

Contact: Thirty-two hours of lectures and 16 hours of tutorials and project work *(Not Offered).*

Description: Upon completion of this subject, students should be familiar with the basic precepts of a particular research topic in mechanical, manufacturing, mechatronic or environmental engineering.

The content of this subject will change from year to year and will be used to present new research-oriented topics in mechanical, manufacturing, mechatronic and environmental engineering, and will generally be presented by researchers who are visiting the department.

Assessment: One 3-hour examination at the end of semester (60%), 2 syndicate presentations and 2 project reports not exceeding 2500 words each excluding computations, diagrams, tables and computer output due throughout the semester (40%).

436-495 Directed Studies B

Availability: This subject may not be offered every year, please refer to the Department of Mechanical and Manufacturing Engineering.

Credit points: 12.5

Prerequisites: Selected 300-level subjects to be announced annually

Contact: Thirty-two hours of lectures and 16 hours of tutorials and project work *(Not Offered).*

Description: Upon completion of this subject students should be familiar with the basic precepts of a particular research topic in mechanical, manufacturing, mechatronic or environmental engineering.

The content of this subject will change from year to year and will be used to present new research-oriented topics in mechanical, manufacturing, mechatronic and environmental engineering, and will generally be presented by researchers who are visiting the department.

Assessment: One 3-hour examination at the end of semester (60%), 2 syndicate presentations and 2 project reports not exceeding 2500 words each excluding computations, diagrams, tables and computer output due throughout the semester (40%).

436-805 Solar Energy Engineering

Availability: This subject may not be offered every year. Please refer to the Department of Mechanical and Manufacturing Engineering.

Credit points: 6.25

Coordinator: Dr K Brown

Contact: Sixteen hours of lectures and eight hours of practice classes *(Semester 1).*

Description: Upon completion students should understand the distribution of solar energy and the limitations that this places on the performance of solar energy systems; comprehend the importance of materials and losses in the systems performance; and have knowledge and skill in solar systems selection and design methods.

Topics covered include nature and availability of solar radiation; radiation estimations and measuring instruments; materials for solar energy utilisation, radiative properties and thermal transport properties; introduction to non-concentrating collectors, design techniques and performance estimation; solar component and solar system operational characteristics; and practical applications of solar energy, special solar devices for developing countries: desalination, photovoltaics and solar water pumping.

Assessment: One 3-hour examination (60%) and practical work not exceeding 20 pages including computations, diagrams, tables and computer output. Each student will make a 10 minute oral presentation on the subject of his or her practical work near the end of the semester (40%).

620-121 Mathematics A (Advanced)

See full subject details on page 4.

620-122 Mathematics B (Advanced)

See full subject details on page 4.

620-123 Applied Mathematics (Advanced)

See full subject details on page 4.

620-141 Mathematics A

See full subject details on page 5.

620-142 Mathematics B

See full subject details on page 5.

620-143 Applied Mathematics

See full subject details on page 5.

620-160 Experimental Design & Data Analysis

See full subject details on page 5.

620-201 Probability

See full subject details on page 6.

620-231 Vector Analysis

See full subject details on page 7.

620-232 Mathematical Methods

See full subject details on page 7.

620-252 Analysis

See full subject details on page 8.

620-331 Applied Partial Differential Equations

See full subject details on page 10.

620-332 Integral Transforms & Asymptotics

See full subject details on page 10.

620-370 Statistics for Mechanical Engineers

See full subject details on page 12.

640-121 Physics A (Adv)

See full subject details on page 2.

640-122 Physics B (Adv)

See full subject details on page 2.

640-141 Physics A

See full subject details on page 2.

640-142 Physics B

See full subject details on page 3.