The University of Sydney

Faculty of Engineering

Handbook

1997

Faculty of Engineering Handbook 1997
©The University of Sydney 1996
ISSN 1034-2648

The University of Sydney
N.S.W. 2006
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Semester and vacation dates 1997*

Semester	Day	1997
First Semester and lectures begin	Monday	3 March
Easter recess		
Last day of lectures	Thursday	27 March
Lectures resume	Monday	7 April
Study vacation -1 week beginning	Monday	16 June
Examinations commence	Monday	23 June
Second Semester and lectures begin	Monday	28 July
Mid-semester recess		
Last day of lectures	Friday	26 September
Lectures resume	Tuesday	7 October
Study vacation -1 week beginning	Monday	10 November
Examinations commence	Monday	17 November

There may be variations to the semester dates for some courses.

Set in 10 on 11.5 Palatine Produced by the Publications Unit, The University of Sydney. Printed in Australia by Printing Headquarters Pty Ltd, Sydney, N.S.W.

Text **printed on** 80gsm **bond,** recycled from milk cartons.

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Index of undergraduate courses
By course number

No.	Title	Course Type
U1.001	MATHS 101F	Gen
U1.002	MATHS 102S	Gen
U1.001A	MATHS 191F	Gen
U1.002A	MATHS 192S	Gen
U1.003A	MATHS 103S	Gen
U1.010	MECHS IE	Gen
U1.021	PHYSICS IE	ME
U1.022	PHYSICS 101F	Gen
U1.023	PHYSICS 103S	Gen
U1.022A	PHYSICS 191F	Gen
U1.023B	PHYSICS 193S	Gen
U1.031	CHEMISTRY IE	Gen
U1.032	CHEMISTRY IE Suppl.	Gen
U1.033A	CHEM 1A111F	Gen
U1.033B	CHEM IB 112S	Gen
U1.034A	CHEM 1A (ADV) 191F	Gen
U1.034B	CHEM IB (ADV) 192S	Gen
U1.0401	COMP 101F	Gen
U1.0402	COMP 102S	Gen
U1.0491	COMP 191F (Adv)	Gen
U1.0492	COMP 192S (Adv)	Gen
U1.050A	GEOLOGY 101F	Gen
U1.050B	GEOLOGY 102S	Gen
U1.051	ENGINEERING GEOLOGY 1	CE
U1.060A	BIOLOGY 101F	Gen
U1.060B	BIOLOGY 192S	Gen
U1.060C	BIOLOGY 103S	Gen
U1.100	MANUF. TECHNOL.	Gen
U1.200	CWIL ENGG 1	CE
U1.220	STATICS	CE
U1.280	ENGINEERING PROGRMNG	Gen
U1.281	COMPUTER GRAPHICS	Gen
U1.411	MECH ENGG 1	ME
U1.446	ENGG COMPUTING	ME
U1.500	INTRO. ELEC ENGG	CE
U1.511	ELEC.ENGG1 .	EE
U1.610	CHEM. ENGG 1	ChE
U1.620	CHEM. ENGG APPLICNS	ChE
U1.630	COMPTNG FOR CHEM ENGRS	ChE
U1.651	CHEM. PROCESS CASE STUDIES	ChE
U1.710	AERO. ENGG 1	AE
U2.002	MATHS 201F	Gen
U2.003	MATHS 202F	Gen
U2.004	MATHS 205S	Gen
U2.005	MATHS 251S	Gen
U2.006	MATHS 252S	Gen
U2.007	MATHS 291F	Gen
U2.008	MATHS 292F	Gen
U2.009	MATHS 297S	Gen
U2.010	MATHS 253S	Gen
U2.011	MATHS 295S	Gen
U2.022	PHYSICS 201F	Gen
U2.022A	PHYSICS 291 (Adv)	Gen
U2.023	PHYSICS 202S	Gen
U2.023A	PHYSICS 292S (Adv)	Gen
U2.022E	PHYSICS 201F E	Gen
U2.023E	PHYSICS 202S E	Gen
U2.030A	CHEM 201F	Gen
U2.030B	CHEM 211F	Gen
U2.030C	CHEM 221F	Gen
U2.030D	CHEM222S	Gen
U2.030E	CHEM231F	Gen
U2.030F	CHEM 232S	Gen
U2.030G	CHEM 252S	Gen
U2.036A	CHEM 291 F (Adv)	Gen
U2.036	CHEM 292S (Adv)	Gen
U2.0401	COMP 201F	Gen
U2.0402	COMP 202F	Gen
U2.0403 .	COMP 203S	Gen
U2.0404	COMP 204S	Gen
U2.0405	COMP 205S	Gen
U2.0406	COMP 206S	Gen
U2.044	COMP 291F	Gen
U2.045	COMP 292F	Gen
U2.046	COMP 293S	Gen
U2.047	COMP 294S	Gen
U2.048	COMP 295F	Gen
U2.049	COMP 296S	Gen
U2.050A	GEOLOGY 201F	Gen
U2.050B	GEOLOGY 202S	Gen
U2.050C	GEOLOGY 203S	, Gen
U2.065A	BIOCHEM 201F	Gen
U2.065B	BIOCHEM 202S	Gen
U2.066A	BIOCHEM 211F	Gen
U2.066B	BIOCHEM 212S	Gen
U2.052	ENGG GEOLOGY 2	CE
U2.090	ASIAN STUDIES 1	Gen
U2.210	INTRO. TO MATERIALS	CE
U2.221	STRUCTURAL MECHANICS	CE
U2.261	FLUIDS 1	CE
U2.272	ENGG COMMUNICATIONS 1	CE
U2.290	STRUCT. DESIGN	CE
U2.410	MECH. ENGG 2	ME
U2.411	INTRO. THERMODYNAMICS	AE
U2.412	ENGG DYNAMICS	AE
U2.417	INTRO. MECHS & MATRLS	ME
U2.440	MECH. DES. 1	ME
U2.441	MECH. DES. 1A	Gen
U2.442	STATISTICS	ME
U2.443	MECHATRONIC DESIGN 1	ME/M
U2.471	INTRODUCTORY MECHATRONICS	ME/M
U2.502	ELEC. TECHNOL.	ChE/AE
U2.504	ELECTRICAL & ELECTRONIC ENGG	ME
U2.511	ELEC. ENGG 2A	EE
U2.512	ELEC. ENGG 2B	EE
U2.610	CHEM. ENGG 2	ChE
U2.611	FUNDAMENTALS OF ENVIRON. CHEM ENG.	ChE
U2.612	CHEM ENGG COMPUTATIONS	ChE
U2.700	MECHS & PROPS OF SOLIDS 1	AE/ME
U2.701	MECHS OF SOLIDS 1	ChE
U2.710	FLUID MECHS	AE
U2.770	ENG. COMPUTATION	AE
U2.800	ENGG CONSTRN 1	CE
U2.820	ENGG ECONOMICS	PEM
U2.821	ENGG ACCOUNTING	PEM
U3.067	MICROBIOLOGY	ChE
U3.090	ASIAN STUDIES 2	Gen
U3.212	PROPERTIES OF MATERIALS	CE
U3.222	STRUCT. ANALYSIS	CE
U3.232	CONCRETE STRUCTURES 1	CE

U3.235	STEEL STRUCTURES 1	CE
U3.244	SOIL MECHANICS A	CE
U3.245	SOIL MECHANICS B	CE
U3.250	SURVEYING 1	CE
U3.262	FLUIDS 2	CE
U3.271	TRANSPORTS ENGG & PLANNING	CE
U3.275	ENGG COMMUNICATIONS 2	CE
U3.283	APPLIED STATISTICS	CE
U3.284	RISK & RELIABILITY ANALYSIS	CE
U3.420	THERMO-FLUID ENGG	ME
U3.421	THERMODYNAMICS	AE
U3.430	MECHS & PROPS OF SOLIDS 2	ME
U3.431	MECH. PROPS OF MATRLS	AE
U3.440	MECH. DES. 2	ME
U3.450	SYSTEM DYNAMICS & CONTROL	ME
U3.460	MANUF. ENGG & MGT	• ME
U3.474	ELEC. MACHINES & DRTVES	ME/M
U3.476	FNDL ELECTRONICS	ME/M
U3.480	MECH. ENGG LAB.	ME
U3.485	MECH. ENGG LAB. A	ME/M
U3.506	FUNDAMENTALS OF BIOMEDICAL ENGG	Gen
U3.511	CIRCUIT THEORY	EE/ISE
U3.512	SIGNALS AND SYSTEMS	EE/ISE
U3.522	POWER ELECTRONICS & DRIVES	EE/ISE
U3.523	TOPICS IN ELECTRICAL ENGG DESIGN	EE/ISE
U3.529	ELECTRICAL SYSTEMS	EE/ISE
U3.530	CONTROL 1	EE/ISE
U3.540	ELECTRONICS 1	EE/ISE
U3.551	ENGINEEREMG ELECTRO-MAGNETICS	EE/ISE
U3.552	COMMUNICATIONS 1	EE/ISE
U3.553	DIGITAL SIGNAL PROCESSING	ISE/EE
U3.554	SPEECH PROCESSING	ISE/EE
U3.560	DIGITAL SYSTEMS 1	EE/ISE
U3.561	COMPUTER ARCHITECTURE	ISE/EE
U3.562	ENGINEERING SOFTWARE	ISE/EE
U3.571	MANAGEMENT FOR ENGRS	EE/ISE
U3.610	UNIT OPERNS 1	ChE
U3.621	THERMODYNAMICS	ChE
U3.626	REACTION ENGG 1	ChE
U3.631	COMPUTNS & STATS	ChE
U3.645	PROJECT ECONS	ChE
U3.646	TRANSPORT PHENOMENA	ChE
U3.647	LAB PRJCTS IN UNIT OPS	ChE
U3.651	MATRLS & CORROSION 2	ChE
U3.660	PROCESS CONTROL 1	ChE
U3.671	CHEM. ENGG LAB.	ChE
U3.720	AERODYNAMICS 1	AE
U3.725	AERODYNAMICS 2	AE
U3.730	AIRCRAFT STRUCTURES 1	AE
U3.735	AIRCRAFT STRUCTURES 2	AE
U3.740	AIRCRAFT DES. 1	AE
U3.750	FLIGHT MECHS 1	AE
U3.755	FLIGHT MECHS 2	AE
U3.760	LAB.	AE
U3.770	FLYING OPERNS	AE
U3.780	AVIATION TECHNOL.	AE
U3.790	INDUSTRIAL ORGN & MGT	AE
U3.801	ENGG CONSTRUCTION 2	CE
U3.810	NETWORK PLANNING	PEM
U3.811	CONTRACTS FORMULN & ADMIN.	PEM
U3.900	INNOVATION & INTERNAT COMPETITIVENESS	Gen
U4.005	PARTIAL DIFFERENTIAL EQUATNS	ME
U4.044	THE BUILDING INDUSTRY IN AUSTRALIA	CE
U4.045	206F ENVIRONMENTAL GEOLOGY: HAZARDS	CE
U4.046	207S ENVIRONMENTAL GEOLOGY: RESOURCES	CE
U4.070	EMDL ERGONOMICS	Gen
U4.080	COMPUTER BASED DES.	Gen
U4.090	ASIAN STUDIES 3	Gen
U4.202	THESIS 1	CE
U4.203	THESIS 2	CE
U4.205	PRACT. EXPERIENCE	CE
U4.214	MATERIAL ASPECTS IN DESIGN	CE
U4.223	FINITE ELEMENT METHODS	CE
U4.232	BRIDGE ENGG	CE
U4.236	CONCRETE STRUCTURES 2	CE
U4.237	STRUCTURAL DYNAMICS	CE
U4.238	STEEL STRUCTURES 2	CE
U4.246	ENVIRON. GEOTECH.	CE
U4.247	FOUNDATION ENGG	CE
U4.251	SURVEYING 2	CE
U4.253	CIVIL ENGG CAMP	CE
U4.260	ENVIRON. FLUIDS 1	CE
U4.265	ENVIRON. FLUIDS 2	CE
U4.266	WATER RESOURCES ENGG	CE
U4.273	ENGG MANAGMT	CE
U4.274	PROJECT PROCEDURES	CE
U4.276	PROFESSIONAL PRACTICE	CE
U4.292	CIVIL ENGG DES.	CE
U4.293	PROJECT FORMULATION	CE
U4.419	THERMAL ENGG	Gen
U4.422	COMPUTATNL METHODS FOR PDE	Gen
U4.430	APPLD NUMERCL STRESS ANAL.	Gen
U4.433	ADV. ENGG MATRLS	Gen
U4.434	AEROSPACE MATRLS ENGG	AE
U4.440	ADV. DES.	ME
U4.441	ORTHOPAEDIC ENGG	M.
U4.451	DYNAMICS & SYSTEMS ENGG	ME/M
U4.456	SENSORS AND SIGNALS	ME/M
U4.457	COMPUTATIONAL FLUID DYNAMICS	ME/M
U4.458	ADV. TOPICS IN MECH ENGG A	ME/M
U4.459	ADV. TOPICS IN MECH ENGG B	ME/M
U4.460	FNDLENGG	Gen
U4.461	INTRO. TO OPERNS RES.	Gen
U4.462	INDUSTRIAL & ENGG MGT	ME/M
U4.470	ROBOTIC SYSTEMS	ME/M
U4.477	CMPTRS IN RLTME CTRL & INSTRMTN	ME/M
U4.478	MICROPRCSSRS IN ENGNRD PRODUCTS	ME/M
U4.480	THESIS	ME
U4.484	PROFESSIONAL ENGG	ME
U4.485	PROFESSIONAL COMMUNICATION	ME

U4.486	PRACT. EXPERIENCE	ME
U4.490	ENVIRONMNTL ENGG	Gen
U4.491	ENVRNMNTL ACSTCS & NOISE CTRL	Gen
U4.506	BIOMEDICAL ENGG SYSTEMS	EE/ISE
U4.512	PRACTICAL EXPERIENCE	EE/ISE
U4.521	POWER SYSTEM ANALYSIS	EE/ISEE
U4.522	ADV. POWER ELECTRONICS AND DRIVES	EE/ISE
U4.529	ELECTRIC SYSTEMS CONTROL	EE/ISE
U4.533	NON LINEAR AND ADAFITVE CONTROL	EE/ISE
U4.539	CONTROL 2	EE/ISE
U4.544	MICROWAVE ENGINEERING	EE/ISE
U4.547	OPTICAL COMMUNICATIONS SYSTEMS	EE/ISE
U4.548	INTEGRATED CIRCUIT DESIGN	EE/ISE
U4.549	ELECTRONIC DESIGN	EE/ISE
U4.555	ADV. COMMUNICATION NETWORKS	EE/ISE
U4.556	ERROR CONTROL CODING	EE/ISE
U4.557	SATELLITE COMMUNICATION SYSTEMS	EE/ISE
U4.558	DIGITAL COMMUNICATION SYSTEMS	EE/ISE
U4.559	DATA COMMUNICATION NETWORKS	EE/ISE
U4.563	ADV. DIGITAL ENGG	EE/ISE
U4.564	ADV. REAL TIME COMPUTING	EE/ISE
U4.568	REAL TIME COMPUTING	EE/ISE
U4.569	DIGITAL SYSTEMS 2	EE/ISE
U4.572	PROJECT MANAGEMENT	EE/ISE
U4.588	THESIS A	BE/BCom
U4.589	THESIS	EE/ISE
U4.591	IMAGE PROCESSING AND COMPUTER VISION	EE/ISE
U4.592	FUZZY SYSTEMS	EE/ISE
U4.593	MACHINE INTELLIGENCE AND PATTERN RECOGNITION	EE/ISE
U4.594	ADAPTIVE PATTERN RECOGNITION	BE/ISE
U4.600	PRACT. EXPERIENCE	ChE
U4.625	REACTION ENGG 2	ChE
U4.629	ADVANCES IN POLYMER ENGG	ChE
U4.630	MINERAL PROC (MIN. DRSSNG)	ChE
U4.631	MINERAL PROC. (EX MTLLRGY)	ChE
U4.632	SEPARATION PROCESSES	ChE
U4.633	ADVANCED PARTICLE MECHANICS	ChE
U4.634	ADV. TOPICS FN ENV ENGG A	ChE
U4.635	ADV. TOPICS IN ENV ENGG B	ChE
U4.640	PROJECT ENGG 2	ChE
U4.4655	ADVANCED FLUID DYNAMICS MODELLING	ChE
U4.660	PROCESS CONTROL 2	ChE
U4.680	MAJOR INDUSTRIAL PROJECT	ChE
U4.681	THESIS	ChE
U4.684	CHEM ENG DESIGN 1	ChE
U4.685	CHEM. ENG. DES. 2	ChE
U4.689	ADVANCES IN CHEM ENGG. A	ChE
U4.690	RESERVOIR ENGG	ChE
U4.691	PROCESS SYSTEMS ENGG	ChE
U4.692	OPTIMISN TECHNIQUES	ChE
U4.694	ENVIRON. IMPACT ASSESS,.	ChE
U4.695	BIOCHEM. ENGG	ChE
U4.696	PROCESS PLANT RISK MANAGEMENT	ChE
U4.697	PROFESSIONAL OPTION	ChE
U4.699	ADVANCES IN CHEM ENGG. B	ChE
U4.720	AERODYNAMICS 3	AE
U4.725	AERODYNAMICS 4	AE
U4.730	AIRCRAFT STRUCTURES 3	AE
U4.740	AIRCRAFT DES. 2	AE
U4.750	FLIGHT MECHS 3	AE
U4.770	PROPULSION	AE
U4.775	ENGG EXPERIENCE	AE
U4.780	SEMINAR	AE
U4.785	THESIS OR DES. PROJECT	AE
U4.790	ROTARY WING AIRCRAFT	AE
U4.791	ADV. ROTARY WING AERODYNAMICS	AE
U4.792	AVIATION OPERN & MANAGEMT	AE
U4.793	PROBABILISTIC DES.	AE
U4.795	FLIGHT DYNAMICS & DIGITAL CTRL	AE
U4.796	ADV. COMPUTATIONAL AERODYNAMICS	AE
U4.797	UNSTEADY AERODYNAMICS	AE
U4.802	ENGGCONSTRN3	PEM
U4.812	OPERNS RES.	PEM
U4.822	VALUE ENGG & RISK ANAL.	PEM
U4.823	COST ENGG	PEM
U4.824	PROJECT FORMULN	PEM
U5.204	THESIS HONS	CE
U5.213	MATRLSHONS	CE
U5.224	STEEL STRUCTURES HONS	CE
U5.225	ADV. FINITE ELEMENTS HONS	CE
U5.226	FINITE ELEMENT APPLICTNS HONS	CE
U5.234	STRUCTURAL DYNAMICS HONS	CE
U5.239	CONCR. STRCTRS HONS	CE'
U5.243	SOIL ENGG HONS	CE
U5.253	SURVEYING HONS	CE
U5.267	ENV. FLUIDS HONS	CE
U5.294	CIVIL ENGG DES. HONS	CE
U5.785	HONS THESIS	AE

By course title

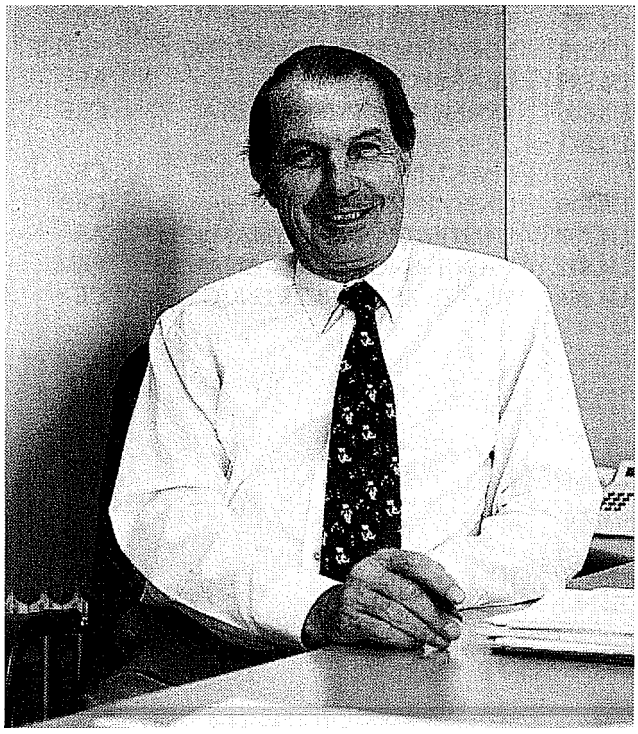
U5.594	ADAPTIVE PATTERN RECOGNITION	EE/ISE EE/ISE
U4.794	ADV. AERODYNAMICS	AE
U4.555	ADV. COMMUNICATION NETWORKS	EE/ISE
U4.796	ADV. COMPUTATIONAL AERODYNAMICS	AE
U4.440	ADV. DES.	ME
U4.563	ADV. DIGITAL ENGG	EE/ISE
U4.433	ADV. ENGG MATRLS	Gen
U5.225	ADV. FINITE ELEMENTS HONS	CE
U4.655	ADV. FLUID DYNAMICS MODELLING	ChE
U4.463	ADV. PARTICLE MECHANICS	ChE
U4.629	ADV. POLYMER ENGG	
U4.522	ADV. POWER ELECTRONICS AND DRTvfES	EE/ISE

U4.564	ADV. REAL TIME COMPUTING	EE/ISE
U4.791	ADV. ROTARY WING AERODYNAMICS	AE
U4.634	ADV TOPICS IN ENV ENGG A	ChE
U4.635	ADV TOPICS IN ENV ENGG B	Che
U4.458	ADV TOPICS IN MECH ENGG A	ME/M
U4.459	ADV TOPICS IN MECH ENGG B	ME/M
U4.689	ADVANCES IN CHEM ENG A	ChE
U4.699	ADVANCES IN CHEM ENG B	ChE
U1.710	AERO. ENGG 1	AE
U3.720	AERODYNAMICS 1	AE
U3.725	AERODYNAMICS 2	AE
U4.720	AERODYNAMICS 3	AE
U4.725	AERODYNAMICS 4	AE
U4.434	AEROSPACE MATRLS ENGG	AE
U3.740	AIRCRAFT DES. 1	AE
U4.740	AIRCRAFT DES. 2	AE
U3.730	AIRCRAFT STRUCTURES 1	AE
U3.735	AIRCRAFT STRUCTURES 2	AE
U4.730	AIRCRAFT STRUCTURES 3	AE
U4.430	APPLD NUMERCL STRESS ANAL.	Gen
U3.283	APPLD STATISTICS	CE
U2.090	ASIAN STUDIES 1	Gen
U3.090	ASIAN STUDIES 2	Gen
U4.090	ASIAN STUDIES 3	Gen
U4.792	AVIATION OPERN & MANAGEMT	AE
U3.780	AVIATION TECHNOL.	AE
U2.065A	BIOCHEM 201F	Gen
U2.065B	BIOCHEM 202S	Gen
U2.066A	BIOCHEM 211F	Gen
U2.066B	BIOCHEM 212S	Gen
U4.695	BIOCHEM. ENGG	ChE
U1.060A	BIOLOGY 101F	Gen
Ui:060B	BIOLOGY 192S	Gen
U1.060C	BIOLOGY 103S	Gen
U4.506	BIOMEDICAL ENGG SYSTEMS	EE/ISE
U4.232	BRIDGE.ENGG	CE
U1.033A	CHEM 1A111F	Gen
U1.033B	CHEM IB 112S	Gen
U1.034A	CHEM 1A (ADV) 191F	Gen
U1.034B	CHEM IB (ADV) 192S	Gen
U2.030A	CHEM 201F	Gen
U2.030B	CHEM 211F	Gen
U2.030C	CHEM221F	Gen
U2.030D	CHEM 222S	Gen
U2.030E	CHEM 231F	Gen
U2.030F	CHEM 232S	Gen
U2.030G	CHEM 252S	Gen
U2.036A	CHEM 291 F (Adv)	Gen
U2.036	CHEM 292S (Adv)	Gen
U1.610	CHEM. ENGG 1	ChE
U2.610	CHEM. ENGG 2	ChE
U1.620	CHEM. ENGG APPLICNS	ChE
U2.612	CHEM ENGG COMPUTATIONS	ChE
U4.684	CHEM. ENGG DES. 1	ChE
U3.671	CHEM. ENGG LAB.	ChE
U1.651	CHEM. PROCESS CASE STUDIES	ChE
U1.031	CHEMISTRY IE	Gen
U1032	CHEMISTRY IE Suppl.	Gen
U3.511	CIRCUIT THEORY	EE/ISE
U1.200	CIVIL ENGG 1	CE
U4.253	CWIL ENGG CAMP	CE
U4.292	CIVIL ENGG DES.	CE
U5.294	CIVIL ENGG DES. HONS	CE
U4.477	CMPTRS IN RL TIME CTRL & INSTRMTN	ME/M
U4.552	CODING FUNDAMENTALS/ APPLN	EE/ISE
U3.552	COMMUNICATIONS 1	EE/ISE
U4.550	COMMUNICNS 2	EE
U1.0401	COMP101F	Gen
U1.0402	COMP 102S	Gen
U1.0491	COMP 191F (Adv)	Gen
U1.0492	COMP 192S (Adv)	Gen
U2.0401	COMP 201F	Gen
U2.0405	COMP 205S	Gen
U2.0402	COMP 202F	Gen
U2.0403	COMP 203S	Gen
U2.0406	COMP206S	Gen
U2.0404	COMP 204S	Gen
U2.044	COMP 291F	Gen
U2.045	COMP 292F	Gen
U2.046	COMP 293S	Gen
U2.047	COMP 294S	Gen
U2.048	COMP295F	Gen
U2.049	COMP 296S	Gen
U4.457•	COMPUTATIONAL FLUID DYNAMICS	ME/M
U4.422	COMPUTATIONAL METHODS FORPDE	Gen
U3.631	COMPUTNS & STATS	ChE
U3.561	COMPUTER ARCHITECTURE	ISE/EE
U4.080	COMPUTER BASED DES.	Gen
U1.281	COMPUTER GRAPHICS	Gen
U1.630	COMPTNG FOR CHEM ENGRS	ChE
U5.239	CONC. STRUCTRS HONS	CE
U3.232	CONCRETE STRUCTURES 1	CE
U4.236	CONCRETE STRUCTURES 2	CE
U3.811	CONTRACTS FORMULN & ADMIN.	PEM
U3.530	CONTROL 1	EE/ISE
U4.539	CONTROL 2	EE/ISE
U4.823	COST ENGG	PEM
U4.559	DATA COMMUNICATION NETWORKS	EE/ISE
U4.558	DIGITAL COMMUNICATION SYSTEMS	EE/ISE
U3.553	DIGITAL SIGNAL PROCESSING	ISE
U3.560	DIGITAL SYSTEMS 1	EE
U4.569	DIGITAL SYSTEMS 2	EE/ISE
U4.565	DIGITAL SYSTEMS 3	EE/ISE
U4.451	DYNAMICS & SYSTEM ENGG	M/ME
U2.504	ELEC. & ELECTRONIC ENGG	ME/M
U1.511	ELEC. ENGG 1	EE
U2.511	ELEC. ENGG 2A	EE
U2.512	ELEC. ENGG 2B	EE
U3.474	ELEC. MACHINES & DRTVES	1A
U4.529	ELEC. SYSTEMS CONTROL	EE/ISE
U2.502	ELEC. TECHNOL.	ChE/AE
U4.549	ELECTRONIC DESIGN	EE/ISE
U3.540	ELECTRONICS 1	EE/ISE
U3.521	ELECTRICAL SYSTEMS	EE/ISE
U2.821	ENGG ACCOUNTING	PEM
U2.272	ENGG COMMUNICATIONS 1	CE
U3.275	ENGG COMMUNICATIONS 2	CE
U1.446	ENGG COMPUTING	ME
U2.770	ENG. COMPUTATION	AE
U2.800	ENGG CONSTRNI	CE

U4.802	ENGG CONSTRN 3	PEM
U3.801	ENGG CONSTRUCTION 2	CE
U2.412	ENGG DYNAMICS	AE
U2.820	ENGG ECONOMICS	PEM
U3.551	ENG ELECTROMAGNETICS	EE/ISE
U4.775	ENGG EXPERIENCE	AE
U1.051	ENGG GEOLOGY 1	CE
U2.052	ENGG GEOLOGY 2	CE
U4.273	ENGG MANAGMT	CE
U1.280	ENGINEERING P'GRAMMING	Gen
U3.562	ENGINEERING SOFTWARE	ISE/EE
U4.491	ENVRNMNTL ACSTCS & NOISE CTRL	Gen
U4.490	ENVIRONMNTL ENGG	Gen
U4.260	ENVIRON. FLUIDS 1	CE
U4.265	ENVIRON. FLUIDS 2	CE
U5.267	ENVIRON. FLUIDS HONS	CE
U4.246	ENVIRON. GEOTECHNICS	CE
U4.694	ENV IMPACT ASSESSMENT	ChE
U4.556	ERROR CONTROL CODING	EE/ISE
U5.226	FINITE ELEMENT APPLICTNS HONS	CE
U4.223	FINITE ELEMENT METHODS	CE
U3.750	FLIGHT MECHS 1	AE
U3.755	FLIGHT MECHS 2	AE
U4.750	FLIGHT MECHS 3	AE
U4.795	FLIGHT MECHS 4	AE
U2.710	FLUID MECHS	AE
U2.261	FLUIDS 1	CE
U3.262	FLUIDS 2	CE
U3.770	FLYING OPERNS	AE
U4.247	FOUNDATION ENGG	CE
U3.506	FUNDAMENTALS OF BIOMEDICAL ENGINEERING	Gen
U2.611	FUNDAMENTALS OF ENVIRON. CHEM ENGG	ChE
U4.592	FUZZY SYSTEMS	EE/ISE
U1.050A	GEOLOGY 101F	Gen
U1.050B	GEOLOGY 102S	Gen
U2.050A	GEOLOGY 201F	Gen
U2.050B	GEOLOGY 202S	Gen
U2.050C	GEOLOGY 203S	Gen
U4.242	GEOTECHNICAL ENGG	CE
U5.785	HONS THESIS	AE
U4.591	IMAGE PROCESSING AND COMPUTER VISION	EE/ISE
U4.462	INDL & MGT ENGG	ME/M
U3.476	INDL ELECTRONICS	ME/M
U4.460	INDL ENGG	Gen
U4.070	INDL ERGONOMICS ,	Gen
U3.790	INDL ORGN & MGT	AE
U3.900	INNOVATION & INTERNAT COMPETITIVENESS	Gen
U4.548	INTEGRATED CIRCUIT DESIGN	EE/ISE
U1.500	INTRO. ELEC. ENGG	CE
U2.471	INTRO. MECHATRONICS	ME/M
U2.417	INTRO. MECHS & MATRLS	ME/M
U2.210	INTRO TO MATERIALS	CE
U4.461	INTRO. TO OPERNS RES.	Gen
U2.411	INTRO. THERMODYNAMICS	AE
U3.760	LAB.	AE
U3.647	LAB. PRJ IN UNIT OPS	ChE
U4.593	MACHINE INTELLIGENCE AND PATTERN RECOGNITION	EE/ISE
U4.680	MAJOR INDUSTRIAL PROJECT	ChE
U3.571	MANAGEMENT FOR ENGRS	EE/ISE
U3.461	MANUF. ENG.	M
U3.460	MANUF. ENGG & MANAGMT	ME
U1.100	MANUF. TECHNOL.	Gen
U4.214	MATERIAL ASPECTS IN DESIGN	CE
U1.001	MATHS 101F	Gen
U1.002	MATHS 102S	Gen
U1.001A	MATHS 191F	Gen
U1.002A	MATHS 192S	Gen
U1.003A	MATHS 103S	Gen
U2.002	MATHS 201F	Gen
U2.003	MATHS 202F	Gen
U2.004	MATHS 205S	Gen
U2.005	MATHS 251S	Gen
U2.006	MATHS 252S	Gen
U2.Q07	MATHS 291F	Gen
U2.008	MATHS 292F	Gen
U2.009	MATHS 297S	Gen
U2.010	MATHS 253S	Gen
U2.011	MATHS 295S	Gen
U3.651	MATRLS & CORROSION 2	ChE
U5.213	MATRLS HONS	CE
U2.440	MECH. DES. 1	ME
U2.441	MECH. DES. 1A	Gen
U3.440	MECH. DES. 2	ME
U1.411	MECH. ENGG 1	ME
U2.410	MECH. ENGG 2	ME
U3.480	MECH. ENGG LAB.	ME
U3.485	MECH. ENGG LAB. A	ME/M
U3.431	MECH. PROPS OF MATRLS	AE
U2.700	MECHS & PROPS OF SOLIDS 1	ME
U3.430	MECHS & PROPS OF SOLIDS 2	ME
U1.010	MECHS IE	Gen
U2.701	MECHS OF SOLIDS 1	ChE
U2.443	MECHATRONIC DESIGN 1	ME/M
U3.067	MICROBIOLOGY	ChE
U1.455	MICROPRCSR CTRL OF MACHINERY	ME
U4.544	MICROWAVE ENGPNEERING	EE/ISE
U4.631	MINERAL PROC. (EX MTLLRGY)	ChE
U4.630	MINERAL PROC.(MIN. DRSSNG)	ChE
U3.810	NETWORK PLANNING	PEM
U4.533	NON-LINEAR AND ADAPTIVE CONTROL	EE/ISE
U4.812	OPERNS RES.	PEM
U4.547	OPTICAL COMMUNICATION SYSTEMS	EE/ISE
U4.692	OPTIMISN TECHNIQUES	ChE
U4.441	ORTHOPAEDIC ENG.	M
U4.005	PARTIAL DIFFERENTIAL EQUATNS	ME
U1.022	PHYSICS 101F	Gen
U1.023	PHYSICS 103S	Gen
U1.022A	PHYSICS 191F	Gen
U1.023B	PHYSICS 193S	Gen
U2.022	PHYSICS 201F	Gen
U2.022A	PHYSICS 291 (Adv)	Gen
U2.023	PHYSICS 202S	Gen
U2.023A	PHYSICS 292S (Adv)	Gen
U2.022E	PHYSICS 201F E	Gen
U2.023E	PHYSICS 202S E	Gen
U3.522	POWER ELECTRONICS & DRIVES	EE/ISE
U4.521	POWER SYSTEM ANALYSIS	EE/ISE

U4.205	PRACT. EXPERIENCE	CE
U4.486	PRACT. EXPERIENCE	ME
U4.512	PRACT. EXPERIENCE	EE/ISE
U4.600	PRACT. EXPERIENCE	ChE
U4.793	PROBABILISTIC DES.	AE
U3.660	PROCESS CONTROL 1	ChE
U4.660	PROCESS CONTROL 2	ChE
U4.496	PROCESS PLANT RISK MGT	CHE
U4.691	PROCESS SYSTEMS ENGG	ChE
U4.485	PROFESSIONAL COMMUNI-CATION	ME
U4.484	PROFESSIONAL ENGG.	ME/M
U4.697	PROFESSIONAL OPTION	ChE
U4.276	PROFESSIONAL PRACTICE	CE
U3.645	PROJECT ECONS	ChE
U4.640	PROJECT ENGG 2	ChE
U4.293	PROJECT FORMULATION	CE
U4.824	PROJECT FORMULN	PEM
U4.572	PROJECT MANAGEMENT	EE/ISE
U4.274	PROJECT PROCEDURES	CE
U3.212	PROPERTIES OF MATERIALS	CE
U4.770	PROPULSION	AE
U3.626	REACTION ENGG 1	ChE
U4.625	REACTION ENGG 2	ChE
U4.568	REAL TIME COMPUTING	EE/ISE
U4.690	RESERVOIR ENGG	ChE
U3.284	RISK AND RELIABILITY ANALYSIS	CE
U4.470	ROBOTIC SYSTEMS	ME/M
U4.790	ROTARY WING AIRCRAFT	AE
U4.557	SATELLITE COMM. SYSTEMS	EE/ISE
U4.780	SEMINAR	AE
U4.456	SENSORS AND SIGNALS	ME/M
U4.632	SEPN. PROCESSES	ChE
U3.512	SIGNALS & SYSTEMS	EE/ISE
U5.243	SOIL ENGG HONS	CE
U3.244	SOIL MECHANICS A	CE
U3.245	SOIL MECHANICS B	CE
U3.554	SPEECH PROCNG	EE/ISE
U1.220	STATICS	CE
U2.442	STATISTICS	ME
U3.235	STEEL STRUCTURES 1	CE
U4.238	STEEL STRUCTURES 2	CE
U5.224	STEEL STRUCT. HONS	CE
U3.222	STRUCT. ANALYSIS	CE
U2.290	STRUCT. DESIGN	CE
U4.237	STRUCTURAL DYNAMICS	CE
U5.234	STRUCT. DYNAMICS HONS	CE
U2.221	STRUCTURAL MECHANICS	CE
U3.250	SURVEYING 1	CE
U4.251	SURVEYING 2	CE
U5.253	SURVEYENIG HONS	CE
U3.450	SYSTEM DYNAMICS & CONTROL	ME
U4.045	206F ENVIRONMENTAL GEOLOGY: HAZARDS	CE
U4.046	207S ENVIRONMENTAL GEOLOGY: RESOURCES	CE
U4.044	THE BUILDING INDUSTRY IN AUSTRALIA	CE
U4.419	THERMAL ENGG	Gen
U3.420	THERMO-FLU1D ENGG	ME
U3.421	THERMODYNAMICS	AE
U3.621	THERMODYNAMICS	ChE
U4.481	THESIS	ME
U4.589	THESIS	EE/ISE
U4.681	THESIS	ChE
U4.202	THESIS 1	CE
U4.203	THESIS 2	CE
U4.588	THESIS A	BE/BCom
U5.204	THESIS HONS	CE
U4.785	THESIS OR DES. PROJECT	AE
U3.523	TOPICS IN ELEC. ENG. DESIGN	EE/ISE
U4.699	TRANSPORT OPNS	AE
U3.646	TRANSPORT PHENOMENA	ChE
U3.271	TRANSPORTN ENGG & PLANNING	CE
U3.610	UNITOPERNS1	ChE
U4.797	UNSTEADY AERODYNAMICS	AE
U4.822	VALUE ENGG & RISK ANAL.	PEM
U4.266	WATER RESOURCES ENGG	CE

Message from the Dean



Welcome to the Faculty of Engineering of the University of Sydney, which is also known as the P.N. Russell School of Engineering in commemoration of its munificent industrialistbenef actor, Sir Peter Russell. Over the past one hundred and ten years about ten thousand students have preceded you along the path you have chosen to follow towards professional engineering.

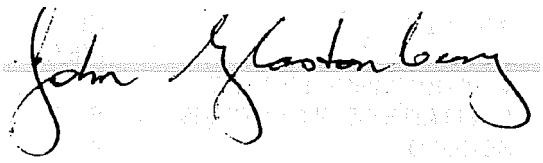
An aim of this faculty is to provide the best possible education for its students, both undergraduate and postgraduate. Undergraduate teaching is one of the highest expressions of education; for us, undergraduate teaching is a great social responsibility as well as an opportunity to produce engineers of the future who are both technically competent and socially aware.

In whichever of the five engineering branches you may choose to enrol, you will find that the engineer is concerned with applying scientific knowledge and exercising social skills. To do so with competence and assurance, we believe he or she should have a strong basis in science: Consequently, during the first two years of your course this scientific basis is laid down. This vital foundation, the soundness of which is the hallmark of the Peter Nicol Russell School, provides you with the ability you will depend on during your future professional career to appreciate the significance of new and developing technologies, and to work with them.

The engineer must operate in the real world of economic forces and social priorities. Engineering is a creative occupation: based on science applied with art and skill, and with the economic arid social dimensions added.

You may have chosen to take engineering because you enjoy proficiency at mathematics and in the sciences, disciplines you probably find interesting and challenging. You perhaps have a liking for solving problems and making things. These are all characteristics of the engineer. Engineering is about meeting people too, and managing. Many engineers travel extensively; they tend to have high starring salaries and high career mobility; and they are gr ea tly needed by the nation.

The course in engineering includes more classes and laboratory hours than most. It calls for steady and concentrated effort. Above all it is stimulating and exciting. Engineering students are a cohesive group who play hard, win more than their share of sporting trophies, and have a reputation for flair and initiative. This, too, is the essence of engineering. I congratulate you for joining us and I wish you well in your university life and professional career.



John Glastonbury
Dean

Introduction

This is the Faculty of Engineering Handbook. In it we hope you will find most of what you need to know about the faculty. In particular, it will help you to know who the people in the faculty are; the requirements for degrees and diplomas in the faculty and the ways that these can be satisfied; what courses are offered, and the books required for them; and where to turn for more information, advice and help.

When making up your mind about your courses of study, look first at chapter 2 dealing with the various branches of engineering, and then at chapter 3, which sets out the requirements for the BE degree and explains how to go about selecting the courses of study.

To obtain more detail on any course refer to chapter 4, where the course details are presented in course number order.

You may need help in deciding on the best courses for you to take—advice is available at the Faculty Office, Room 226, Engineering Faculty Building, or from Year Advisers.

Chapter 5 is a collection of other information about the faculty, such as special enrolment instructions, scholarships and prizes available, and professional societies.

Access

Potential students, students and their parents, industry and members of the public are invited to contact the Faculty of Engineering as follows:

The Faculty of Engineering
Faculty Building J13
The University of Sydney, N.S.W. 2006

Student Enquiry Office
Room 226, Faculty Building J13, tel. 9351 2534

Engineering Library
Level 1, PNR Bdg J02, tel. 9351 2138

Dean's Office, tel. 9351 4739/4757
General correspondence, contract research

Advancement Office
Room 323B, PNR Bdg J02, tel. 9351 4613
Enquiries about industry links, faculty foundations, Women for Engineering Bursaries, careers markets, gifts and donations, public relations, engineering alumni, etc.

CSE Office
Room 323A, PNR Bdg J02, tel. 9351 2834
Chancellor's Scholarships in Engineering

Foundations and Centres

- Chemical Engineering Foundation
  Room 454, ChE Bdg J01, tel. 93513959
- Civil and Mining Engineering Foundation
  Room 335, CE Bdg J05, tel. 9351 2127
- Electrical Engineering Foundation
  Room 606, EE Bdg J03, tel. 9351 3659
- Warren Centre for Advanced Engineering
  Level 2, Faculty Building J13, tel. 9351 3752
- ASIIC (Australian Centre for Innovation and International Competitiveness)
  Level 2, Faculty Building J13, tel. 9351 3934
- AGSEI (Australian Graduate School of Engineering Innovation) tel. 9209 4111

Timetables

The timetable of classes for Junior and Intermediate courses is available in the Engineering Faculty Office. Students should consult individual Engineering departments for the times and places of Senior and Senior Advanced courses.

1 Staff[1]

FACULTY AND DEPARTMENTS/ SCHOOLS

Dean
Professor John R. Glastonbury, BE MEngSc PhD, FIChemE FATE MAusIMM FIEAust

Pro Dean
Professor John Robert Booker, BSc PhD DEng, FAA

Associate Dean (Research and Development)
Professor Y.-W. Mai, Bsc(Eng) PhD *U.K.,* MASME FIEAust

Associate Dean (Undergraduate)
Associate Professor Robin J. King, BEng *Sheff.* PhD *Lond.,* MIEE FIEAust FIREE

Advisers to Undergraduate Students
Aeronautical—all years—Professor G.P. Steven
Chemical—
' UndergraduateAdviser-AssociateProfessorG.W.Barton
Junior—
Intermediate—Dr V.G. Gomes
Senior—Associate Professor D.F. Bagster
Senior Advanced—Dr LA. Furzer
Civil—
Junior and Intermediate—-Mr N.L.Ings
Senior—Dr M.J. Clarke
Senior Advanced—Associate Professor A. Abel
Electrical—
Junior and Intermediate—Dr M. Johnson
Senior—Dr J. Rathmell
Senior Advanced—Associate Professor D. Wong
Mechanical—
Undergraduate Adviser—Dr Assaad Masri
Postgraduate Adviser—Prof. Nhan Phan-Thien
Junior—Dr L. Bilston
Intermediate—Mr P. McHugh
Senior—Dr Zhong
Senior Advanced—Dr J.D. Atkinson

Faculty Manager and Secretary to Faculty
Ms Jenny Beatson

Student Administration Staff
Postgraduate Adviser—Ms Julie Barry, BA
Undergraduate Adviser—Ms Anne Kwan, BA DipEd *Chinese H.K.*
Office Manager—Mrs Anna Maria Brancato
Office Assistant—vacant

Administrative Assistant (Secretary to the Dean)
Ms Josephine Harty, BA *Macq.*

Executive Officer, Engineering Advancement Office
Mr Jeremy M. Steele, BA *Keele*

Chancellor's Scholarships in Engineering Program
Executive Officer—Mrs Lee Jobling, MA

Administrative Assistant
Ms Jane Busquets

Computer Engineer
Mr Kevin R. Rosolen, MSc *Macq.*

Computer Programmers
Mr Bernard Gardiner, BSc
Mrs Lila Yassini

Professional Officer Grade II
Didier Debuf, BE *U.N.S. W.*

Faculty Librarian
Mrs Joan Morrison, BA MSLS *Case Western Reserve*

Aeronautical Engineering

Head
Professor Grant P. Steven

Administrative Officer
Ms Yvonne Witting

Chemical Engineering

Head
Associate Professor Brian S. Haynes

Administrative Assistant
MrsKylieWootton

Civil and Mining Engineering

Head
Professor John Philip Carter

Executive Assistant to Head of School
Ms Tmne Blair, BA *U.N.S. W.*

Electrical Engineering

Head
Professor David J. Hill

Administrative Officer
Ms Kim L. Murphy, BA *N'cle(N.S.W.)* MEdAdmin *N.E.* GradDipSecStudies C.C.AE.

Mechanical Engineering

Head
Associate Professor John Kent

Administrative Officer
Ms Carol Prasad BA *Auck.*

DEPARTMENTS

Aeronautical Engineering

Lawrence Hargrave Professor
Grant P. Steven, BSc *Glas.* DPhil *Oxf.*
Appointed 1991

Senior Lecturers
Douglass J. Auld, BSc BE MEngSc PhD
Karkenahalli Srinivas, ME PhD *I.I.Sc.*

Lecturers
Peter Gibbens, BE(Aero) PhD *N'cle*
Daniel M. Newman, BE MEngSc
Kee-Choon Wong, BE PhD
Liyong Tone, BSc MEngSc *Dalian* PhD *B.U.A.A.,* MIEAust

'As at October 1996.

Part-time Lecturer
John Bladder, BE

Associate Lecturer
Osvaldo Querin, BE ME(Res)

Professional Officers
Nikos Pitsis, DipEng *Athens Polytechnic* BE MEngSc
Radu Turcanu, BE(Aero) *Bucharest*

Chemical Engineering

Professor
Rolf G.H. Prince, BE BSc *N.Z.* PhD, FIChemE HonFIEAust FTSE FEng
Appointed 1969

ICI Australia/University of Sydney Professor of Process Systems Engineering
Jose Romagnoli, BE *N.delSur.Arg.* PhD *Minn.*
Appointed 1991

ANSTO/University of Sydney Professor of Risk Engineering
H. Mark Tweeddale, BE MEng *Melb.,* FIChemE FIMechE FIEAust FTSE CEng
Appointed 1988

ShellProfessor of Environmental Engineering

Professorial Fellow
Ric Charlton, BE MESc, FTS

Associate Professors
David F. Bagster, BScApp BSc BE *Qld* PhD *Camb.,* FIEAust FIChemE CEng
John P. Barford, BE PhD *U.N.S. W.,* FIChemE FIEAust CEng (Director of Research)
Geoffrey W. Barton, BE PhD
Brian S. Haynes, BE PhD *U.N.S. W.*

Senior Lecturers
Ian A. Furzer, DSc(Eng) PhD *Lond.,* MIChemE CEng MAIChemE
Timothy A.G. Langrish, BE *N.Z.* DPhil *Oxf.,* MIChemE
Barry W. Walsh, BE PhD, MIChemE CEng SPE

Lecturers
Parisa A. Bahri, BSc, MSc *Tehr.* PhD
Vincent G. Gomes, BTech MEng PhD *Montr.*
Marc Shelikoff, BS *Venn.* PhD *M.I.T.*

Technical Manager
Robert Staker, PhD *Adel.*

Professional Officer Grade IV
Denis M. Nobbs, BE *U.N.S. W.*

Honorary Appointments

Honorary Research Associates
G. DeLeon, PhD, MAIMM GSA
Neville A. Gibson, MSc PhD, MRSChem ARACI FAusIMM CChem
Kenneth C. Hughes, BSc PhD *U.N.S.W.* ASTC *S.T.C.*
Peter B. Linkson, BE PhD, FIEChemE FAusIMM FGAA CEng

Honorary Professional Associate
Wayne A. Davies, BSc PhD, MIEAust

Civil and Mining Engineering

Challis Professor of Civil Engineering
Nicholas Snowden Trahair, BSc BE MEngSc PhD DEng, FIEAust
Appointed 1979

Professors
Harry GeorgePoulos, AM, BEPhDDScEng,FIEAustFASCE FAA
Appointed 1982

John P. Carter, BE PhD, MICE FIEAust
Appointed 1990

Professor of Engineering Mechanics
John Robert Booker, BSc PhD DEng, FIEAust FAA
Appointed 1985

BHP Steel Professor of Steel Structures
Gregory J. Hancock, BE BSc PhD, FIEAust
Appointed 1990

Associate Professors
Andrew Abel, DipIIng T. *U. Bud.* MSc *McM.* PhD *U.N.S. W.,* CEngFIM
Peter Ansourian, BSc BE PhD, FIEAust
Ali Ja'afari, BSc ME *Tehr.* MSc PhD *Sur.*
Kenny C.S. Kwok, BE PhD *Monash,* FIEAust
Stuart G. Reid, ME *Cant.* PhD *McG.*
John C. Small, BSc(Eng) *Lond.* PhD, MIEAust MASCE
Robert J. Wheen, BSc BE MEngSc, FIEAust MASCE

Senior Lecturers
David W. Airey, BA MPhil PhD *Camb.*
Logan W. Apperley, BE PhD *Auck.*
Murray J. Clarke, BSc BE PhD
Kim J.R. Rasmussen, MEngSc *T.U. Denmark* PhD

Lecturers
Noel L. Ings, MEngSc *U.N.S.W.* BE, MASCE MIEAust
Lloyd J, Pilgrim, BSurv PhD *N'cle(N.S.W.)*

Tutor in Surveying
John Curdie, ME DipT&CP, FIS

Professional Officers Grade II
Nigel P. Balaam, BE PhD
John P. Papangelis, BE PhD

Professional Assistant
David Wang, BE *Tong-ji* MBldgSc *U.N.S.W.*

Computer Systems Officer
Danny D.Q. Kim, BSc *Ho Chi Minh United*

Honorary Appointments

Emeritus Professor
A.E. Jenkins, BMetE MEngSc PhD *Melb.,* FIM FIEAust MAIMM MAIM

Honorary Research Associates
Russel Q. Bridge
Peter T. Brown, BE PhD
Roger J. Enright, BE PhD *U.N.S.W.* MSc *W.Virginia*
Howard B. Harrison, BE PhD, MIEAust
Ian S.F. Jones, BE *U.N.S.W.* PhD *Wat.,* MIEAust
Harold Roper, BSc PhD *Witw.* MEngSc, MAIMM
Richard D. Watkins, BE *Qld* PhD *Aberd.,*- MIEAust

Honorary Teaching Associate
Ian G. Bowie, MSc *Mane,* MCSCE MIEAust

Electrical Engineering

P.N. Russell Professor
Trevor William Cole, BE *W.Aust.* PhD *Camb.,* FIEAust
Appointed 1980

Professors
David Hill, BE BSc *Qld* PhD *N'cle(N.S.W.),* FIEAust FIEEE
Marwan A. Jabri, Maitrise de physique *Paris* PhD

Associate Professors
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Robert A. Minasian, BE PhD *Melb.* MSc(Dist) DipMicrowave Eng(Dist) *Lond.,* MIEE SMIREE HEAust
Stephen W. Simpson, BSc PhD, FIEAust
Anthony D. Stokes, BSc BE PhD, FIEAust
Branka S. Vucetic, MSc PhD *Belgrade*
David G. Wong, BSc BE MEngSc PhD, FIEAust

Readers
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Shu Yuen Ron Hui, BSc *Birm.* PhD DIC *Lond.,* MIEEE MIEE

Senior Lecturers
David F. Gosden, ME *U.N.S.W.* MBA *A.G.S.M.,* MIEAust
David Levy, BSc, MSc *(Engl), Natal,* MIEE P h D *Natal*
James G. Rathmell, BSc BE PhD, SMIREE
Jonathan B. Scott, BSc BE MEngSc
Graham E. Town, BE *N.S.W.I.T.* PhD, MIEEE MIREE
Hansen Yee, BSc BE PhD, MIEEE

Lecturers
Ho-Yul Choi, BE *Kwangwoon* ME *Yonsei*
Mark Hedley, BE BSc PhD
Xiheng Hu, DipMechEng *Beijing* DipElecEng *Chongoing Indust.Uni.* MElecCompEng *China* PhD
Mark Johnson, BSc BE PhD
Philip Heng Wai Leong, BE BSc PhD
Swamidoss Sathiakumar, BSc *American Coll. India* BE ME PhDJ.LSc.

Professional Officers Grade III
Ross Hutton, BE *Q.I.T.*
Peter J. Seebacher, BAppSc *N.S.W.I.T.* MEngSc
Robert G. Sutton, ME *U.N.S.W.*

Professional Officers Grade II
Ebrahim Gogani, ME *Tehr. Polytechnic* PhD *Brunei*
Michael Rados, BSc BE MEngSc
Ali Raghemi-Azar, BSc *Tehr. Polytechnic* MSc PhD *S'ton*
Gagarin Vasimalla, BTech *Warangal* MTech LIT. *Bombay*

Professional Assistants
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Victor W. Smith, BE *N.S.W.I.T.* MSc *U.M.I.S.T.*

Research Fellows
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Zhong-Ping Jiang, BSc *Wuhan* PhD *Ecole des Mines France*
Peiyuan Zhu, MSc *Fudan* PhD

Honorary Appointments

Emeritus Professors
W.N. Christiansen, DSc *Melb.,* FInstP FAIP FIEE FIEAust FAA FIREE(Aust)
Hugo K. Messerle, MEngSc DSc *Melb.* PhD, FTS HEE HEAust FIREE FIEEE FAIP

Research Associate
Peter M. Nickolls, MB BS BSc BE PhD

Research Affiliate
J.J. Lowke, BSc PhD DipEd *Adel.*

Mechanical and Mechatronic Engineering

P.N. Russell Professor
Roger Ian Tanner, BSc *Brist.* MS *Calif.* PhD *Mane,* FAA FTS FIEAust MASME MAIChE
Appointed 1975

Professors
Robert William Bilger, BSc BE N.Z. DPhil *Oxf,* FTS FIEAust
Appointed 1976

Hugh Francis Durrant-Whyte, BSc(Eng) *Lond.* MSE PhD *Penn.*
Appointed 1995

Yiu-Wing Mai, BSc(Eng) PhD *H.K.,* MASME HEAust
Appointed 1987

Nhan Phan-Thien, BE PhD
Appointed 1991

Associate Professors
John H. Kent, BE MEngSc PhD

Senior Lecturers
John D. Atkinson, PhD *Cal.Tech.* BSc BE
M. W.M.G. Dissanayake, BSc(Eng) *Peradeniya* MSc PhD *Birm.*
Andrei Lozzi, BSc *U.N.S. W.* MEngSc PhD
Assaad R. Masri, BE PhD
PaulJ.McHugh,BScBE
Eduardo M. Nebot, BS *Bahia Blanca* MS PhD *Colorado*

Lecturers
Lynne E. Bilston, MSc PhD *Penn.* BE
David C. Rye, BE *Adel.* PhD
Lin Ye, BS *Harbin* MS PhD BIAA
Liangchi Zhang, BSc MEng *Zhejiang* PhD *Beijing*

Lecturer (part-time)
John Blackler, BE

Professional Officer
Jonathan P. Woolmington, BE

ARC Research Fellow
Sten H. Starner, BE PhD

Visiting Professor
Michael V. Swain, BSc PhD *U.N.S.W.*

Adjunct Associate Professor
Robin J. Higgs, St Bartholomew's Hospital Medical School, London

2 The Faculty of Engineering

A short history

A hundred years of engineering education

In 1983 the Faculty of Engineering celebrated one hundred years of engineering education at the University of Sydney.

At the beginning of March 1883 the first classes in engineering were held in the Main Building. Engineering then formed part of the newly created Faculty of Science (1882). The classes were attended at the opening by three matriculated students who were candidates for the engineering certificate and by seven non-matriculated students.

The lecturer in engineering was Mr W.H. Warren, who had been appointed in December 1882 following a decision by the University Senate to carry out significant revisions to the teaching of the University. These revisions, which provided for the establishment of Schools of Medicine, Science and Engineering, were unable to be implemented in 1881 for lack of staff, accommodation, and facilities.

In 1883, when the new engineering curriculum was introduced, the Senate reported that 'great inconvenience [had] been felt during the year, bo th by the lecturers and the students, through the deficiency in accommodation for lecturing purpose ... the room occupied by the Lecturer in Engineering [was] much too small to contain the apparatus required for the illustration of his lectures...' A temporary structure was erected at the rear of the Main Building, and in 1885 classes moved to a fairly commodious low white building with a verandah facing Parramatta Road, on a site now partly occupied by the Holme Building.

In 1909 the new building for the P.N. Russell School of Engineering was sufficiently completed early in the year for the work of the school to be conducted within its walls. This building—an outcome of the P.N. Russell benefactions described on the pages following—was formally opened by the Governor on 20 September 1909 at the same time as he opened the new Fisher Library building (now MacLaurin Hall). During the course of the next few decades extensions were made to the PNR Building until, with the expansion in student numbers in the 1950s and early 1960s, new facilities were constructed in the Darlington extension area across City Road. Since the mid seventies all departments have been accommodated in this area, although a wind tunnel in the Woolley Building is still in use by Aeronautical Engineering.

Curriculum development

It was the Senate's intention in establishing engineering education at the University in 1.882 to award Certificates in Engineering—in Civil Engineering and Architecture, Mechanical, and Mining Engineering. In 1883, however, the Senate adopted revised by-laws to establish two degrees in engineering, those of Bachelor of Engineering and Master of Engineering. In so doing the Senate specified three branches of engineering: Civil Engineering and Architecture; Mechanical Engineering and Machine Construction; and Mining Engineering, Metallurgy, Assaying and Mining Law.

In 1891 Civil and Mechanical were combined. By 1893 Mining had become Mining and Metallurgy and a separate curriculum in Electrical Engineering had been introduced. In 1900 Mechanical and Electrical were combined, and in the same year the degree course in Civil Engineering was extended to four years.

In 1920, in an act of major academic restructuring, the University created six new faculties including Engineering, so separating it off from the Faculty of Science after nearly forty years of association. To this day the two faculties remain closely allied in teaching and outlook. The other faculties created at that time were Agriculture, Architecture, Dentistry, Economics and Veterinary Science.

Administrative arrangements in Engineering remained unchanged until 1926 when Engineering Technology was added as a fourth branch. With the decision of the Senate to introduce teaching in Aeronautical Engineering in 1939, Aeronautical Engineering became the fifth branch. In 1948, on the appointment of Professor T.G. Hunter as the first Professor of Chemical Engineering in Australia, the Department of Engineering Technology was replaced by the Department of Chemical Engineering. In 1957 separate curricula in Mechanical Engineering and Electrical Engineering were developed and implemented.

In 1982 the departments of Civil Engineering and of Ma terials and Mining Engineering were amalgama ted to form the School of Civil and Mining Engineering. This amalgamation recognised the close association that has developed in Australia between civil engineering and the mineral extractive industries; moreover, by providing for wider contacts with the various branches of the industry, it was intended to strengthen the teaching and research activities in the two areas.

The Faculty continued to award separate bachelor's degrees in the five areas of engineering:

Aeronautical	Civil	Mechanical
Chemical	Electrical	

Professor William Henry Warren

At its meeting on 6 December 1882 the Senate appointed Mr W.H. Warren, CE, as Lecturer in Engineering from 1 March 1883.

Warren was born in Bristol in 1852 and obtained his technical and scientific training in the London and Northwestern Railway Works and as a student at the Royal College of Science in Dublin and Owen's College, Manchester. He sailed for Sydney in 1881 and,

following nearly two years as an employee of the Public Works Department, took up his university post. He was to hold this, first as lecturer and then, from 1884, as Professor of Engineering, until his retirement at the end of 1925, a record term of 42 years. During his occupancy of his Chair he was also Chairman of the Professorial Board, Dean of the Faculty of Science, and first Dean of the Faculty of Engineering. Professor Warren retired on 31 December 1925 and was made emeritus professor from 1 January 1926.

To his peers Warren was the acknowledged leader of his profession in Australia. His services to the community on royal commissions, on scientific and technical councils, and his work in the Department of Engineering, were widely recognised and respected. His students loved and respected him.

Peter Nicol Russell*

With the transfer of the Faculty of Engineering to the new engineering precinct in Darlington between 1961 and 1974, the Peter Nicol Russell School of Engineering moved from the building in Science Road where it had been housed for over 50 years. That building had been erected primarily through the generosity of a man whose engineering works thrived in Sydney a century ago.

Peter Nicol Russell was born in Sco tland in 1816. He came to Australia in 1832 where, with his brothers Robert and John, he helped his father establish a general engineering and foundry business in Hobart Town. In 1838 they moved to Sydney and, just before their father died, commenced a new business, Russell Bros, in Queens Place on the banks of the Tank Stream, later moving to larger premises in Macquarie Place.

Peter Russell left the firm in 1842 when he rented the foundry and ironmongery premises which were part of the estate of James Blanch, located next to the Royal. Hotel in George Street, and commenced operations under the name 'The Sydney Foundry and Engineering Works'. This business quickly flourished and in its second year received contracts for all the iron work required for the Military Barracks at Paddington, and for the Darlinghurst, Maitland and Newcastle Gaols.

Peter was later joined by his brothers, when the firm of Russell Bros was wound up, and in 1855 the partnership of P.N. Russell and Company was formed, comprising the brothers Peter, John and George (the youngest whose business 'George Russell and Company, Engineers' was absorbed in the new partnership) and the works foreman J.W. Dunlop. During the next twenty years the firm grew to such size that the works extended over a large area at Darling Harbour with a big warehouse in George Street.

It soon became the most complete organisation of its kind in Australia and undertook extensive contracts for road and railway bridges, railway rolling stock, steam dredges, gun boats for the Maori War, and crushing and flour milling machinery. Many of the beautiful cast-iron columns and ornamental architectural iron work executed by P.N. Russell & Co.'s foundry could be seen at the entrances and around the balconies of many old Sydney buildings. Bridges over the Macquarie River at Bathurst and over the Yass River at Yass, the latter with a wrought iron superstructure spanning 55m, were constructed by P.N. Russell & Co. in 1870-71.

Peter Nicol Russell returned to Londonin 1864 and retired as an active member of the firm, but for many years continued to act as overseas representative. He showed sound judgement and foresight by his anticipation of possible future labour troubles in the colony. He repeatedly suggested to P.N! Russell & Co. that they should devote more attention to the importing side of the business rather than continue manufacturing engineering equipment in keen competition with overseas trade, for in those days there was little protection to aid the local manufacturer.

On 30 October 1873 the workmen at the Sydney foundry made a demand for ten hours' pay for eight hours' work, and went on strike. No satisfactory arrangements for the settlement of the strike were reached and the engineering works and warehouses were closed in June 1875, never to be opened again. Thus P.N. Russell & Co. with a capital of £250 000 and employing over 1000 men went out of existence. When Peter Russell revisited Sydney after the closing of the firm which had been his life's work, it is said that he was so distressed that he immediately returned to London; there he lived in retirement until his death in 1905 at the age of 89, having been knighted in 1904. He was buried at St Marylebone cemetery in London, where his grave dominates, marked by a massive monument.

It was in 1895, while on leave in London, that Professor W.H. Warren, the first Professor of Engineering at the University of Sydney, had a fortunate meeting with Peter Russell, which led ultimately to the magnificent endowments totalling £100 000 for Engineering at this University. In 1896 Russell endowed the Department of Engineering by a gift of £50 000, including in the deed of gift a provision that the department should thereafter be styled "The Peter Nicol Russell School of Engineering'. In 1904 this gift was followed by a second benefaction of £50 000 as an extension of the first amount, when Sir Peter Russell stipulated that the Government of New South Wales should undertake to hand to the University, within three years, a sum of £25 000 to provide an extension of the buildings of the School of Engineering or to erect new buildings. This the Government agreed to do and a building was erected from designs prepared by the Government Architect.

Thus was founded the Peter Nicol Russell School of Engineering, the new building for which was opened in 1909. It is fitting that the present faculty building in the Darlington engineering precinct should retain the name of this great benefactor, thus preserving for future generations the P.N.R. tradition.

At the ground floor entrance of the Peter Nicol Russell Building may be seen one of the hardwood lintels from the Darling Harbour foundry. An elaborate Royal Coat of Arms, which was cast in the foundry for

This short biography is based on an article that appeared in the *JournalR.A.H.S.Vo\. 50 Ft2.*

an exhibition in London in 1851, is on display in the foyer. In the courtyard stands one of the many cast iron building columns made in the P.N. Russell & Co.'s foundry, and nearby is the monument in granite and bronze—a duplicate of Russell's St Marylebone Cemetery memorial—presented to the University by Lady Russell in honour of her husband. A portrait in oilsof Charlotte Russell hangs above the mainstairway leading from the foyer to the first floor drawing office.

The Warren Centre for Advanced Engineering

Origin

The Warren Centre for Advanced Engineering is an independent, industry-linked institute committed to fostering excellence and innovation in advanced engineering throughout Australia. Set up in 1983 to mark the centenary of engineering education at The University of Sydney, The Warren Centre is a self-funding, non-profit organisation.

The Warren Centre has four objectives:

- stimulatinginnovationintheadvanced engineering technologies important to Australia's industrial development;
- encouraging effective deployment and use of new engineering technologies;
- promoting the integration of technology, management, design and enterprise among Australian businesses; and
- providing independent advice and comment on the aboveissues and their impact onnational policies and industrial development and enterprise.

In its brief history, The Warren Centre has gained wide recognition for its unique approach and achievements in diverse fields of engineering technology and industry development.

The Centre's core services include major projects, seminars and lectures and a range of programs being developed in recent years for high-tech enterprises.

Operation

The Warren Centre is governed by a Board of Directors which consists of a majority of members fromindus try as well as the Dean of Engineering and representatives from the Engineering Faculty and The University.

The Centre's fundamental aim is to engage in activities which are likely to justify strongparticipation and financial support by industry and the engineering profession.

The Centre underwrites the initial setup costs and risks for each activity from its investment income, which also covers core operating and administrative costs.

The investment base comprises donations, bequests and reserves. The reserves are adjusted regularly from investment income to preserve the original capital value of donations and bequests in current dollars.

Standing currently at just over $3 million, the investment base plays an important role in determining the scope and growth of The Warren Centre's activities.

Activities

Conferences and seminars

Seminars are held during each Major Project. The Centre also sets up conferences and seminars to explore contemporary issues such as engineering risk, intellectual property, financing innovation, engineering mathematics and adding value.

SME networking

The WarrenCentre promotes activities targeting small to medium size enterprises (SMEs), including the AusIndustry Business Networks Program and Round Tables where SMEs in suburban and regional centres exchange ideas, discuss issues and explore opportunities of mutual interest.

Opening other frontiers

The Warren Centre played a key role in the establishment of the Australian Graduate School of Engineering Innovation (AGSEI) and the Asia Pacific Smart Card Forum.

Publications

The Centre's publications on the findings of its activities have received world-wide respect for their value and objectivity.

Major Projects

The Warren Centre brings together leading people in selected fields of engineering technology to work on Major Project teams to:

- develop new insights and knowledge in the technology; and
- accelerate the tecliholpgy'sapplicationin Australian industry.

These Major Projects invariably result in important breakthroughs in the technology itself and impact on Australian engineering practice and business enterprise. Major Projects have included:

Underground Space in the Urban Environment (1996)—which established the status quo for development and use of underground space and provided strategies, supported by engineering technology, for integrating the use of underground space into the fabric of the urban environment.

Utilisation of Supercomputers in Science and Engineering (1992)—which demonstrated how high performance computing can provide a new approach to solving practical problems for industry and government through extensive use of case studies, giving hands-on experience to the project team.

Energy Management in the Process Industries (1990)—which demonstrated that commercially practical applications of modern energy management techniques and technology offer annual savings exceeding $1 billion nationally, and indicated how this might be achieved.

Economic Recycling and Conservation of Structures (1989)—which combined philosophy with practical technology to achieve cost-effective conservation and re-use buildings.

Fire Safety and Engineering (1989)—which established the basis for a new systematic engineering approach to achieve fire safety, with the prospect of large savings in building construction costs without any reduction in safety.

Preparing Australians for a Future with Technology (1988)—which examined cultural and educational tasks involved and provided guidelines for initiatives in technological awareness.

Winning by Design (1987)—which explored the key role that design plays in creating successful value-added products for export markets; it also played an important role in the establishment of the Australian Academy of Design.

Advanced Process Control (1987)—which identified potential benefits from the use of advanced process control in Australian industry and offered courses in technology.

Chairman, Board of Directors
Peter J North, BE, MBA *Harv.,* FAIM FAICD

Executive Director
Professor Trevor W. Cole, BE *WAust.* PhD *Camb.,* FTSEFIEAustCPEngFRSAAIDC(Dip) .

General Manager
Angus M Robinson, BSc *Melb.,* FAIM FAusIMM

Administration Manager
Cheonhee Sohn, BA *H.U.F.S. S.Korea* MEd *U.N.S.W.*

Administrative Assistant

Australian Centre for Innovation and International Competitiveness (ACIIC)

ACIIC was established as a non-profit company in April 1992 and has the status of a department of the Faculty of Engineering. It is dedicated to building bridges between Australia's intellectual capability and the world of business and government. Its mission is to:

- work closely with Australian industry to build international competitiveness;
- support economic and social development using the leverage of technological innovation;
- integrate innovation to capture the benefits of the national investment in science and technology; and
- assist the engineering community to understand the forces which are reshaping the requirements of engineering employment and engineering education.

ACIIC delivers a number of services to the Faculty. These include:

- teaching undergraduate and postgraduate courses in engineering management, innovation and environmental engineering and public policy;
- supervision of undergraduate final year theses and PhD students; and
- assistance with strategic planning, marketing, the development of new teaching initiatives, and linkages with government and industry:

ACIIC is also engaged in grant and contract-supported research on issues of science, technology, engineering and innovation planning and management. Recent projects include:

- development of appropriate models for innovation and competitiveness in the knowledge economy;
- models of social and organisational innovation appropriate to the learning organisation;
- application of foresight techniques to strategic planning and priority-setting;
- strategic planning for public sector organisations such as universities, schools, local governments and public libraries in the context of the information economy and technologies;
- evaluationofresearchfundingprograms, university industry linkages, and the distribution of basic research capability across Australian universities; and
- application of new learning theories and technologies in schools and adult education and in involving industry.

ACIIC provides a non-engineering capability to the Faculty which will assist it to pursue relevant objectives of the strategic plan. Its contribution will be assessed against the quality of the student intake, the visibility and image of the Faculty, the quality and impact of non-engineering education and the strength of and revenue raised for research.

Australian Graduate School of Engineering Innovation (AGSEI)

AGSEI is a national Advanced Engineering Centre promoting an engineering culture which brings together technology, management and marketing, with an overall focus on wealth creation and the introduction of a more effective process of engineering innovation to Australian industry.

AGSEI has been formed jointly by the Engineering Faculties of the University of Sydney and the University of Technology, Sydney, and is located separately from both of them. Its objectives are:

- to ensure that today's engineers, as well as those of tomorrow, are better equipped to take leadership roles inassuring the success of industrial enterprises;
- to educate engineers and others to think and contribute across disciplines in a corporate environment;
- to demonstrate the central role of innovation in achieving competitive advantage;
- to provide industry with convenient access to national and international best practice in engineering management and the application of technology;
- to enhance the capability to commercialise new technology and the results of research and development;
- to foster the creation of new industry through technology transfer and the introduction of appropriate management systems;
- to raise understandingin the professions and society of the role of industry, technology and engineering in the creation of national wealth; and
- to educate engineers to understand and contribute to enterprise management, and to educate executive managements to understand and utilise their engineering capability more effectively.

Students

Initially programs are being structured for engineers and other professionals who have been in industry for two to three years after completing their bachelor's degree. Later programs will be developed for undergraduate courses.

The programs

AGSEI offers an array of courses centring on:
Engineering Management
Engineering Innovation
Industrial Systems Engineering
The programs cover topics in:

- quality
- innovation
- technology
- systems engineering
- information technology and management
- computer-aided engineering and logistic support
- human resources and change management
- professional and business ethics
- design and documentation
- manufacturing
- government
- economics
- marketing
- finance
- law

The approach taken is distinctly different from that of an MBA. The MBA programs teach generic management, regardless of what is being managed. AGSEIbuilds specifically on the capability of *engineers,* and is wholly about organisation and application of engineering effort to innovation and business performance—*total engineering,* not total management.

Modules

The basic program element is the module, typically offered over one week and involving intensive material presentation plus workshop and project sessions. Modules may be aggregated, by those who wish to do so, to lead to formal awards at several levels such as graduate certificate or master's degree. Modules will have the following characteristics:

- All modules will be available in stand-alone form, designed expressly to meet the needs of engineers and engineering enterprises.
- All programs require the course content to be trialed in industry, with advice from AGSEI staff, and (where possible) the results to be reported and discussed in workshop sessions.
- Heavy use is made of industry-based project work.
- Wherever possible, modules involve group interaction,normallymulti-disciplinary.AGSEIacts not only as a teaching and advisory resource but as a framework in which participants (engineers and other professionals who deal with engineers) learn from each other and from inter-organisation contacts.

More detailed information may be obtained from the AGSEI (tel. 9209 4111).

Chemical Engineering Foundation

The Chemical Engineering Foundation within the University of Sydney was established in 1981 with the following objectives:

- to foster good communications between industry and commerce and the Department of Chemical Engineering;
- to advise on courses of instruction in Chemical Engineering;
- to encourage students of high calibre to work in the Department;
- to assist graduates in Chemical Engineering to make appropriate contributions to industry; and
- to facilitate and develop research in Chemical Engineering with particular reference to industry oriented projects.

The Chemical Engineering Foundation provides an opportunity for executives in Australian industry to assess and discuss what is taught in the undergraduate course in chemical engineering.

Activities include financial support to the undergraduate program and to research by both postgraduates and staff. Continuing educationcourses for practising engineers are regularly arranged, publication of updates on the Department's research activities is undertaken twice yearly, and emphasis is placed on expanding industry-university collaboration.

Australian Centre of Advanced Risk and Reliability Engineering

The Australian Centre of Advanced Risk and Reliability Engineering Ltd (ACARRE) is a joint venture of the University and the Australian Nuclear Science and Technology Organisation (ANSTO). It is a company limited by guarantee, and has the objective of promoting appropriate application of risk and reliability engineering and management principles in Australia and the near region. It operates in three fields: education, through undergraduate, postgraduate and external courses; research; and industry and government consultancy throughout Australia ranging from the chemical industry and oil refining to transport, storage and distribution. In undertaking these activities, ACARRE draws on specialist skills from the University, ANSTO and elsewhere. The Executive Director is the ANSTO Professor of Risk Engineering.

The Civil and Mining Engineering Foundation

The objectives of the Foundation are to assist the University of Sydney on matters associated with education and research in civil and mining engineering. By securing resources the Foundation enables the School to be the leading provider of civil engineering education and research in Australia.

In particular the Foundation aims to identify the needs and to provide the resources to:

- assist the School to achieve and maintain pre-eminence in selected disciplines in civil and mining engineering;
- establish the School as the leader in the provision of postgraduate and continuing education;
- enhance cooperation between industry and the School in education, research and technical services; and
- facilitate communication at all levels between the civil and mining engineering community and the School.

The Foundation actively fosters collaboration between the school, the engineering profession and the industry it serves.

This is achieved by:

- promoting engineering consultation, research, training, lectures, short courses and technical reporting;
- providing direction to undergraduate and post-graduate education programs;
- sponsoring research projects in the School and encouraging research links with industry;
- forming working parties of top engineers from government, consulting practices, the civil and miningindustry and the University to study topical issues arising in the engineering profession; and
- reporting the important results of all these activities to Members and the Public through reports and engineering publications.

The Foundation is supported by annual subscriptions from its Benefactors, Governors, Members and Personal Members, functions and by special donors. The annual subscriptions, as determined by the Foundation Council are: $5000 for Governor level and $1000 for Member. Details of other grades of membership are obtainable from the Foundation. Tel (02) 93512127.

Management of the Foundation is vested in a Council of not less than five representatives of Governor and Member organisations and up to five representatives of Members appointed by the Senate. Ex-Officio members of the Council include the Chancellor, Deputy Chancellor, Vice-Chancellor, the Professor in the School of Civil and Mining Engineering, the Head of the School, the Presidents of the Civil Engineering Graduates' Association, the Directors of the School's Centres, and representatives of the Students.

Electrical Engineering Foundation

The mission of the Electrical Engineering Foundation is to build a successful partnership between Sydney University Electrical Engineering, industry and the profession which facilitates, in Australia, the achievement of world-class performance through education, research and development.

The Foundation is managed by a Board made up of representatives from industry, University staff, students and graduates.

The Foundation pursues its mission through activities in the following areas:

- Alumni Relations
- Business Development
- Conference Management
- Continuing Education
- Departmental Development
- Information Services
- Membership Development
- Quality Management
- Student Development

The current President of the Foundation is Mr Allan Gillespie, Chief Executive Officer of AUSTA Electric. The Director is Professor Trevor Cole. The Foundation's Office is located in Room 606 of the Electrical Engineering Building.

Centre for Geotechnical Research

The Centre was set up within the University of Sydney in August 1987 with the primary aim of promoting industry-university cooperation in furthering knowledge in the theory and application of geo technics and geomechanics.

It comprises staff and laboratories from the following departments, schools and groups: Civil and Mining Engineering, Geology and Geophysics, Geography, Soil Science, Ocean Sciences, Ocean Sciences Institute and the Coastal Studies Unit.

The objectives of the Centre are:

- to serve as a focus for research in geotechnics and geomechanics within the University of Sydney;
- to undertake specialised research, investigation, consulting, and testing work for industry and government organisations;
- to foster inter-disciplinary research and teaching and geotechnics and geomechanics;
- to develop techniques and equipment for geotechnical testing; and
- todisseminatetechnicalinformationongeotechnics and geomechanics to industry.

Centre for Advanced Structural Engineering

The Centre for Advanced Structural Engineering was established within the University of Sydney to promote the advancement of structural engineering within and beyond the University. The Centre is housed within, and involves University staff and facilities of, the School of Civil and Mining Engineering.

The Centre provides a focus for researchers, industry, government and practising structural engineers for research and the teaching of contemporary structural technology.

The Centre undertakes specialised research, investigation, consulting and testing work for government, consulting engineering, and industry, and disseminates technical information on structural engineering to the profession and industry.

Mechanical Engineering Foundation

The Mechanical Engineering Foundation was established in November 1988 to assist the Senate of the University of Sydney and the Vice-Chancellor on matters associated with education, study and research in mechanical engineering within the University of Sydney and, without restricting the generality of the foregoing, in particular to:

- fostergoodcommunicationsbetweenindustryand commerce and the Department of Mechanical and Mechatronic Engineering;
- assist in devising courses of instruction in mechanical engineering;
- encourage students of high calibre to join the Department;
- assist graduates in mechanical engineering to make appropriate contributions to industry; and
- facilitate and develop research in mechanical engineering with particular reference to industry oriented projects.

Centre for Advanced Materials Technology

The Centre was established within the University of Sydney in 1989 and is located in the Department of Mechanical and Mechatronic Engineering with the main objective of promoting industry-University

collaborative research on the design, engineering, development and manufacturing technology of advanced materials. The Centre also undertakes specialised research and development projects, consulting and testing activities for industry and government organisations in advanced materials. It comprises staff and research facilities in the Departments of Mechanical Engineering, Civil and Mining Engineering, Aeronautical Engineering, Applied Physics, Operative Dentistry and the Electron Microscope Unit.

Cooperative Research Centre in Aerospace Structures

In 1992 the Cooperative Research Centre in Aerospace Structures started on its program of research in composite aircraft structures. This is aimed at providing a research base for manufacturing in Australia. Cooperatingin the Centre are the University of Sydney, Monash University, the University of New South Wales, the Royal Melbourne Institute of Technology, Aeronautical Research Laboratories, Hawker de Havilland and Aerospace Technologies of Australia. When at full operation it is expected that nearly 30 researchers will be active on the Centre's projects.

Optical Fibre Technology Centre (OFTC)

The OFTC at the University was established in 1989 as an initiative of the telecommunications industry with the primary aim to undertake research and development in the design, fabrication and application of Application Specific Optical Fibres. The key researchers are Dr Ian Bassett (Physics), Dr Simon Poole (Technical Director), Dr Mark Sceats (Chairman, Chemistry), and Associate Professor Tony Stokes (Electrical Engineering). The excellence of the inter-disciplinary OFTC research team, which now numbers 15 full-time staff and a similar number of higher degree students, is recognised world-wide. The Centre also provides training courses in optical fibre technology to industry.

Chancellor's Industrial Scholarships in Engineering (CISE)

Chancellor's Scholarships in Engineering are open to final year high school students who expect to achieve' a TER of at least 96.00 in the HSC or interstate equivalent. They are highly competitive and many applications are received each year for the limited number of places available.

The Scholarships are worth $11 000 in 1996. This is paid in fortnightly instalments for the four year duration of the normal undergraduate course, subject to continued satisfactory academic performance.

Chancellor's Scholars attend site visits to the sponsoring companies as well as functions at the University designed to promote good relations and personal interaction between the students and the organisations supporting the CSE program.

During the long vacations between first, second and third year, each Scholar is allotted to a sponsoring organisation for industrial education placement (IEP). Unlike other engineering undergraduates who have only one industrial placement during their time at the University, Chancellor's Scholars have the opportunity to gain experience working in various aspects of industry. Every Scholar works for three different companies and every sponsor sees three different students over the four years of the undergraduate course.

Most scholars expect to, and do join one of the sponsors on graduation, but there is no formal obligation either way.

The CSE Program is controlled by a Steering Committee and administered by the Faculty of Engineering.

Chairman, Steering Committee
Mr P. Moyle (Shell Australia)

Director
Professor R.G.H. Prince

Executive Officer
Mrs Lee Jobling

Administrative Assistant

Sponsoring organisations

ABB Asea Brown Bovery
AGL Sydney Ltd
Alcan Australia Limited
Ansett Airlines
Babcock Australia Limited
Baulderstone Hornibrook
BHP Engineering Pty Ltd
BHP Rod and Bar Products
BHP Slab and Plate Products
Boral Limited
Bull HN Information Systems
Caltex Refining
CIG
Civil Aviation Authority
CMPS&F Pty Ltd
Comalco Rolled Products
Council of the City of Sydney
CRA Adv. Tech. Development
CSR Humes
CSR Refined Sugars
Dow Chemical
DSTO Surveillance Research Laboratories
EPT Limited
Esso Australia
Federal Airports Corporation
Hawker De Havilland
ICI
James Hardie Building Projects
Master Foods of Australia
Metal Manufactures Limited
Optus Pty Ltd
Pacific Power
Pioneer Concrete
Qantas Airways
Rheem Australia Water Heater Div.
Roads and Traffic Authority
Schlumberger Seaco Inc.
Shell Company of Australia Ltd
Shell Refining (Australia) Pty Ltd

State Rail Authority
Sydney Electricity
Telecom
Telestrar
The Readimix Group
Thiess Contractors
Transfield Group
Wang Australia
Water Board

Engineering Advancement Office

Activities on behalf of the Public Relations Committee of the Faculty of Engineering are handled by the Engineering Advancement Office established in 1990. Responsibilities of the office include but are not restricted to preparing brochures, arranging visits to and by schools, organising school mailings, attending careers markets, advertising, coordinating the organisation of faculty public events, contacting industry, preparation of newsletters for staff, students, alumni and the community, fosteringstaff and student relations with former staff and students, and fund-raising.

Executive Officer, Advancement Office
Jeremy Steele

The branches of engineering

From the 18th century onwards all types of engineers, other than military engineers, were known as *civil engineers.* This definition was still valid in the early years of the Institution of Civil Engineers in Britain, whose royal charter granted in 1828 described civil engineering as'...being the art of conducting the great sources of power inNature for the use and convenience of Man'. Professor Warren was trained as a civil engineer in the modern sense, but was able to conduct courses in Mining Engineering and in Mechanical Engineering, in addition to his own area of expertise. The increase in specialisation has reduced the scope of the title *civil engineer,* although it is still the largest branch of the profession in Australia.

Aeronautical Engineering

The number of aeronautical engineers in Australia is small and the employment situation can be drastically affected by changes in internal policies or external conditions. The flow of projects to the manufacturing industry is intermittent at present and this is being reflected in a steady, though restricted, demand for new graduates.

The operations field also provides opportunities since, as aircraft become more complex, the requirements of the operators for professional engineers tend to increase. Openings exist with Ansett Airlines, QANTAS *et. al* and the RAAF. The work includes performance analysis of engine and airframe, structural analysis and the forecasting of future requirements. Many challenging problems arise on the operational side and, as some of these are peculiar to Australia, original thinking is required. Opportunities are not confined to the operators; in particular, the Civil Aviation Safety Authority employs many aeronautical engineers to investigate the airworthiness and performance of all aircraft operating in Australia.

Research and development work has beencentred on the Aeronautical and Maritime Research Laboratories and the Defence Scientific and Technology Organisation (DSTO). There is some recruitment of new staff. In addition, the extensive basic training which aeronautical engineers receive in fluid, and solid mechanics along with computer skills places them in a position to take advantage of the research and development openings that occur in many fields outside of aeronautics.

Chemical Engineering

Chemical engineering is concerned with industrial processes in which material in bulk undergoes changes in its physical or chemical nature. Chemical engineers design, construct, operate and manage these processes and in this they are guided by economic and environmental considerations.

Industries employing chemical engineers are generally referred to as the process industries: examples of these are the large complexes at Botany in New South Wales and Altona in Victoria, and the petroleum refineries in all mainland States; other examples are the minerals processing industries that refine Aus tralian ores such as bauxite, nickel sulphides and rutile to produce aluminium, nickel and titanium. In addition there are the traditional metallurgical industries, steel, copper, zinc, lead, etc., as well as general processing industries producing paper, cement, plastics, paints, glass, pharmaceuticals, alcohol and foodstuffs. Allied process operations are those involving waste disposal, pollution abatement, power production and nuclear technology.

Chemical engineering studies are based on chemistry, mathematics and physics and the first two are taken to some depth. The chemical engineer must learn something of the language and principles of mechanical, electrical, and civil engineering, and of administration, and industrial relations.

Each student completes a common core of courses, fundamental to the study of chemical engineering, and also takes a number of elective courses, chosen according to his or her particular field of interest from course options listed later. Three of these introduce students to some important industries in the process field.

Minerals Engineering. For students who are interested in gaining some familiarity with the minerals processing industries.

Biochemical Engineering. For those interested in biochemical methods of pollution control or in any of the biochemical industries such as pharmaceuticals, fermentation or food and dairy processing.

Reservoir Engineering. These courses deal with the properties and behaviour of petroleum and natural gas reservoirs, and the strategies used in their development.

Regardless of the option chosen, the graduate will be a fully qualified chemical engineer, well prepared for a career in any of the process industries.

The Department has a number of active overseas exchange programs. The exchanges, with the Royal Institute of Technology, Stockholm, and the Ecole Nationale Superieure D'Ingenieurs de Genie Chimique in Toulouse, see five or six of our final year students completing their degrees at one of these Institutions each year, with similar numbers of their students finishing their courses in Sydney. There is also an exchange program with Iowa State University which allows one or two of our students to spend their third year there. Each of these exchange schemes includes Industrial Experience in the host country. Some financial assistance is available to approved students.

The majority of chemical engineering graduates enter industry, taking up positions in plant operation, supervision, and eventually management. Others will be engaged in plant design, construction, and commissioning work either for a large process company or one of the specialist construction firms.

There is also scope for research and development work with industry or government organisations.

Chemical engineers are also recruited by many of the larger companies for technical service and sales. Graduates may also be able to obtain positions overseas either directly or through Australian companies with overseas associations.

Civil Engineering

The title Civil Engineer is given to one who invents, contrives, designs and constructs for the benefit of the community. Civil engineering covers a wide range including the conception, design, construction and maintenance of those more permanent structures and services such as roads, railways, bridges, buildings, tunnels, airfields, water supply and sewerage systems, dams, pipelines, river improvements, harbours and irrigation sys terns. In the broader sense civil engineers are charged with the task of producing structures and systems that give the greatest amenity for the funds expended. They have therefore to optimise their schemes in terms of technological performance, impact upon the environment and the financial resources available.

Civil engineers find employment: in government authorities whose concern is the design, construction and maintenance of public services; with consultants whose main interest is the design of civil engineering works; with contractors who carry out the construction work; and in civil engineering industries which manufacture and supply materials, plant and equipment.

In the junior and intermediate years of the course, the student is given a grounding in mathematics and the sciences with an introduction to structural theory, design, construction, and the properties of materials.

In the senior year, basic courses are given in structures, soil mechanics, surveying, hydraulics, structural design, construction, materials and practice of civil engineering.

In the senior advanced year, the basic courses of the senior year are continued with an additional course which requires the preparation of a thesis. Honours degree students must select courses at honours level from subjects such as: structures, soil mechanics, surveying, fluids, materials and steel and concrete structures. At honours level a more extensive thesis is required. A major segment of final year studies for pass degree students are options in structures, fluid mechanics, engineering management and geomechanics.

As civil engineering is a practical profession, attention is given to this aspect throughout the course. Full use is made of the laboratories with students carrying out experiments to obtain a better understanding of behaviour under practical conditions. There is extensive use of computers in design and other exercises. E>uring the vacation between the senior and senior advanced years, every student must obtain practical experience in a civil engineering field and must submit a satisfactory report on this experience. During the senior advanced year, students attend a two-week camp for practical surveying experience and to apply surveying methods to a project. Seminars are also held and visits to works in progress are made as opportunities arise. Students are encouraged to take a close interest in current research and investigations.

Quality Assurance: For most subjects originating in the School of Civil and Mining Engineering, independent Quality Assurance Auditors have been appointed. These auditors have no direct teaching involvement with the subjects for which they act and are responsible for maintaining an overview of each of these subjects through to the monitoring of results. As the auditors are changed more frequently than subject content, the names of current auditors, together with those of staff responsible for coordinating and running the subjects, are available from the School's Office.

Electrical Engineering

Electrical engineers are primarily concerned with development and manufacture of components and systems which utilise electrical, magnetic and optical phenomena. This wide and expanding discipline of electrical engineering may be conveniently divided in several ways. The title 'electronics engineering' is often used to differentiate the areas associated with electronic devices, such as computers and digital systems and communications, from those associated with electrical energy conversion and control systems. An alternative is to identify communications, computers, digital systems, and signal and image processing as 'information systems engineering'.

With its roots in science, electrical engineering is frequently to be found at the forefront of many new and exciting fields, such as neural computing and superconductivity. Indeed the frontiers of knowledge in all branches of electrical engineering continue to advance very rapidly with new devices, techniques and systems continually appearing. For example, developments in materials technology and solid state physics led to the invention of transistors in the 1940's. The subsequent miniaturisation of transistors in integrated circuits (microelectronics) has led to

computer and electronic communication systems of great reliability and information processing power which underpin the 'information technology revolution' of the 1980s. Transistors are also available as high power semiconductors capable of switching and controlling powers exceeding 1MW.

Their initial education and training must provide electrical engineers with the background and confidence to exploit and contribute to these rapid developments. The undergraduate program concentrates initially on the fundamental mathematics and physics which provide the models for electrical engineering circuits and devices, and information and system concepts. The first two years of the course also include computer science and introduce the main areas of electrical engineering as described earlier. The last two years of the course concentrate on developing the principles and practice of the main areas of electrical engineering. The course has a high laboratory and project content in all years. One important additional theme developed in all years of the course is that of design, communication skills and engineering management.

There are two patterns of study in the final two years. In the **'general'** electrical engineering program students study courses in all branches of the discipline: electrical energy conversion, control systems, electronics, digital systems and communications. There is an opportunity to take advanced courses in these areas. Students taking the **'information systems engineering'** program in their final two years concentrate on more advanced material in digital systems and computer engineering, and do not take the electrical energy conversion, or more advanced control systems courses. Both programs offer students the chance to take interdisciplinary electives such as biomedical engineering.

A very wide range of professional opportunities is open to graduates of electrical engineering. They may join organisations concerned with telecommunications or electrical power generation and distribution, such as Telstra and Pacific Power. They may join one of the manufacturers of electronics, communications and control devices and systems, such as AW A, Alcatel Australia and Leeds and Northrup. Others may enter the computer industry, join CSIRO or undertake further study. Like electrical engineering itself, the possibilities are almost limitless.

Mechanical and Mechatronic Engineering

Mechanical Engineering is a very broad branch of professional engineering and mechanical engineers are found in almost every type of engineering activity. They are involved in power generation, transportation systems for land, sea and air, pollution control, environmental protection and, biomedical engineering. They are found in a wide range of industries which manufacture machinery and consumer goods and offer research and technical services.

Mechanical engineers design machinery, engines, vehicles, agricultural and mining equipment, ships and household appliances. They are managers who run production lines, power stations and steel mills. They design and maintain coal conveyer systems, building services, oil and gas pipelines and port loading facilities. The great diversity of applications for mechanical engineers means they are much sought after in both commercial and industrial fields.

Students have the opportunity to complete the Bachelor of Mechanical Engineering in one of two different strands—Mechanical and Mechatronics. All students complete a common first year and select either the Mechanical or Mechatronics strand prior to commencing second year.

Mechatronics combines mechanical engineering, electronics and computing. It is the enabling technology of computer-automated manufacturing through the use of robots and automated machine tools. Mechatronics maybe concerned with individual machines such as robots, or manufacturing systems automated in their entirety.

Mechatronic engineers use computers and other digital systems to control industrial processes. They bring electronic, materials and mechanical sciences together to create a diverse range of products. These range from everyday products such as cameras, washing machines, photocopiers and anti-lock car brakes, to miniaturised substitutes for human organs and to powerful and precise computer-controlled machine tools used in manufacturing.

The first two years of undergraduate study in mechanical and mechatronic engineering provide students with an introduction to engineering science, design and manufacturing methods, management, computing and electronics, so that by the end of the intermediate year, a broad field has been covered.

In third year, mechanical engineering students study in more depth the hardware, materials and manufacturing processes which are at the heart of mechanical engineering. In addition to this, mechatronics students study topics such as control, digital systems and computer technology, electronics and electrical machines. Three months' practical training in industry follows third year for all students.

The final year of mechanical and mechatronic engineering allows students to develop the professional skills that they will need after graduation. Emphasis is placed on using engineering science, up-to-date technologies and professional tools to solve practical problems. Specialisation in the final year is encouraged. Areas of specialisation include: management, thermofluids, environmental engineering, computational fluid dynamics, design, rheology, advanced materials, orthopaedic/ biomedical engineering and mechatronics.

Project Engineering and Management (Civil)

The degree program will be offered when resources to do so become available. As at December 1996 the following description is for information only.

Recent years have seen the dawn of a new era in both the national and international scene. On the one hand there is a perceptible trend to 'globalisation' of engineering and construction businesses. On the other, engineer-constructors and project managers are required to act as forerunners in the export drive.

The onset of the twenty-first century will demand managers with technical skills to act as entrepreneurs. The competitive market forces in the construction and engineering industries will require engineers and contractors to seek alternative ways to secure business, remain viable and experience sustained growth. This demand translates into a need for a class of engineer who can synthesise projects, analyse their impacts and act as the catalyst in their implementation.

Project engineering and management embraces the 'engineering' of all types of projects, from conception and feasibility studies through to construction and commissioning, albeitat the strategic level and through multidisciplinary teamwork. The project engineer-manager is the specialist in project processes and systems, a significant role in a society becoming increasingly dependent on the creation and management of projects to solve its economic, environmental and social problems.

The degree program responds to the need for technologically competent people with financial, organisational and managerial skills to take the lead in Australia's future engineering and technological projects.

The course is virtually identical to the present Civil Engineering curriculum in the first year. In the second year, courses are introduced in such areas as engineering economics, engineering accounting as well as engineering construction. In the third and fourth years subjects such as network planning, contracts formulation and administration, human and industrial relations, operations research, cost engineering and estimatingproject formulation, value engineering and risk analysis are included.

In addition, up to 20% of all the courses taken will be electives. These are to encourage students to follow their own interests and aspirations, and at the same time expose them to as wide a variety of subjects as possible in order to prepare them as team leaders and communicators.

Graduates will be able to conceptualise, analyse and plan a range of technologies for construction and operation of engineering projects. As agents of advanced technology the graduates will be able to appreciate the human side of projects and processes. Their training will give them a better understanding of individual and group behaviour, organisational concepts, state-of-the-art planning, goal setting and other managerial know-how. In addition, they will possess project management skills that will encompass techniques for achieving project goals.

Money is the life blood of industry, and engineering is a subset of business and industrial activities. Project engineering graduates will find it intellectually rewarding to initiate projects and/or take part in the economic and monetary processes under which projects are created and executed. They will appreciate the world of finance and the intricate ways under which projects are initiated by the private and public sectors of the economy. They will also be competent enough to conduct economic appraisal of proposals, evaluate risks, undertake valuation and depreciation analyses, formulate feasible plans for project funding, and generally sell the proposal to others.

Graduates will have the capability to respond to most challenges in a resourceful manner, virtually from the day of graduation. They will be self-starters, communicators, adaptors, performers.

Employment opportunities for such a group is as diverse as the field of project engineering and construction management itself. As an example/the following organisations will typically find the prospective graduate a valuable asset:

- Construction companies
- Project managers/major consulting engineers/ planners
- Government and public agencies/municipalities and shires
- Property developers/owners/major clients
- Industrial and mining corporations
- Management consultants/investment analysts
- Development and industrial banks.

Constitution of the faculty

Extract from the Resolutions of the Senate

1. The Faculty of Engineering shall comprise the following persons:

(a) the Professors, Readers, Associate Professors, Senior Lecturers, Lecturers and Associate Lecturers in the Departments in the Faculty of Engineering, being full-time permanent or full-time temporary members of the teaching staff;

(b) the Heads of the Schools of Mathematics and Statistics, Physics and Chemistry;

(c) the Heads of the Departments of Geology and Geophysics and Computer Science;

(d) one full-time member of the academic staff of each of the Schools and Departments mentioned in subsections (b) and (c), nominated by the respective Head from time to time;

(e) two persons being full-time members of the academic staff in the Faculty of Architecture, nominated by the Faculty of Architecture;

(f) such Fellows of the Senate as are graduates in Engineering;

(g) not more than three persons distinguished in the field of Engineering appointed by the Senate on the nomination of the Dean with the approval of the Faculty;

(h) not more than five students elected in the manner prescribed by resolution of the Senate;

(i) such other persons, if any, being full-time members of the senior administrative or senior research staff in the Faculty as may be appointed from time to time by the Senate on the nomination of the Faculty;

(j) the Executive Director of the Australian Centre for Innovation and International Competitiveness.

(a) The persons nominated under section 1(e) shall hold office for a period of two years from 1 January in the year following their nomination and shall be eligible for renomination;

(b) The persons appointed under section 1 (g) shall be appointed for a period of three years and shall be eligible for re-appointment for one further period of three years;

(c) The persons, if any, appointed under section l(i) shall be members of the Faculty for so long as they remain full-time members of the senior administrative or senior research staff in the Faculty.

3 Undergraduate degree requirements

Bachelor of Engineering

There are separate quota arrangements for:

(a) Chemical Engineering;
(b) Electrical Engineering; and
(c) Aeronautical, Civil and Mechanical Engineering.

The requirements for the degree of Bachelor of Engineering are set out in Senate, Academic Board and Faculty resolutions. The Faculty resolutions and extracts from the Senate resolutions are set out later in this chapter. It is important for candidates to become familiar with these rules and regulations.

A summary of the degree requirements and of many of the rules and regulations is set out below. This is intended to assist students in understanding the rules but is not intended to replace them in any way.

Summary of degree requirements

To become eligible for the award of the degree of Bachelor of Engineering, you must

— complete the core courses of your chosen branch of engineering,
—gain credit for a minimum of 200 units,
—complete a period of practical experience in engineering and
— that the minimum time for completion of the BE degree shall be two years and the maximum shall be eight years.

Core courses and elective courses

For each of the branches of engineering in which a degree is awarded there is a list of prescribed *core* courses and recommended *elective* courses. Many of these are common to more than one branch.

A core course is one that must be passed to fulfil the requirements for the degree. In some cases the Faculty has specified courses that are acceptable alternatives to the core courses, completion of which satisfies the core course requirement. An elective course is one that is acceptable as part of the requirements but is not a compulsory course.

The core courses and the elective courses for each branch of engineering are listed in the tables at the end of this chapter. The first part of the tables summarises the Junior and Intermediate courses; the second, the Senior, Senior Advanced and Honours courses.

Descriptions of each course, in numerical order, are provided in Chapter 4.

Unit value of courses

Each course has a unit value, which is an approximate measure of the time required for lectures, tutorials and practical classes, e.g. four units may mean approximately 4 hours of classes each week for one semester or, alternatively, 2 hours of classes each week throughout the year.

When you pass a course you are credited with the unit value of the course, except where

—it is mutually exclusive with a course you have already passed, or
—you are attempting the course a second time, having gained a terminating pass the first time.

Completion of courses

In order to complete a course you must: attend the lectures, tutorials and laboratory and practical classes prescribed for the course; complete the exercises, practical work and assignments prescribed; and pass the examination(s) set for the course.

If you have been absent without leave from more than ten percent of the classes in any one semester in a particular course, you'may be asked to show cause why you should not be deemed to have failed to complete that course. Should you fail to show cause, you shall be deemed not to have completed that course.

Absence from lectures and other classes

If you are unable to attend lectures and/or practical classes because of illness, accident or for any other reason, you must submit an 'Application for Special Consideration' form. When applicable, a medical certificate or other supporting evidence should be attached. Notification forms for this purpose are available at the Engineering Faculty Office. Please see Chapter 5 for further information on applications for special consideration based on illness and misadventure.

Minimum number of units and rates of progress

To satisfy the requirements for a pass degree you are required to gain not less than 200 units, which must include all the core courses for at least one branch of engineering.

The total of 200 units is the minimum, but many students gain more than this. Some students choose to take extra elective courses and other students change their chosen branch of engineering and therefore have to pick up outstanding core courses for the new branch.

The minimum time in which you can qualify for the degree is four years. If you want to qualify in the minimum four years, you should plan to gain not less than 48 to 52 units each year. Some students take five years to complete the degree requirements. This is usually because of failure in some of the courses attempted, with the consequent need to repeat the courses. Some candidates, however, plan to progress at a slower rate, sometimes so that they can take a number of elective courses.

The BE degree is available on a full-time basis only and students cannot complete the degree requirements on a part-time basis or externally.

Classification into years

Students are classified as being in Junior (First), Intermediate (Second), Senior (Third) or Senior Advanced (Fourth) year according to the year from which the majority of their units are being taken.

Selection of courses

The following advice is intended to help you select your courses. You should become familiar with the courses that are available for the degree and particularly with those that have been prescribed as core courses for the branch or branches of engineering in which you are interested.

The full list of Junior and Intermediate courses for which you may gain units toward the degree in any branch of engineering is to be found in Tables 1(a) and (b) of the Tables of Courses accompanying the Senate resolutions at the end of this chapter.

Tables 2 to 8 set out the core courses prescribed for each of the branches of engineering. Next to each of Tables 2 to 8 is a summary of the Faculty and Department/School resolutions relating to that branch of engineering, showing, e.g., acceptable alternative courses to the core courses listed in the tables. Information about which elective courses are recommended for which branch of engineering and other relevant information is also set out on the pages next to the Tables of Courses.

For detailed descriptions of each course refer to Chapter 4, *Courses of Study.* If, for special reasons, you want to take a course which is not included in the lists of prescribed courses you may apply to the Faculty for permission.

Junior year enrolment

In your first year of attendance you are normally Tequired to enrol in 48,50 or 52 units.

Depending on the choice of elective courses you make in your first year of attendance, you may be able to proceed to the degree in any of the branches of engineering (subject to the separate electrical and chemical engineering quota arrangements).

Students in all branches of engineering study mathematics, chemistry, physics and/or mechanics and computing in their first year. Courses in these basic science subjects form the solid science basis upon which the teaching in the various branches of engineering is later built. First year students also take introductory courses in the branch of engineering towards which they are proceeding.

At enrolment time students are given information about a variety of enrolment menus, which are combinations of courses designed for each of the branches of engineering. Enrolment menus comprise courses which are considered to provide the best possible introduction to the branch of engineering for which they are designed and they will lead to sensible second year enrolments.

For some branches of engineering there is only one Junior (First) year menu, which comprises all the Junior core courses prescribed for that particular branch. In other branches, there is a choice of menus which comprise some or all of the Junior core courses together with a choice of recommended elective courses.

While first year students in the quota for Aeronautical, Civil and Mechanical Engineering must choose an enrolment menu designed for one of these particular branches of engineering, there is sufficient flexibility for students to be able to change their branch of engineering at the beginning of second year and still be able to complete the degree requirements within the minimum of four years in most cases. Students who wish to change branches at a later stage may do so but it would probably take them longer than the minimum of four years to complete the degree requirements.

Similarly, students who wish to do so may change from Chemical or Electrical Engineering into one of the other branches. The number of years that it would take them to complete the degree requirements would depend on the stage at which they wish to change and also on which branch of engineering they wish to enter.

Students who wish to transfer from Aeronautical, Civil or Mechanical branches into Chemical or Electrical Engineering must apply through the Universities Admissions Centre.

If you wish to take the opportunity of transferring to the Faculty of Science at the end of your Intermediate (or Senior) BE year, you should study the rules relating to the double degree under Resolution 13. (These rules are set out below.) You will need to fulfil a number of conditions to be eligible to transfer to the Faculty of Science, one of which is the completion of two 16-unit Science courses in your Intermediate BE year. You should therefore ensure that the menu/ courses you take in your first year will enable you to take the appropriate Science courses in your second year.

It is strongly recommended that you enrol in a menu and not in a one-off combination of courses if you wish to complete the degree requirements in the minimum of four years.

Each menu shows the branch of engineering for which it is suitable and also the consequential minimum number of units necessary for Intermediate year to complete all Junior and Intermediate core courses for each branch if all courses on the menu are completed at a satisfactory standard. There is also an indication where the consequential Intermediate enrolment would be very heavy, where it would be excessive and where there would be serious timetabling problems.

A 'one-off enrolment in courses outside the menus can have a number of pitfalls:

—the courses might not timetable,
—the consequential Intermediate Year BE enrolment mighthaveprerequisite/corequisiteproblems and/ or serious timetabling problems,
—it might result in you needing to spend five years completing the degree requirements.

Intermediate and later year enrolments

The minimum enrolment for re-enrolling students is normally 36 units and the maximum is normally 64 units (unless the Faculty has imposed any special conditions on your re-enrolment because of unsatisfactory progress in the previous year).

Enrolments outside the 36 to 64 units limit require special Faculty permission. You should note, however, that an enrolment of more than 48 to 52 units is demanding, and only an exceptionally strong student should contemplate an enrolment in the region of 56 to 64 units. Experience has shown that a student who fails a number of units and who then tries to 'catchup' by taking more than 48 to 52 units will perform far worse than if he or she had attempted a more realistic number of units.

Intermediate year students must include in their enrolment any outstanding Junior core courses for their chosenbranchof engineering. (Outstanding core courses are courses which a student either did not attempt in the previous year, or attempted but did not complete satisfactorily.) Similarly, Senior students mustinclude in their enrolment any outstanding Junior and Intermediate core courses, etc.

If you received a Terminating Pass for a course in the previous year and if that course is an '(a)' level prerequisite for a higher year core course in your chosen branch, then you would normally be required to repeat that course in your next year of enrolment (unless you were granted permission otherwise).

Your enrolment in outstanding core courses must generally take priority over your enrolment in higher year courses and you must not enrol in courses with timetable clashes.

If you are enrolling, for example, in the Intermediate year and if you are not able to add sufficient Intermediate core courses to your outstanding Junior courses to total the normal minimum enrolment of 36 units, then you should add elective units (from courses that do not cause timetable clashes) or you may apply to the Faculty for special permission to enrol in less than 36 units. Senior and Senior Advanced students should proceed in the same way.

You should note that, generally speaking, time-tabling problems with outstanding core courses and current year core courses only occur when students have failed to complete courses at a satisfactory standard and have to repeat courses or when students change their branch of engineering.

If you are thinking about proceeding towards the 'double degree' of BSc BE, then you should include two 16 unit Science courses in your Intermediate year enrolment. If this would resultin an excessive number of units, then you should discuss with advisers at enrolment time the feasibility of leaving one or two 4 to 8 unit Intermediate Engineering courses out of your enrolment. There is provision for the Faculty to grant you special permission to 'carry' these 4 to 8 units in a part-time BE enrolment concurrently with your Resolution 13 BSc degree enrolment. There is also provision for the Faculty of Science to allow you to take as part of the BSc enrolment one of the Engineering Science courses (e.g. Mechanical and Aeronautical Engineering Science). (This permission is normally only given if one of your Intermediate Science courses is not prescribed as a core course for the branch of engineering in which you are proceeding.) On completion of the Engineering Science course you could then apply to the Faculty of Engineering for exemption from the Engineering courses which comprise the Engineering Science course.

Advice for students

Advisers are available for all the branches of engineering during the official enrolment periods in February each year. This is generally the appropriate time for students to seek advice and discuss'their plans of courses.

If you require further guidance in the selection of your courses, however, or advice on any other matter concerning your studies, do not hesitate to consult a member of staff.

The Dean or Undergraduate Adviser is available throughout the year at the Engineering Faculty Office in the Faculty Building for consultation with Junior and Intermediate year students.

Senior and Senior Advanced students seeking advice on courses should consult the member of staff shown in the list of Advisers to Undergraduate Students at the beginning of Chapter 1.

Result grades

The Board of Examiners of the Faculty of Engineering is mebodywhichdeterrninesBEstudents' examination results. The Board meets in December each year when it considers the results recommended by the examiners of each course for each student. Official examination result notices are then sent to students.

Some teaching departments may release informal results at the end of First Semester, but these are not official, final results.

Satisfactory performance in a course is recognised by the award of the grade of Pass (P). Performance at levels higher than this is recognised by the award of a Credit (Cr), Distinction (D) or High Distinction (HD). If the requirements for a course are not completed then a grade of Fail (XX) may be awarded.

Grade	*%*
Pass	50-64
Credit	65-74
Distinction	75-84
High Distinction	85-100
Fail below	50

If a student failed a course but the failure was borderline, then the Board of Examiners may award one of the following results instead of a Fail:

Terminating Pass (T)—A Terminating Pass will not permit a student to enrol in further courses in that subject or to use that course as a prerequisite for courses that require a clear pass in their prerequisite courses. (This means that a T Pass does not fulfil '(a)' level prerequisite requirements.)

Terminating Pass, Optional Supplementary (M)—This is a T Pass (see above), with permission to attempt a supplementary examination: if you perform satisfactorily in the supplementary you may be granted a clear pass; if you fail, or do not sit the supplementary, you will be granted a Terminating Pass in the course.

Fail, Supplementary Examination (X)—This means that you have failed the course but have been granted permission to attempt a supplementary examination: if you perform satisfactorily in the supplementary you may be granted a clear pass or you may be

granted a Terminating Pass; if you fail, or if you do not sit the supplementary, you will be awarded a Fail in the course.

The Board also uses a concession system where, if a student failed a course but the student's overall performance in all courses reached a certain standard, the Board may award one of the following results instead of a Fail:

Pass, Concessional (PCon)—This means that the Board has conceded you a Pass. A PCon may be treated as a full, clear pass for progression purposes.

Terminating Pass (Concessional)—This means that the Board has conceded you a Terminating Pass (see T above).

Terminating Pass, Optional Supplementary (Concessional) (MC)—This means that the Board has conceded you a Terminating Pass, with permission to attempt a supplementary examination (see M above). This affords an opportunity for you to gain a full pass.

Fail, Concessional Supplementary (XC)—This means that you have failed the course but have been granted permission to attempt a supplementary examination: if you perform satisfactorily in the supplementary you may be granted a Pass; you could also be awarded a Concessional or Terminating Pass (see above); or you could be awarded a Fail. If you do not sit the supplementary, you will be awarded a Fail in the course.

If a student has not been able to complete the requirements for a course because of serious ill-health or misadventure (which has been duly attested), the Board may grant the following result:

Supplementary Examination to count as an Annual (XTCA)—This means that you may sit for a supplementary examination, and your result in the supplementary will be treated as though you had obtained it at the annual examination. You may be awarded any of the passing grades (up to and including HD) and if you fail the examination you will be awarded a Fail.

Students who are awarded supplementary examinations for reasons of illness or misadventure and who have already achieved some form of passing grade will have their result achieved indicated, followed by 'SUPP TO CHANGE GRADE'. This gives students the opportunity to attempt a supplementary exam in order to improve their original grade.

Students awarded supplementary examinations should consult the department that teaches the course for information about the form and content of the supplementary examination.

Students who have been awarded a result of Incomplete (I or IXX) or Result to Come (V) should consult the member of staff responsible for the course.

Supplementary examinations should be regarded as privileges and not as rights.

The Board of Examiners meets again each February to determine the results of students who were granted permission to sit for supplementary examinations. Students who pass their supplementary examinations will not be awarded grades of pass higher than Pass (except where an XTCA or other result of STCA—Supplementary to count as Annual—was awarded).

Exemption from attendance at classes

If you enrol in a course which you have previously attempted you may be granted exemption from attendance at laboratory or practical classes. To seek such exemption, apply on the appropriate form *before the course starts.* Application forms are available at the Engineering Faculty Office.

Deferment of enrolment

Deferment of enrolment is only possible from second year onwards. To ensure your place is kept open, you must apply in writing to the Faculty Manager, stating the reasons for your requested deferment. Deferment is normally granted for only one year, although this may be extended in exceptional circumstances which must be detailed in your letter of application.

Practical experience

At an appropriate stage of your training you are required to work as an employee of an approved engineering-related organisation and submit a satisfactory written report of your work. This period of experience, usually about 12 weeks, is normally undertaken after you complete some or all of the prescribed Senior courses and before you enrol for your final year of study. It is possible to undertake all of the work experience at the end of Senior Year, or undertake a part at the end of Intermediate Year and complete the work experience at the end of Senior Year. There is a core course prescribed for each of the branches of engineering which comprises this practical experience requirement. Please refer to the course descriptions later in this Handbook for specific conditions applying in each Department in relation to when the work experience can be undertaken and what type of experience is "suitable.

If you are not committed to employment as a cadet or scholarship holder the Careers and Appointments Service of the University is available to help you obtain suitable employment.

Candidates for the degree in chemical engineering obtain this experience in special vacation practice schools, located in industrial plants and supervised by academic staff, whenever this can be arranged.

Honours degree

If you have made good progress for three years you may apply for admission as a candidate for the honours degree before commencing on your fourth and final year of study.

When you are accepted as a candidate for honours you may be required to enrol, in the final year, in Honours courses specified by the head of the department in which you are a candidate.

Alternatively, if you satisfy the requirements for the award of the pass degree in four years, you may then apply for admission as a candidate for honours. If accepted, you will be required to enrol for a fifth year of study and the award of the degree is deferred for one year.

In both cases the acceptance of an application rests with the head of the department concerned. Applications from students who have taken longer than three or four years, as the case may be, to reach the necessary standard may be considered, but in such cases it is necessary to obtain special approval of the Faculty.

The various Engineering departments use different formulae for determining students' eligibility for the award of Honours. All enquiries about this should be addressed to the relevant department.

The double degree BE/BCom

The double degree of BE/BCom was introduced in 1993. Engineering graduates often end up in management. This is because they are trained insolving problems, are good with figures, have learnt to work in teams and to deal with people. A background in commerce is a valuable asset in such progression. The engineer with financial skills can be more useful to his or her employer, and is likely to advance more securely and rapidly in a career headed towards management.

The five-year double degree with Commerce begins with a standard first year in Engineering. If accepted into the program you will spend a further four years studying Engineering and Commerce subjects in parallel.

Engineering workload: The normal Engineering degree consists of about 200 units: 50 units per year over four years. For the double degree with Commerce the total Engineering unit count is about 169. Over Years 2 to 5 of the double degree program the average number of Engineeringunits per year is 30, or 60% of the standard load. This load may be distributed differently in each department.

Commerce workload: The normal Commerce degree consists of 22 semester courses over three years. For the double degree this is 15. The Engineering equivalent of the Commerce courses is about 108 units spread over Years 2 to 5 of the double degree. The average load of Commerce and Engineering units taken together is 57 per year.

Who is eligible: Students enrolling in Intermediate (second) Year Engineering with a Junior (First Year) weighted average mark (WAM) of at least 62% maybe eligible for admission to the Bachelor of Engineering/ Bachelor of Commerce double degree program. Applicants will be selected in order of decreasing WAM. You will also need to have gained credit for at least 48 units towards the Bachelor of Engineering degree (a minimum unit requirement for first year Engineering), and have completed all courses attempted at full pass level or better at the first examination (i.e. you cannot upgrade through supplementary exams).

Who is not eligible: The double degree with Commerce is not available to those who enrol in Aeronautical Engineering and cannot be taken with:

- Information Systems Engineering
- Mechatronics
- The BE BSc double degree.

How to apply: Apply to the Faculty of Engineering by 30 November of your first year of attendance, on the applicationformavailableattheFaculty of Engineering Office.

The double degree BSc BE

Many Engineering students take the opportunity of gaining the 'double degree' of BSc BE.

If you satisfy certain requirements you may be permitted to transfer to the Faculty of Science for one year in order to complete the requirements for the BSc degree. This one year is additional to the four years required to complete the BE degree. Students who proceed towards the 'double degree' usually transfer to the Faculty of Science after they have completed two years of Engineering, but there is provision for students to do so after they have completed the Senior (or Third) year of the BE degree course. There is also provision for students to complete the BSc degree under Resolution 13 over two years part-time instead of one year full-time. Most students do so full-time, however. There is also provision for students to remain in the Faculty of Science for an extra year in order to complete an Honours BSc degree.

After completion of the Science year(s), students then transfer back to the Faculty of Engineering in order to complete their BE degrees.

The rules and regulations relating to the 'double degree' are set out in Resolution 13 of the Resolutions of the Senate relating to the degree of Bachelor of Science and in Resolutions of the Faculty of Science. These rules are set out below and you should study them carefully if you are interested in obtaining the 'double degree' of BSc BE.

A summary of the mainpoints of the rules is also set out below. This summary is intended to assist students to understand the rules but is in no way intended to replace them,

Summary of Resolution 13 rules

In order to be eligible to transfer to the Faculty of Science for the 'double degree', you should normally have:

—completed 96 units at the end of your second year of enrolment in the BE degree course (or 108 units at the end of your third year of enrolment);

—course including at least two 16 unit Intermediate Normal or Intermediate Long Science courses (for example, Chemistry 2, Computer Science 2, Mathematics 2, or Physics 2).

In order to qualify for the BSc degree you are required to complete courses totalling 24 units. The 24 units should normally include at least one 12 unit Senior course (for example, Chemistry 3, Computer Science 3, Pure or Applied Mathematics 3, Physics 3). If only one 12 unit Science course is completed, then at least 8 of the remaining 12 units should be for an Intermediate course. You have the choice of a wide range of subjects in the Faculty of Science, but you must have satisfied the prerequisites laid down in the BSc degree requirements for any course in which you wish to enrol.

If you are interested in proceeding towards the 'double degree' it is essential that you plan your

courses carefully in your Junior (First) year, so that you fulfil prerequisite requirements for the two 16 unit Intermediate Science courses which you must take in your Intermediate (Second) year.

Application to transfer to the Faculty of Science under Resolution 13 should be made at the end of your Intermediate (or Senior) year studies (i.e. by the end of December in the year prior to the one in which you wish to undertake the Science year). Applications will close on the last working day in the University prior to the closing of the University for the Christmas break.

Similarly you will need to lodge an application to transfer back to the Faculty of Engineering from the Faculty of Science.

Applications for transfer to and from the Faculty of Science are available at the Student Centre and the Faculty of Science and Faculty of Engineering Offices.

Resolution 13 Rules

1. Pursuant to Resolution 13 of the Resolutions of the Senate governing the degree of Bachelor of Science, students who are of two or three years' standing in the Faculty of Engineering maybe admitted to candidature for the degree.

2. To be eligible for admission, such students:

(1) must have gained credit in the Faculty of Engineering for not less than 96 units if of two years' standing in that faculty, or not less than 108 units if of three years' standing in that faculty; and

(2) except with the permission of the Dean of the Faculty of Science, must have completed at full Pass Level or better

(i) all courses attempted in the Faculty of Engineering at their first examination; including

(ii) at least two Intermediate Normal or Intermediate Long courses offered by departments of the Faculty of Science. In some circumstances students may be permitted to count as *one* of the Intermediate courses for this purpose, courses undertaken in the Faculty of Engineering which combined are the equivalent of one of the following courses in the Faculty of Science:
Chemical Engineering Science 2,
Civil Engineering Science 2,
Mechanical and Aeronautical Engineering Science 2.

3. To qualify for the award of the pass degree, candidates after admission under Resolution 13 of the Resolutions of the Senate governing the degree of Bachelor of Science shall complete in one year of full-time study or in two consecutive years of part-time study, courses totalling at least 24 units subject to the provisos:

(1) that at least 12 of the required 24 units shall be for a Senior course and, if only one Senior course is completed, at least 8 of the remaining 12 units shall be for an intermediate course; and

(2) that, except with the permission of the Dean, the 24 units shall not include any units

(i) for courses listed under Senate Resolution 10 Groups (d) or (e) relating to the degree of Bachelor of Science, or

(ii) for any courses already attempted either completely or in part, within the Faculty of Engineering, or

(iii) for all or part of the courses:
Chemical Engineering Science 2,
Chemical Engineering Science 2 Auxiliary,
Civil Engineering Science 2,
Mechanical and Aeronautical Engineering Science 2.

Such permission will be given only if the candidate has not counted one of these courses as an Intermediate course for the purpose of gaining admission under Resolution 13; up to 8 units, taken in one year to complete *one* of the above courses, may then be included. Any one of the 8 unit courses above may then be counted as an Intermediate course for the purposes of part (1) of this resolution provided the whole course is completed in one year.

4. Candidates admitted under Resolution 13 shall comply with Resolution 13 of the Resolutions of the Senate governing the degree of Bachelor of Science.

5. To qualify for admission to Honours courses, such candidates shall comply with Resolution 13 of the Resolutions of the Senate.

There is no provision for students admitted under Resolution 13 to continue in the Faculty of Science after one full-time or two part-time years of study except to complete an Honours course.

Candidates who fail to complete the required 24 units may only be readmitted to the Faculty of Science if a successful application is made at the appropriate time through UAC. Successful applicants will be given credit for courses completed in accordance with Resolution 11 of the Resolutions of the Senate governing the degree of Bachelor of Science.

Admission of BSc graduates

If you are enrolled in the Bachelor of Science degree course at this University and wish to transfer to the Bachelor of Engineering degree course, you must make application through the Universities Admissions Centre by a closing date which is late in September in the year preceding that in which you wish to enrol in the Faculty of Engineering.

Your application will be considered on the basis of academic merit, to the extent that facilities are available. Consideration will be given to your HSC examination results and to your examination results in the Faculty of Science (and to your results in any other tertiary courses you may have completed). The offer of a place in the Faculty of Engineering is NOT automatic and the competition for entry is keen.

If you are a graduand/graduate in the Faculty of Science and if you are offered a place in the Faculty of Engineering, you may be able to complete the BE degree requirements in two further years of full-time study. You would need to have completed appropriate courses in the Faculty of Science so that you could be given credit for/exemption from all or most of the

Junior and Intermediate core courses prescribed for that branch of Engineering in which you wish to proceed.

The departments in the Faculty of Engineering have indicated that they would recommend that a science graduand/graduate be given sufficient credit/ exemption to enable him or her to complete the BE degree requirements in two years if he or she has completed the courses set out below.

The BSc degree requirements would need to have been completed in the minimum time and in some Engineering departments minimum standards of performance in science courses are required.

For Aeronautical Engineering
Chemistry 1
Computer Science 1
Mathematics 2 (Pure or Applied)
Physics 2
Mechanical and Aeronautical Engineering Science 2

For Chemical Engineering
Mathematics 2 (Pure or Applied)
Chemistry 2 Auxiliary
Chemical Engineering Science 2

For Civil and Mining Engineering
Chemistry 1
Physics 1 or Computer Science 1
Mathematics 2 (Pure or Applied)
Civil Engineering Science 2

For Electrical Engineering
Mathematics 2 (Pure or Applied)
Computer Science 2
Physics 3D (passed at Credit level or better)

For Mechanical and Mechatronic Engineering
Chemistry 1
Computer Science 1
Mathematics 2 (Pure or Applied)
Physics 2
Mechanical and Aeronautical Engineering Science 2

For Mechanical and Mechatronic Engineering, students need to have achieved good grades in the courses listed above. When entering Mechanical Engineering, students will be required to enrol in Mechatronic Design.

If you have completed courses other than those listed above then the Faculty would need to give individual consideration to what credit/exemption you could be given.

The Commonwealth Department of Education may approve the extension of benefits under AUSTUDY for a period of two years for students in the final year of the science degree who proceed to studies in the Faculty of Engineering.

Engineering Talented Students Scheme

The Faculty makes special provision for first year students who have achieved outstanding academic results before coming to the Faculty. Examples of such results would include a TER of 99+, or successful competition in a Maths or Physics Olympiad. The Engineering Scheme links in with the corresponding program in the Faculty of Science since all students undertake a high proportion of Science subjects in their Junior year. Students who are admitted to the scheme undertake flexible course programs which are individually tailored to their needs; talented students can take additional subjects to broaden- their knowledge, undertake courses at a more advanced level and accelerate their progress towards the degree. Students can apply to enter the scheme at the time of enrolment in first year.

Discontinuation and variation of enrolment

Your enrolment is your responsibility. It is in your best interests to ensure that the formal record of your course enrolment is correct.

If you wish to cease attending a course (or all your courses), you are discontinuing your enrolment in those courses. You must notify the University of your intention to discontinue by submitting the appropriate form to the Engineering Faculty Office. If you fail to do so, you may be recorded as being Absent Fail in the course(s) at the end of the year and may be sent a warning letter or asked to 'Show Cause' why you have not made satisfactory progress.

There are three categories of discontinuation results used to record discontinuations in the Faculty of Engineering: 'Withdrawn', 'Discontinued with Permission', and 'Discontinued'. *These results are dependent upon the time of year you choose to discontinue (seebelow).*

If your enrolment is 'Withdrawn' (W), then your enrolment is cancelled as though you had never enrolled. This enrolmentdoesnotappearonanofficial transcript of your academic record.

If your enrolment is 'Discontinued with Permission', it means that you commenced the course(s) and were given permission to discontinue without any academic penalty or implication of failure whatsoever. However, HECS or fees are still liable for these subjects. The enrolment and the result of 'Discontinued with Permission' (DP) appear on an official transcript of your academic record.

If your enrolment is TMscontinued' (Disc), then it means that the discontinuation counts as a failure. HECS or fees are still liable for these subjects. On an official transcript of your academic record, your enrolment appears with the result of 'Discontinued'. As this result implies failure, you will be allocated a 0% unit value for this subject in the calculation of your weighted average mark. The Faculty takes student WAMs into consideration when determining whether or not students have made satisfactory progress.

Total discontinuation

If you wish to discontinue all your courses, then you must notify the University of this intention by completing and submitting your 'Confirmation of Enrolment' form (together with your student card) to the Engineering Faculty Office. You should note your reasons for discontinuing on this form. If your 'Confirmation of Enrolment' form is not available, then you should obtain an 'On-line variation form' from the Student Centre or Faculty Office and use that instead.

If your enrolment is recorded as 'Discontinued', which means that the discontinuation counts as a failure, then you have failed to make satisfactory progress with your studies and the Faculty may determine that you should be sent a 'Warning Letter' or that you should be asked to 'Show Cause'.

Variation of enrolment

Any change to your enrolment, including total withdrawal from the degree, can only be done through the Engineering Faculty Office. This includes courses taken outside this Faculty. Collect a 'Variation of Enrolment' form from the Faculty Office, have the changes approved by your Year Adviser/Supervisor and hand the completed form back to the Faculty Office, Note: Some Science undergraduate courses offering 'Normal' and 'Advanced' options are exempt from the following rules and you may move freely between the options throughout the year. If you're not sure if your course is one of these, please check with the Faculty Office. Again, you must lodge the changes through the Faculty Office.

Before March 31 (Sent 1 HECS deadline)
You may enrol in or withdraw from any course—semester or year-long—without academic or financial penalty. Your discontinuation result will be 'Withdrawn'.

After March 31
You may only enrol in or withdraw from Semester 2 courses without academic or financial penalty.
—You cannot enrol in Semester 1 or full-year courses;
—If you drop a Semester 1 or full-year course between March 31 and the seventh teaching week of Semester 1, you will automatically receive a 'Discontinue with Permission' result;
—If you drop any course after the seventh teaching week, you will receive a result of 'Discontinue'. If, however, you believe you have good reason for discontinuing at this late stage, discuss this with your Year Adviser, who may recommend a result of 'Discontinue with Permission'.

After August 31 (Sem 2 HECS deadline)
—You cannot enrol in any course this year;
—You cannot drop any course this year without penalty;
—If you drop a Semester 2 course between August 31 and the seventh week of teaching of Semester 2, you will automatically receive a 'Discontinued with Permission' result;
—If you drop any course after the seventh teaching week, you will receive a result of 'Discontinued' .If, however, you believe you have good reason for discontinuing at this late stage, discuss this with your Year Adviser, who may recommend a result of 'Discontinue with Permission'.

There is no way these rules can be bent or broken, so it is in your best interests to ensure that your enrolment is correct. If you haven't lodged every change through the Faculty Office and in accordance with the HECS deadlines, we will not be able to help you if you discover something wrong.

Other rules relating to variation of enrolment
You should note that variations of enrolment are subject to all the other rules relating to enrolment in the BE degree course. First year students are normally required to be enrolled in 48 to 52 units, and re-enrolling students are normally required to be enrolled in 36 to 64 units (unless special conditions have been imposed on their re-enrolment). Students are normally required to fulfil prerequisite and corequisite requirements and they are not permitted to enrol in courses with timetable clashes. Students must enrol in outstanding core courses and must give priority to their enrolment in these courses over higher year courses.

Weighted Average Mark (WAM)

The Faculty uses students' weighted average marks (or WAMs) when considering a number of aspects of students' candidatures: Engineering departments use WAM calculations when determining students' eligibility for the award of Honours degrees. The Faculty uses WAM calculations when ranking applicants for scholarships for postgraduate study and for undergraduate prizes and scholarships. The Faculty also takes account of students' WAMs when determining whether or not students have made satisfactory progress with their studies. A WAM is calculated for every student for every year of enrolment by adding together the products of the marks achieved with the unit value of each course attempted (including courses which have been failed or 'Discontinued') and dividing by the total number of units attempted. Courses which have been 'Withdrawn' or 'Discontinued with Permission' are not included in the WAM calculation.

Application procedure to re-enrol in the BE degree course after total discontinuation

New first year students
If you are a new first year student who totally discontinues his/her enrolment and if you wish to re-enrol in the BE degree course, then generally speaking you will need to apply for re-enrolment through the Universities Admissions Centre (unless you were recorded as 'Discontinued with Permission' and were given 'Repeat status'). ('Repeatstatus' means thatyou may enrol in the BE degree course in the next calendar year by completing an internal University 'General application for enrolment' form and that you will not need to compete for a place through UAC for that one calendar year only. If you do not take up that option and then wish to re-enrol in the BE degree course in a future year, you will need to apply for re-admission through UAC.)

UAC applications must be lodged by the closing date late in September/early in October in the year prior to that in which you wish to re-enrol.

Re-enrolling students
If you are a re-enrolling student in the BE degree course who totally discontinues his/her enrolment and wish to re-enrol in the BE degree course, then generally speaking you should apply for re-enrolment by completing an internal University 'General application for enrolment' form by 1 October in the year prior to that in which you wish to re-enrol.

Failure to make satisfactory progress and exclusion

If the Faculty considers that you have failed to make satisfactory progress with your studies, the Faculty may exclude you from re-enrolment in the Faculty of Engineering. This process of excluding students is designed to ensure that the resources available in the Faculty are used to teach those students who make the bestuse of them. Failure to make satisfactory progress cannot be defined precisely in all cases in advance, but generally you will be considered not to have made satisfactory progress if:

—your weighted average mark (WAM) for the year is poor; and/or
—you do not gain at least half of the units for which you are enrolled; and/or
—you fail a major course more than once; and/or
—you had special conditions imposed on your re-enrolment (usually because of lack of satisfactory progress in the previous year of enrolment) and you fail to meet these conditions.

If the Faculty considers that your annual progress has not been satisfactory, it may decide that you should be sent a 'Warning Letter', in which you are advised of this and also of certain conditions that you would need to meet in your next year of enrolment in the Faculty. These conditions would normally specify the number of units and particular courses that you would need to pass in the next year of enrolment in the Faculty. Failure to meet such conditions would normally result in you being asked to show good cause why you should be allowed to re-enrol in the Faculty of Engineering.

If the Facul ty considers that your progress has been most unsatisfactory it may decide that you should be asked to show good cause why you should be allowed to re-erirol in the Faculty of Engineering. This means that you are being asked for an explanation for your failure to make satisfactory progress in your studies. When the Faculty considers students' statements purporting to show good cause, it takes account of illness, accident and/or personal problems.

If the Faculty determines that you have shown good cause (i.e. it accepts your explanation), then it will allow you to re-enrol. In doing so, the Faculty will probably impose certain conditions on your re-enrolment (such as specifying the number of units and particular courses that you must pass in your next year of enrolment). Should you fail to meet these conditions you may be called upon again to show good cause why you should be allowed to re-enrol in the Faculty of Engineering.

If the Faculty considers that you have failed to show good cause (or if no statement is received from you), then the Faculty may exclude you from enrolment. If you are excluded, you have the right of appeal to the Senate. The Senate may either uphold your appeal and allow you to re-enrol in the Faculty of Engineering or it may disallow your appeal and confirm your exclusion.

A student who is excluded from re-enrolment in the Faculty may apply for re-admission to the Faculty after two academic years have elapsed. When considering an application for re-admission, the Faculty takes account of the following: the circumstances that led to the student's failure to make satisfactory progress; how these circumstances have changed; and the student's activities since being excluded. TheFaculty would normally expect a student to have undertaken relevant tertiary studies successfully during this period. (You should note, however, that students who are excluded from one Faculty or degree course at this University are finding it increasingly difficult to gain selection into another course at this University and at other tertiary institutions.)

Outcomes of degree programs in the Faculty of Engineering

This section provides a statementof expected outcomes from the undergraduate degree programs in the Faculty of Engineering.

Outcomes

Outcomes of the undergraduate degree programs can be specified in terms of the attributes of graduates from the Faculty, with two qualifications:

(a) There is a minimum common set of attributes that all Engineering graduates will possess. However, in recognition of the differences between students, the Faculty provides a wide range of learning opportunities so that students can achieve optimum outcomes consistent with their own interests.
(b) The more advanced objectives of teaching in the Faculty can probably only be specified in very general terms. This is appropriate for university-level teaching.

The attributes of our graduates can be divided into three classes:

(1) Knowledge and understanding: Course curriculum descriptions in this Handbook summarise the fields covered, which embrace broad areas of engineering and adjoining disciplines. The courses emphasise understanding of underlying principles and conceptual frameworks rather than rote learning of facts. It is this type of understanding that graduates can carry with them into their future careers.

(2) Abilities: These encompass generic capabilities, such as management and communication skills, as well as specific engineering abilities, such as proficiency in engineering problem-solving and analysis; testing and measurement; and planning and design. Graduates will possess the ability to effectively apply knowledge acquired during the course and, equally importantly, be able to adapt to new environments in engineering with confidence. A range of practically-orientated capabilities are developed in the Faculty's programs. These include: the ability to extract key aspects from information; the ability to evaluate the reliability of data; skills in estimation and approximation; the ability to recognise when additional expertise or information is required; and the ability to take the broad view of an engineering task including the non-engineering aspects. To help develop these capabilities, laboratory work is a key element in the Faculty's undergraduate programs.

Through laboratory design and project work, students not only acquire up-to-date technical skills (including computer-based skills), but develop attitudes important to the practice of engineering.

(3) Attitudes: Personal characteristics of the graduates include: an understanding of the function of engineers in society; an understanding of the roles of scholarship, research, and innovation; a recognition of the importance of continued study to remain up-to-date; an appreciation of professional ethics; and a cognisance of environmental issues.

The Engineering degree is accredited by the Institution of Engineers with Continued Full Recognition. The rigorous periodic accreditation process includes a full review of course structure and content, inspection of Faculty facilities, perusal of examination papers and meetings with students and staff. The Faculty is developing uniform procedures for quality assessment of courses, including a common scheme for course evaluation by students and review of examination material.

Statutes

Bachelor of Engineering

Resolutions of the Senate

1. (1) The degree of Bachelor of Engineering shall be awarded in:
   (a) Civil Engineering
   (b) Mining Engineering
   (c) Mechanical Engineering
   (d) Mechanical Engineering (Mechatronics)
   (e) Electrical Engineering
   (f) Electrical Engineering (Information Systems Engineering)
   (g) Chemical Engineering
   (h) Aeronautical Engineering
   (i) Project Engineering and Management (Civil).

   (2) The certificates for the degree shall specify the department or departments of Engineering for which they are awarded.

   (3) (i) Graduates in Engineering in any department may be admitted to the degree examination in any other department or departments on conditions to be prescribed by the Faculty.

   (ii) Upon passing the examination such candidates shall receive a certificate for such additional department or departments.

IA. For the purpose of these resolutions—

(i) a 'course' shall comprise such lectures, tutorial instruction, essays, exercises and practical work as the Faculty may provide.

(ii) to complete a course' means—

(a) to attend the lectures and the meetings, if any, for tutorial instruction;

(b) to complete satisfactorily the essays, exercises and practical work, if any; and

(c) to pass the Annual Examination of the course,

and derivative expressions shall have a corresponding meaning.

(iii) 'core course' means a course which must be completed by a candidate in order to qualify for the award of a degree, unless the candidate is granted exemption by the Faculty.

(iv) 'elective course' means a course other than a core course.

(v) 'prerequisite' means a course which a candidate must complete before the candidate is permitted to enrol in any course for which that course has been declared a prerequisite.

(vi) 'corequisite' means a course in which, unless previously completed, a candidate must enrol concurrently with any course for which that course has been declared a corequisite.

(a) The courses which may be taken for the degree are—

(i) the Junior and Intermediate courses set out in Table 1 of the Tables appended to these resolutions.

(ii) the Senior and Senior Advanced courses set out in Tables 2 to 8.

(iii) elective courses, being Senior, Senior Advanced and Honours courses from time to time prescribed by the Faculty; such courses may not be provided in every year.

(iv) such other course or courses as may be approved by the Faculty in special cases.

(b) (i) The core courses for the degree and their corequisite and prerequisite courses are set out in the Tables as follows:
In Civil Engineering—Table 2.
In Mining Engineering—Table 3.
In Mechanical Engineering—Table 4.
In Mechanical Engineering (Mechatronics)—Table 4A.
In Electrical Engineering—Table 5.
In Electrical Engineering (Information Systems Engineering)—Table 5A
In Chemical Engineering—Table 6-
In Aeronautical Engineering—Table 7.
In Project Engineering and Management (Civil)—Tlble 8.

(ii) The Faculty may prescribe courses alternative to one or more of the core courses set out in the tables, completion of which shall satisfy the requirement to complete the core course concerned.

(iii) The Head of the Department or School concerned may accept other work completed by a candidate as the equivalent of a

corequisite or prerequisite for any course provided by that Department or School.

(c) The Faculty at the time of prescribing elective courses may also prescribe corequisites and prerequisites for those courses. At the discretion of the Head of the Department concerned, other work completed by a candidate may be accepted as the equivalent of a prerequisite or corequisite prescribed for any course provided by that Department.

(d) A candidate may only enrol in courses in accordance with these resolutions and subject to the exigencies of the timetable. Where a candidate wishes to enrol in two courses given wholly or partly at the same time, the Heads of the Departments or Schools concerned in their discretion may permit the candidate to attend equivalent courses or parts of courses at other times.

3. The courses for the degree shall have a unit value; elective courses prescribed by the Faculty shall have the unit value given them at the time of prescription and all other courses shall have the unit values shown in the Tables.

4. (a) An examination called an 'Annual Examination' shall be held for each course.

(b) The Annual Examination may consist of written or oral examinations, exercises, essays or practical work or any combination of these.

(c) A candidate who has been prevented by duly certified illness or misadventure from sitting for the whole or part of the Annual Examination may be tested at such times and in such a way as the Faculty shall determine and this shall not count as a re-examination.

5. (a) A candidate who has completed a course shall have credited to the candidate's degree the unit value of that course except that:

(i) no course may be counted more than once as a qualifying course for the degree;

(ii) a candidate may not have credited for the degree units derived from more than one of such courses as the Faculty may deem to be mutually exclusive; and

(iii) a candidate may not receive credit for an option within a course which is similar in content to part of a course concurrently being taken or previously completed.

(b) (i) In any course at the Annual Examination the Faculty may award a Terminating Pass which entitles the candidate to be credited with the full number of units for that course.

(ii) A candidate who has been awarded a Terminating Pass in a course shall be held to have completed such course except that the Tables prescribe for core courses certain prerequisites in which a terminating pass is not acceptable, and the Faculty may prescribe the same restriction as to prerequisites for an elective course.

(iii) A candidate who is awarded a Terminating Pass in any course may take that course again but on completion of the course the units thereof may notbe counted again.

5A. (1) The degree of Bachelor of Engineering shall be awarded in two grades, namely, the Pass degree and the Honours degree.

(2) (i) There shall be three classes of Honours, namely, Class I, Class II and Class III.

(ii) Second-class Honours may be awarded in two divisions.

6. (a) To qualify for the award of a Pass degree a candidate shall unless granted exemption by the Faculty under part (b) of this resolution:

(i) complete all the core courses listed in the Table pertaining to the Department in which the candidate is pursuing the degree, and

(ii) complete additional elective courses as maybe necessary to gain credit for a total of not less than 200 units.

(b) In special circumstances the Faculty may grant an exemption from completion of any core course to a candidate. No credit will be allowed for any core course for which an exemption from completion has been granted.

(c) A candidate who, with the prior permission of the Faculty, completes a course or courses at another university or an appropriate institution may be given credit for suchof the courses set outin the Tables attached to these Resolutions as the Faculty may determine.

7. Except with the permission of the Faculty, a candidate, in the first year of attendance, shall enrol in Junior courses with a total unit value of not less than 48 units and not more than 52 units.

8. (a) In each subsequent year of attendance after the first, a candidate may enrol in any of the courses for which there is no prerequisite or for which the candidate has completed the prerequisites provided that:

(i) in the second year of attendance the candidate may enrol in Junior and/or Intermediate courses only.

(ii) the candidate shall include amongst the courses in which the candidate enrols such of the core courses for the degree for which the candidate was qualified to enrol in the previous year of attendance and for which the candidate has not yet gained credit, and for Which the candidate has not been granted exemption under section 6(b).

(iii) the candidate shall in no case enrol for courses having a total unit value of more than 64, nor enrol for courses having a total unit value of less than 36 unless the candidate already has a credit for 158 or more units.

(iy) once the candidate has gained credit for 28 or more units from Senior or Senior Advanced courses, the candidate shall not enrol in any further such courses until the candidate has obtained such practical experience as the Faculty may require in an Engineering organisation approved by the Faculty.

(b) The Faculty may in special circumstances grant dispensationfrom the above requirements on such conditions as it thinks fit.

(c) A candidate enrolled in a course provided outside the Faculty of Engineering shall as regards that course be governed by the requirements of the Department providing such course.

(d) A candidate who has been enrolled for the degree of Bachelor of Engineering but who has not re-enrolled for a period of one year or more shall complete the requirements for the degree under such conditions as the Faculty may determine.

(a) A candidate who re-enrols in a course which the candidate has previously failed to complete shall, unless exempted by the Faculty, attend all lectures and other classes and complete all written and other work prescribed for the course.

(b) A candidate who presents for re-examination in any course shall not be eligible for any prize or scholarship awarded in connection with such examination.

(a) Graduates in other Faculties' of the University of Sydney or graduates of other universities who desire to proceed to the degree of Bachelor of Engineering, may be admitted to candidature with credit for such of the courses set out in the Tables as the Faculty may determine, up to a maximum of 100 units, provided they have completed for their previous degree those courses or a course or courses considered by the Faculty to be equivalent. Such candidates shall then be required to complete, in accordance with these resolutions, the requisite number of courses not already taken to meet the requirements of section 6.

(b) Students who have completed a course or courses in another Faculty or other Faculties of the University of Sydney may apply for permission to enrol as candidates for the degree of Bachelor of Engineering and if granted such permission, may be given credit for any of the courses set out in the Tables which they have completed in the other Faculty or Faculties, or for any course or courses considered by the Faculty to be equivalent, provided they have abandoned credit for such course or courses in the other Faculty or Faculties. Such candidates shall thenbe required to complete, in accordance with these resolutions, the requisite number of courses not already taken to meet the requirements of section 6.

(c) Students who have completed a course or courses in another university or institution may apply for permission to enrol as candidates for the degree of Bachelor of Engineering and if granted such permission may be given credit for such of the courses set out in the Tables as the Faculty may determine.

(d) In each of the circumstances of the foregoing subsections, where an applicant for candidature has completed courses which are not comparable with any of the courses set out in the Tables, the Faculty may, either instead of or in addition to giving credit for any course that is so set out, give credit for such number of units, to be designated by the Faculty as Junior, Intermediate, Senior or Senior Advanced, as the Faculty may determine, and all units so credited shall, notwithstanding anything contained in these resolutions, count accordingly towards the satisfaction of the requirements of the degree.

10A, (1) Students who have completed one year of candidature toward the degree of Bachelor of Engineering may be admitted by the Faculty of Economics, on the recommendation of the Dean of the Faculty of Engineering, to candidature for the combined degrees of Bachelor of Engineering and Bachelor of Commerce. Students who have completed two years of candidature toward the degree of Bachelor of Engineering will only be considered for admission to the combined degrees in exceptional circumstances.

(2) Such students shall comply with such requirements for the combined degrees as may be prescribed in the resolutions of the Senate relating to the two degrees and consequential resolutions of the Faculties.

11. (a) To qualify for admission to candidature for the Honours degree, a candidate shall—

(i) be considered by the Head of the Department concerned to have the requisite knowledge and aptitude, and

(ii) except with the permission of the Faculty, be *either* of not more than three years' standing in the Faculty and have gained credit for not less than 48 units from Senior and Senior Advanced courses or of not more than four years' standing in the Faculty and have completed the requirements of the Pass degree.

(b) In the case of a candidate who transfers to the Faculty of Science in accordance with the provisions of section 13 of the Senate resolutions which govern candidature for the degree of Bachelor of Science, the time spent as a candidate in the Faculty of Science shall not be counted in determining the candidate's years of standing in the Faculty of Engineering.

(a) To qualify for the award of an Honours degree a candidate shall—

(i) complete the requirements of section 6, and

(ii) complete such Honours courses as are determined by the Head of the Department in which the candidate is pursuing the degree.

(b) The Faculty may prescribe any Senior or Senior Advanced course as a course which may be taken as an Honours course.

(c) Where an Honours course and a core course are deemed by the Faculty to be mutually exclusive, completion of the Honours course will be taken as satisfying the core course.

(d) Except with the permission of the Faculty, a candidate shall not be eligible for the award of an Honours degree unless the candidate has completed all the requirements within one year from admission to candidature.

(e) A candidate for an Honours degree who has failed to be placed in any Honours classification may be awarded a Pass degree.

13. If a candidate graduates with First Class Honours and the Faculty is of the opinion that the candidate's work is of outstanding merit, that candidate shall receive a bronze medal.

14. The provisions of these resolutions came into force on 1 January 1989. All candidates who commenced candidature prior to this date shall complete the degree requirements under such conditions as the Faculty may determine.

Resolutions of the Faculty

Bachelor of Engineering/Bachelor of Commerce

1. (1) Candidates admitted to candidature for the combined degrees of Bachelor of Engineering and Bachelor of Commerce shall qualify for admission to the pass degree of Bachelor of Engineering on completion of 168 units including the core courses listed in the branch or specialisation in which the candidate is pursuing the degree and the completion of the requirements for the degree of Bachelor of Commerce as set out in the resolutions of the Faculty of Economics.

(2) Except with special permission of the Dean of Science on advice from the Dean of Engineering, a candidate for the combined degrees of Bachelor of Engineering and Bachelor of Commerce who is admitted to the degree of Bachelor of Science in accordance with the provision of section 13 of the Senate Resolutions which govern candidature for the degree of Bachelor of Science, shall cease to be a candidate for the combined degrees and may only be eligible to be readmitted to the degree of Bachelor of Engineering.

(3) A candidate who ceases to be a candidate for the degree of Bachelor of Commerce and who has not been awarded that degree shall be eligible for the award of the degree of Bachelor of Engineering on completing such additional requirements as the Faculty of Engineering may determine.

Alternative core courses

2. Pursuant to section 2(b)(ii) of the Senate resolutions the Faculty has prescribed the following variations to the core courses required for candidates proceeding to the combined degrees of Bachelor of Engineering and Bachelor of Commerce.

Bachelor of Engineering in Chemical Engineering with Bachelor of Commerce

A candidate admitted to candidature for the combined degrees of Bachelor of Engineering in Chemical Engineering and Bachelor of Commerce shall not be required to complete the following core courses:

U2.502	Electrical Technology	4 units
U2.701	Mechanics of Solids 1	4 units
U3.645	Project Economics	4 units
U3.650	Materials and Corrosion 2	4 units
U3.670	Chemical Engineering Laboratory	10 units

but must complete the following alternative core course:

U3.670A	Chemical Engineering Laboratory	6 units

Bachelor of Engineering in Mechanical Engineering with Bachelor of Commerce

A candidate admitted to candidature for the combined degrees of Bachelor of Engineering in Mechanical Engineering and Bachelor of Commerce shall not be required to complete the following core course:

U3.460	Manufacturing Engineering and Management	10 units

but must complete the following alternative core course:

U3.461	Manufacturing Engineering	5 units

Bachelor of Engineering in Civil Engineering with Bachelor of Commerce

A candidate admitted to candidature for the combined degrees of Bachelor of Engmeering in Civil Engineering and Bachelor of Commerce shall not be required to complete the following core course:

U3.283	Applied Statistics	4 units

but shall be required to complete 10 units from the following core courses:

U4.212	Materials 3	4 units
U4.222	Structural Analysis 2	4 units
U4.223	Finite Element Methods	4 units
U4.231	Structural Behaviour 2	4 units
U4.241	Soil Engineering	4 units
U4.251	Surveying 2	4 units
U4.262	Fluids 2	4 units

Bachelor of Engineering in Electrical Engineering with Bachelor of Commerce

A candidate admitted to candidature for the combined degrees of Bachelor of Engineering in Electrical Engineering and Bachelor of Commerce shall not be required to complete the following core courses:

U3.571	Management for Engineers	3 units
U4.589	Thesis	12 units

nor be required to complete 36 units from additional approved Senior Advanced courses as described in Table 5 in the sentence commencing 'A further core requirement is to gain credit', but must complete the following course:

U4.588	Thesis A	8 units

An additional requirement is to gain credit for 12 units from the following set of Senior Advanced courses:

U4.529	Electrical Systems Analysis	4 units
U4.539	Control 2	4 units
U4.549	Electronic Design	4 units
U4.558	Digital Communication Systems	4 units
U4.559	Data Communication Networks	4 units
U4.568	Real Time Computing	4 units
U4.569	Digital Systems 2	4 units

Other Senior Advanced courses may be approved by the Head of the Department of Electrical Engineering from time to time.

Table 1 — Junior and Intermediate courses *[See Resolution 2]*

Table 1 (a) — Junior courses

Course No.	Title	Unit value	Assumed standard of knowledge at the HSC examination	Corequisites
U1.001	Mathematics 101F	6	Mathematics 3 unit course and either 2 unit Physics or the Physics core of 3/4 unit Science	
U1.002	Mathematics 102S	6	Mathematics 3 unit course and either 2 unit Physics or the Physics core of 3/4 unit Science	
Ul.O10	Mechanics IE	6	Mathematics 3 unit course and either 2 unit Physics or the Physics core of 3/4 unit Science	12 units of First Year Maths
U1.021	Physics IE	6	Mathematics 3 unit course and either 2 unit Physics or the Physics core of 3/4 unit Science **Note:** See prerequisites for 2nd Year Physics	one of Ul.O10 or U1.400 or U1.710 or U1.411
U1.022	Physics 101F	6	Mathematics 3 unit course and either 2 unit Physics or the Physcis core of 3/4 unit Science	
U1.023	Physics 103S	6	Mathematics 3 unit course and either 2 unit Physics or the Physcis core of 3/4 unit Science	
U1.031	Chemistry IE	6	Mathematics 2 unit course and either 2 unit Chemistry or the Chemistry core of 3/4 unit Science	
U1.032	Chemistry IE Supplementary	6	Mathematics 2 unit course and either 2 unit Chemistry or the Chemistry core of 3/4 unit Science	U1.031
U1.033A	Chemistry 11 IF	6	Mathematics 2 unit course and either 2 unit Chemistry or the Chemistry core of 3/4 unit Science	
U1.033B	Chemistry 112S	6	Mathematics 2 unit course and either 2 unit Chemistry or the Chemistry core of 3/4 unit Science	
U1.0402	Computer Science 101F	6	Mathematics 3 unit course	12 units of First Year Maths
U1.0402	Computer Science 102S	6	Mathematics 3 unit course	12 units of First Year Maths
U1.050A	Geology 101F	6		
U1.050B	Geology 102S	6		
U1.051	Engineering Geology 1	5		
U1.060A	Biology 101F	6	2 unit Biology or 3 unit Biology or 4 unit Science	
U1.060B	Biology 192S	6	2 unit Biology or 3 unit Biology or 4 unit Science	
U1.060C	Biology 103S	6	2 unit Biology or 3 unit Biology or 4 unit Science	

For other 12 unit First Year courses offered by the Faculties of Arts, Economics and Science consult the relevant Faculty Handbook for the rules relating to assumed. knowledge and mutual exclusiveness.

U1.100	Manufacturing Technology	4		
U1.200	Civil Engineering 1	4	For courses U1.100 to U1.710 inclusive: Mathematics 3 unit course and either the Science 4 unit course or the Chemistry 2 unit course and the Physics 2 unit course.	

Course No.	Title	Unit value	Assumed standard of knowledge at the HSC examination	Corequisites
U1.220	Statics	**4**		U1.000
U1.280	Engineering Programming	**3**		U1.281
U1.281	Computer Graphics	**3**		U1.280 or U1.040
U1.411	Mechanical Engineering 1	12		U1.000
U1.446	Engineering Computing	**8**		U1.000
U1.500	Introductory Electrical Engineering	**4**		U1.000
U1.511	Electrical Engineering 1	14		Ul.OOOand U1.020
U1.610	Chemical Engineering 1	**8**		
U1.620	Chemical Engineering Applications	**4**		U1.610
U1.630	Computing for Chemical Engineers	**2**		
U1.651	Chemical Process Case Studies	**4**		
U1.710	Aeronautical Engineering 1	12		U1.000

Table (1)(b) — Intermediate courses

Course No.	Title	Unit value	Prerequisites* (a)	(b)	Corequisites
U2.002	Maths 201F	**4**	12 units of First Year Maths		
U2.003	Maths 202F	**4**	12 units of First Year Maths		
U2.004	Maths 205S	**4**	12 units of First Year Maths		
U2.005	Maths 251S	**2**	12 units of First Year Maths		
U2.006	Maths 252S	**2**	12 units of First Year Maths		
U2.022	Physics 201F	**8**	U1.022 and/or U1.023	U1.001 and; (U1.002orU1.003) and; (U1.010 or U1.400)	
U2.023	Physics 202S	**8**	U1.022 and/or U1.023	U1.001 and; (U1.002orU1.003) and; (U1.010 or U1.400)	
U2.022E	Physics 201F (Elec Eng)	**6**	U1.022 and/or U1.023	U1.001 and U1.003	
U2.023E	Physics 202S (Elec Eng)	**6**	U1.022 and/or U1.023	U1.001 and U1.003	
U2.030A	Chemistry 201F	**8**	U1.033A and U1.033B, or U1.031 and U1.032		
U2.030B	Chemistry 211F	**8**	U1.033A and U1.033B, orU1.031andU1.032		
U2.030C	Chemistry 221F	**8**	U1.033A and U1.033B, or U1.031 and U1.032		
U2.0401	Computer Science 201F	**4**	U1.0402		
U2.0402	Computer Science 202F	**4**	U1.0402		
U2.0403	Computer Science 203S	**4**	U1.0402		
U2.0404	Computer Science 204S	**4**	U1.0402		
U2.0405	Computer Science 205S	**3**	U1.0402		
U2.0406	Computer Science 206S	**3**	U1.0402		
U2.050A	Geology 201F	**8**	U1.050B		

Table (1)(b) — Intermediate courses (continued)

Course No.	Title	Unit value	Prerequisites* (a)	(b)	Corequisites
U2.050B	Geology 202S	4	U2.050A		
U2.050C	Geology 203S	4	U2.050A		
U2.052	Engineering Geology 2	5	U1.051; or U1.050		
U2.065A	Biochemistry 201F	8	(U1.033A and U1.033B) or (U1.031 and U1.032)		
U2.065B	Biochemistry 202S	8	to be advised		
U2.066A	Biochemistry 211F	4	to be advised		
U2.066B	Biochemistry 212S	4	to be advised		
U2.090	Asian Studies 1	8			
U2.210	Introduction to Materials	4	Ul.OOO and • Ul.O10		
U2.221	Structural Mechanics	5	U1.220 and Ul.OOO and Ul.O10		
U2.261	Fluids 1	5		Ul.OOO	
U2.272	Engineering Communications 1	2			
U2.290	Structural Design	4	U1.220 and Ul.OOO and Ul.O10		U2.221
U2.410	Mechanical Engineering 2	10		Ul.OOO and U1.411orU1.710	
U2.411	Introductory Thermodynamics	.4		Ul.OOO	
U2.412	Engineering Dynamics	4		Ul.OOO and U1.410 or U1.710	
U2.417	Introductory Mechanics and Materials	8		Ul.OOO	
U2.440	Mechanical Design 1	8		U1.411 or U1.710	
U2.441	Mechanical Design IA	6		U1.411 or U1.710	
U2.443	Mechatronic Design 1	2			U2.441
U2.471	Introductory Mechatronics	6		U1.500	U2.504
U2.504	Electrical and Electronic Engineering	6		U1.500	
U2.511	Electrical Engineering 2A	8	U1.511		
U2.512	Electrical Engineering 2B	8	U1.511		U2.022E and U2.023E
U2.610	Chemical Engineering 2	8		Ul.OOO	U1.610
U2.611	Fundamentals of Environmental Chemical Engineering	4	Ul.OOO and U1.030	U1.610	U2.610
U2.612	Chemical Engineering Computations	4	Ul.OOO and U1.630		
U2.700	Mechanics and Properties of Solids 1	6		Ul.OOO	
U2.701	Mechanics of Solids 1	4		Ul.OOO	
U2.710	Fluid Mechanics	4			
U2.770	Engineering Computation	4	Ul.OOO and U1.280 and U1.281		
U2.800	Engineering Construction 1	4		Ul.OOO	
U2.820	Engineering Economics	4			U2.000
U2.821	Engineering Accounting	4			U2.820

[f]For prerequisites in Column (a) a Terminating Pass is not acceptable.

Table 2 — Civil Engineering

Candidates for the degree of Bachelor of Engineering in Civil Engineering are required to gain credit for the core courses set out below. Any additional credit necessary to satisfy the requirements of Resolution 6 shall be gained by completing other courses from Table 1 and/or from the Senior and Senior Advanced elective courses prescribed by the Faculty from time to time.

Junior and Intermediate courses (from Table 1)

U1.001 Mathematics 101F
TJ1.002 Mathematics 102S
U1.010 Mechanics IE
U1.031 Chemistry IE
U1.051 Engineering Geology 1
TJ1.200 Civil Engineering 1
U1.220 Statics
U1.280 Engineering Programming
U1.281 Computer Graphics
U1.500 Introductory Electrical Engineering

U2.002 Mathematics 201F
U2.003 Mathematics 202F
U2.004 Mathematics 205S
U2.005 Mathematics 251S
U2.006 Mathematics 252S
U2.052 Engineering Geology 2
U2.210 Introduction to Materials
U2.221 Structural Mechanics
U2.261 Fluids 1
U2.272 Engineering Communications 1
U2.290 Structural Design
U2.800 Engineering Construction 1

Course No.	Title	Unit value	Prerequisites* (a)	(b)	Corequisites
Senior courses					
U3.212	Properties of Materials	**4**	U2.210		
U3.222	Structural Analysis	**6**	U2.221	U2.000	
U3.232	Concrete Structures 1	**6**	U2.221 and U2.290	U2.000	U3.212 and U3.222
U3.235	Steel Structures 1	**6**	U2.221 and U2.290	U2.000	U3.212 and U3.222
U3.244	Soil Mechanics A	**4**	U2.210 and U2.221	U1.000	
U3.245	Soil Mechanics B	**4**	U2.210 and U2.221	U1.000	U3.244
U3.250	Surveying 1	**4**	U1.000		
U3.262	Fluids 2	**4**	U2.261		
U3.271	Transportation Engineering and Planning	**2**			
U3.275	Engineering Communications 2	**2**	U2.272		
U3.284	Risk and Reliability Analysis	**2**	U2.221 and U2.290	U1.000	
U3.801	Engineering Construction 2	**4**	U2.800		
Senior Advanced courses					
U4.202	Thesis 1	6	A Senior core course in the field of the thesis		
U4.205	Practical Experience	4	28 units of Senior courses		
U4.214	Materials Aspects in Design	4	U3.212		
U4.253	Civil Engineering Camp	4	U3.250		
U4.273	Engineering Management	4			
U4.276	Professional Practice	4			
U4.292	Civil Engineering Design	4	U3.232 and U3.235		

Together with the above core courses you must complete at least 20 units of Senior Advanced courses chosen from the elective courses in Civil Engineering or recommended streams which are available from time to time. One 4-unit course, other than an Honours course, may be replaced by at least 4 units available elsewhere in the Faculty. These are subject to the approval of the Head of School. It is not compulsory to enrol in all the subjects in any one recommended stream, i.e., subjects may be drawn from more than one stream.

[+] For prerequisites in Column (a) a Terminating Pass is not acceptable

RESOLUTIONS OF THE FACULTY OF ENGINEERING relating to Table 2 — Civil Engineering

Acceptable alternative courses

Pursuant to Resolution 2, the Faculty has prescribed the following acceptable alternatives to the core courses listed in Table 2:

Core course «	*Acceptable alternative*
U1.031 Chemistry IE	U1.033A Chemistry 111F and U1.033B Chemistry 112S
U1.051 Engineering Geology 1	U1.050A Geology 101F and U1.050B Geology 102S
U1.280 Engineering Programming	U1.0401 Computer Science 101F and U1.0402 Computer Science 102S
U1.281 Computer Graphics	U2.0401 Computer Science 201F and U2.0402 Computer Science 202F and U2.0403 Computer Science 203S and U2.0404 Computer Science 204S
U1.500 Introductory Electrical Engineering	U1.021 Physics IE or U1.022 Physics 101F and U1.023 Physics 103S or U2.502 Electrical Technology
TJ2.052 Engineering Geology 2	U2.050A Geology 201F and U2.050B Geology 202S and U2.050C Geology 203S
U2.800 Engineering Construction 1	U2.0401 Computer Science 201F and U2.0402 Computer Science 202F and U2.0403 Computer Science 203S and U2.0404 Computer Science 204S
U4.202 Thesis 1 '	U5.204 Thesis Honours

RESOLUTIONS OF THE SCHOOL OF CIVIL AND MINING ENGINEERING

Recommended elective courses

Course No.	Title	Unit value	Prerequisites* (a)	(b)	Corequisites
Junior elective courses					
U1.021	Physics IE	6	See Table 1(a) for the assumed standard of knowledge at the Higher School Certificate Examination for courses U1.021 to U1.100.		One of: U1.010 or U1.400 or U1.410 or U1.710
U1.0401	Computer Science 101F	6			
U1.0402	Computer Science 102S	6			
U1.050A	Geology 101F	6			
U1.050B	Geology 102S	6			
U1.050	Geology 1	12			
U1.100	Manufacturing Technology	4			
Intermediate elective courses					
U2.090	Asian Studies 1	8			
♦Archaeology (P&H) 101		6			
♦Archaeology (P&H) 102		6			
Senior Advanced elective courses					
U4.071	Human and Industrial Relations	6	Credit for 36 units of Senior courses plus completion of work experience		
U4.203	Thesis 2	4			U4.202
U4.223	Finite Element Methods	4	U3.222		
U4.232	Bridge Engineering	4	U3.222 and U3.232and U3.235		
U4.236	Concrete Structures 2	4	U3.232		
U4.237	Structural Dynamics	4	U3.222		
U4.238	Steel Structures 2	4	U3.235		

Recommended elective courses (continued)

Course No.	Title	Unit value	Prerequisites* (a)	(b)	Corequisites
U4.246	Environmental Geotechnics	4	U3.244 and U3.245		
U4.247	Foundation Engineering	4	U3.244and U3.245		
U4.251	Surveying 2	4	U3.250		
U4.260	Environmental Fluids 1	4			
U4.265	Environmental Fluids 2	4			
U4.266	Water Resources Engineering	4			
U4.274	Project Procedures	4			
U4.293	Project Formulation	4			U4.273
U4.461	Introduction to Operations Research	2	U2.000		
U4.044	The Building Industry in Australia Refer to Faculty of Architecture Handbook for course details	4			
U4.045	206F Environmental Geology: Hazards Refer to Faculty of Science Handbook for course: details	4			
U4.046	207S Environmental Geology: Resources Refer to Faculty of Science Handbook for course: details	4			
U5.204	Thesis Honours	10	A Senior Core course in the field of the thesis		
U5.213	Materials Honours	4			U4.214
U5.224	Steel Structures Honours	4	U3.235		
U5.226	Finite Element Applications Honours	4			U4.223
U5.234	Structural Dynamics Honours	4	U3.222		
U5.239	Concrete Structures Honours	4	U3.232		
U5.243	Soil Engineering Honours	4	U3.244 and U3.245		U4.247
U5.253	Surveying Honours	4			U4.251
U5.267	Environmental Fluids Honours	4	U3.262		
U5.294	Civil Engineering Design Honours	4	U3.232 and U3.235		U4.292

Students must take at least 20 units of elective subjects at Senior Advanced level.

Honours candidates replace core subject U4.202 Thesis 1 by U5.204 Thesis Honours and also enrol in U4.233 Finite Element Methods, 12 units of elective subjects at Honours level and at least 8 units of other elective subjects at Senior Advanced level-

Elective Streams:

Recommended elective streams are:

Construction Engineering and Management Stream
U4.071, U4.251, U4.274, U4.293, U.4.461

Environmental Engineering Stream
U4.246, U4.260, U4.265, U4.266, U4.694 (or U4.490)

Structural Engineering Stream
U4.232, U4.223, U4.236, U4.237, U4.238

Geotechnical Engineering Stream
U4.223, U4.246, U4.247, Environmental Geology 2 Auxiliary (Faculty of Science: 2 units)

[+]For prerequisites in column (a), a Terminating Pass is not acceptable.
* Faculty of Arts courses—enrol at Faculty Office.

Table 4 — Mechanical Engineering

Candidates for the degree of Bachelor of Engineering in Mechanical Engineering are required to gain credit for the core courses set out below. Any additional credit necessary to satisfy the requirements of Resolution 6'shall be gained by completing other courses from Table 1 and/or from the Senior and Senior Advanced elective courses prescribed by the Faculty from time to time.

Junior and Intermediate courses (from Table 1)

	Unit value		*Unit value*
U1.001 Mathematics 101F	6	U2.002 Mathematics 201F	4
U1.002 Mathematics 102S	6	U2.003 Mathematics 202F	4
		U2.004 Mathematics 205S	4
		U2.005 Mathematics 251S	2
		U2.006 Mathematics 252S	2
U1.021 Physics IE	6	U2.410 Mechanical Engineering 2	10
U1.031 Chemistry IE	6	U2.417 Introductory Mechanics and Materials	8
U1.411 Mechanical Engineering 1	12		
U1.446 Engineering Computing	8	U2.440 Mechanical Design 1	8
U1.500 Introductory Electrical Engineering	4	U2.443 Mechatronic Design 1*	2
		U2.504 Electrical and Electronic Engineering	6

* U2.443 (Mechatronic Design 1): Intermediate core course to be taken by Mechanical/Mechatronic Engineering students undertaking the BE/BSc double degree.

Course No.	Title	Unit value	Prerequisites* (a)	(b)	Corequisites
Senior courses					
U3.420	Thermo-fluid Engineering	10	U2.410		
U3.421	Thermodynamics	4	U2.410 and U2.411		
U3.430	Mechanics and Properties of Solids 2	8	U2.000 and either U2.416 or U2.417		
U3.440	Mechanical Design 2	8		U2.700 or U2.417and U2.440 or U2.441	
U3.451	System Dynamics and Control	6	U2.000 and U2.410 or U2.412		
U3.460	Manufacturing Engineering and Management	10		U1.411	
U3.461	Manufacturing Engineering*	5		U4.411	
U3.465	Project and Practice	6			U3.420 U3.430 U3.450and U3.460
Senior Advanced courses					
U4.480	Thesis	12	36 units of Senior courses		
U4.484	Professional Engineering	4	U3.460		
U4.485	Professional Communication	4	Completion of industrial experience		
U4.486	Practical Experience	6	28 units of Senior courses		

Together with not less than 28 units of Senior and Senior Advanced level courses chosen from the elective courses available from time to time and subject to restriction upon combinations as the Head of the Department of Mechanical and Mechatronic Engineering may prescribe from time to time.

[+]For prerequisites in Column (a) a Terminating]Pass is not acceptable.

* For BE/BCom students only

RESOLUTIONS OF THE FACULTY OF ENGINEERING relating to Table 4 — Mechanical Engineering

Acceptable alternative courses

Pursuant to Resolution 2, the Faculty has prescribed the following acceptable alternatives to the core courses listed in Table 4:

Core course	*Acceptable alternative*
U1.021 Physics IE	U1.022 Physics 101F and U1.023 Physics 103S
U1.031 Chemistry IE	U1.033A Chemistry 111F and U1.033B Chemistry 112S
U2.440 Mechanical Design 1	Both: U2.441 Mechanical Design IA and U2.443 Mechatronic Design 1
U1.445 Engineering Computing	U1.0401 Computer Science 101F and U1.0402 Computer Science 102S

RESOLUTIONS OF THE DEPARTMENT OF MECHANICAL AND MECHATRONIC ENGINEERING

Recommended elective courses

Students are required to complete 28 units of Senior and Senior Advanced elective courses. At least 24 units of these must be chosen from the mainstream electives (starred in the list below):

Course No.	Title	Unit value	Prerequisites* (a)	(b)	Corequisites
Intermediate elective course					
U2.090	Asian Studies 1	**8**			
Senior elective courses					
U3.090	Asian Studies 2	**8**	U2.090		
U3.271	Engineering Transportation and Planning	**2**			
U3.431	Mechanical Props of Materials	**4**		U2.700 or U2.417	
U3.506	Fundamentals of Biomedical Engineering	**4**			U3.540 or U2.504
U3.900	Innovation and International Competitiveness	**4**			
Senior Advanced elective courses					
U4.005	Partial Differential Equations	**2**		U2.000	
U4.070	Industrial Ergonomics	**2**			
U4.071	Human and Industrial Relations	**6**		36 units of Senior courses and completion of industrial experience	
U4.090	Asian Studies 3	**8**		U3.090	
U4.419	Thermal Engineering*	**4**		U3.420	
U4.457	Computational Fluid Dynamics	**4**		U3.420	
U4.422	Computational Methods for Partial Differential Equations*	**4**		U2.000	
U4.430	Applied Numerical Stress Analysis*	**6**		U3.430	
U4.433	Advanced Engineering Materials*	**6**		U3.430 or U3.431	
U4.434	Aerospace Materials Engineering	**4**		U3.430 or U3.431 and U3.730	
U4.438	Biomaterials and Biomechanics*	**4**	Any Intermediate year Materials course or Physics	U3.540 or U3.750 or U3.530 or U3.660	
U4.440	Advanced Design*	**6**		U3.440	

Recommended elective courses (continued)

Course No.	Tide	Unit value	Prerequisites* (a)	(b)	Corequisites
U4.441	Orthopaedic Engineering*	4		U3.431; or U3.430	
U4.451	Dynamics and Systems Engineering*	6		U3.450 and U2.504	
U4.460	Industrial Engineering*	6	U2.000 and U3.460		
U4.461	Introduction to Operations Research	2	U2.000		
U4.462	Industrial and Engineering Management	2	U3.460 or U3.571 or U3.790 together with completion of the industrial period		
U4.470	Robotic Systems*	4	U3.450		
U4.490	Environmental Engineering*	6	U3.420		U4.486
U4.491	Environmental Acoustics and Noise Control	2	24 units of Senior courses		
U4.694	Environmental Impact Assessment*	4	U3.420		

[f]For prerequisites in Column (a) a Terminating Pass is not acceptable.
* Mainstream electives.

Table 4A — Mechanical Engineering (Mechatronics)

Candidates for the degree of Bachelor of Engineering in Mechanical Engineering (Mechatronics) are required to gain credit for the core courses set out below. Any additional credit necessary to satisfy the requirements of Resolution 6 shall be gained by completing other courses from Table 1 and /or from the Senior and Senior Advanced elective courses prescribed by the Faculty from time to time.

Junior and Intermediate courses (from Table 1)

	Unit value		*Unit value*
U1.001 Mathematics 101F	6	U2.002 Mathematics 201F	4
U1.002 Mathematics 102S	6	U2.003 Mathematics 202F	4
		U2.004 Mathematics 205S	4
		U2.005 Mathematics 251S	2
		U2.006 Mathematics 252S	2
U1.021 Physics IE	6	U2.410 Mechanical Engineering 2	10
U1.031 Chemistry IE	6	TJ2.417 Introductory Mechanics and Materials	8
U1.411 Mechanical Engineering 1	12	U2.440 Mechanical Design 1	8
U1.446 Engineering Computing	8	U2.443 Mechatronic Design 1*	2
U1.500 Introductory Electrical Engineering	'4	U2.471 Introductory Mechatronics	6
		U2.504 Electrical and Electronic Engineering	6

*U2.443 (Mechatronic Design 1): Intermediate core course to be taken by Mechanical/Mechatronic Engineering students undertaking the BE/BSc double degree.

Course No.	Title	Unit value	Prerequisites* (a)	(b)	Corequisites
Senior courses					
U3.431	Mechanical Properties of Materials	4		U2.700 or U2.417	
U3.440	Mechanical Design 2	8		U2.700 or U2.417 and U2.440 or U2.441	
U3.450	System Dynamics and Controls	8		U2.410 or U2.412	
U3.460	Manufacturing Engineering and Management	10		U1.410	
U3.465	Project and Practice	6			U3.431 U3.450 U3.460 U3.476
U3.474	Electrical Machines and Drives	4		U2.471 and U2.504	
U3.476	Industrial Electronics	10		U2.471 and U2.504	
Senior Advanced courses					
U4.480	Thesis	12	36 units of Senior courses		
U4.484	Professional Engineering	4	U3.460		
U4.485	Professional Communication	4	Completion of industrial experience		
U4.486	Practical Experience	6	28 units of Senior courses		

Together with not less than 24 units of Senior and Senior Advanced level courses chosen from the elective courses available from time to time and subject to restriction upon combinations as the Head of the Department of Mechanical and Mechatronic Engineering may prescribe from time to time

t For prerequisites in column (a) a Terminating Pass is not acceptable.

Acceptable alternative courses

Pursuant to Senate Resolution 2(b)(ii), the Faculty has prescribed the following acceptable alternatives to the core courses listed in Table 4A:

Core course	*Unit value*	*Acceptable alternative course(s)*		*Unit value*
U1.021 Physics IE	6	U1.022	Physics 101F and	6
			U1.023 Physics 103S	6
U1.031 Chemistry IE	6	U1.033A	Chemistry 111F and	6
			U1.033B Chemistry 112S	6
U1.445 Engineering Computing	12	U1.0401	Computer Science 101F and	6
			U1.0402 Computer Science 102S	6
U2.440 Mechanical Design 1	8	Both:	U2.441 Mechanical Design 1A	6
		and	U2.443 Mechatronic Design 1	2

Recommended elective courses

Students are required to complete 24 units of Senior and Senior Advanced elective courses. At least 3 courses must be chosen from the mainstream electives (starred in the list below).

Course No.	Title	Unit value	Prerequisites* (a)	(b)	Corequisites
Senior Advanced Mainstream Elective courses					
U4.451	Dynamics and Systems Engineering*	6		U3.540and U2.504	
U4.456	Sensors and Signals	6	U3.450 and U3.476		
U4.462	Industrial and Engineering Management	2	U3.460or U3.571 or U3.790 together with completion of the industrial period		
U4.470	Robotic Systems	4		U3.450	
U4.477	Computers in Real-time Control and Instrumentation*	6		U3.476	
U4.478	Microprocessors in Engineered Products*	6		U3.476	
U3.090	Asian Studies 2	8	U2.090		
U3.506	Fundamentals of Biomedical Engineering	4		U3.540 or U2.504	
U3.561	Computer Architecture	3	U2.510 or (U2.504andU2.471)	U3.562	
U3.562	Software Engineering	3	U2.510 or (U2.504 and U2.471)	U3.561	
U4.438	Biomaterials and Biomechanics	4	Any Intermediate year Materials Course or Physics	U3.540 or U3.750 or U3.530 or U3.660	
U4.070	Industrial Ergonomics	2	U2.510 or (U2.504 and U2.471)		
U4.440	Advanced Design	6		U3.440	

[f]For prerequisites in column (a) a Terminating Pass is not acceptable.
*Mainstream electives

Table 5 — Electrical Engineering

Candidates for the degree of Bachelor of Engineering in Electrical Engineering are required to gain credit for the core courses set out below. Any additional credit necessary to satisfy the requirements of Resolution 6 shall be gained by completing other courses from Table 1 and/or from the Senior and Senior Advanced elective courses prescribed by the Faculty from time to time.

Junior and Intermediate courses (from Table 1)

		Unit value			*Unit value*
U1.001	Mathematics 101F	6	U2.002	Mathematics 201F	4
U1.003	Mathematics 103S	6	U2.003	Mathematics 202F	4
			U2.004	Mathematics 205S	4
			U2.006	Mathematics 252S	2
U1.022	Physics 101F	6	U2.022E	Physics 201F (mod)	6
U1.023	Physics 103S	6	U2.023E	Physics 202S (mod)	6
U1.0401	Computer Science 101F	6	U2.0402	Computer Science 202F	4
U1.0402	Computer Science 102S	6	U2.0404	Computer Science 204S	4
U1.511	Electrical Engineering 1	14	U2.511	Electrical Engineering 2A	8
			U2.512	Electrical Engineering 2B	8

Course No.	Title	Unit value	Prerequisites* (a)	(b)	Corequisites
Senior courses					
U3.511	Circuit Theory	4	U2.511, U2.512 and (U2.000; or U2.001)		
U3.512	Signals and Systems	5	U2.511, U2.512 and (U2.000;orU2.001)		U3.511
U3.530	Control 1	4	U2.511 and U2.512		U3.511
U3.540	Electronics 1	10	U2.511 and U2.512		U3.511 and U3.512
U3.552	Communications 1	6	U2.511 and U2.512		U3.512 and U3.540 and U3.551
U3.560	Digital Systems 1	4	U2.511 and U2.512		
U3.571	Management for Engineers	3			
Senior Advanced courses					
U4.512	Practical Experience	8	28 units of Senior courses		
U4.588	Thesis A*	8	12 units of Senior Advanced Electrical Engineering Courses		
U4.589	Thesis	12	24 units of Senior Advanced Electrical Engineering Courses		

A further core requirement is to gain credit for 6 units from additional approved Senior courses, and for 36 units from additional approved Senior AdvancedI courses, chosen from Table 5A or from the Table of Recommended Elective courses below.

[+] For prerequisites in Column (a) a Terminating]Pass is not acceptable.
* For BE/BCom students only

Table 5a — Electrical Engineering (Information Systems Engineering)

Candidates for the degree of Bachelor of Engineering in Electrical Engineering (Information Systems Engineering) are required to gain credit for the core courses set out below. Any additional credit necessary to satisfy the requirements of Resolution 6 shall be gained by completing other courses from Table 1 and/or from the Senior and Senior Advanced elective courses prescribed by the Faculty from time to time.

Junior and Intermediate courses (from Table 1)

	Unit value			*Unit value*
U1.001 Mathematics 101F	6	U2.002	Mathematics 201F	4
U1.003 Mathematics 103S	6	U2.003	Mathematics 202F	4
		U2.004	Mathematics 205S	4
		U2.006	Mathematics 252S	2
U1.022 Physics 101F	6	U2.022E	Physics 201F (mod)	6
U1.023 Physics 103S	6	U2.023E	Physics 202S (mod)	6
U1.0401 Computer Science 101F	6	U2.0402	Computer Science 202F	4
U1.0402 Computer Science 102S	6	U2.0404	Computer Science 204S	4
U1.511 Electrical Engineering 1	12	U2.511	Electrical Engineering 2A	8
		U2.512	Electrical Engineering 2B	8

Course No.	Title	Unit value	Prerequisites* (a)	(b)	Corequisites
Senior courses					
U3.511	Circuit Theory	4	U2.511, U2.512 and •14 units of approved Maths 2 options		
U3.512	Signals and Systems	5	U2.511, U2.512 and 14 units of approved Maths 2 options		U3.511
U3.530	Control 1	4	U2.511 and U2.512		U3.511
U3.540	Electronics 1	10	U2.511 and U2.512		U3.511 and U3.512
U3.551	Engineering Electromagnetics	4	U2.511 and U2.512		U3.511
U3.552	Communications 1	6	U2.511 and U2.512		U3.512 and U3.540 and U3.551
U3.553	Digital Signal Processing 1	4	U2.511 and U2.512		U3.51-2
U3.560	Digital Systems 1	4	U2.511 and U2.512		
U3.561	Computer Architecture	3		(U2.0422 and U2.0404) or U2.504	U3.560 or U3.476
U3.562	Engineering Software	3	U2.0422 and U2.0404		
U3.571	Management for Engineers	3			
Senior Advanced courses					
U4.512	Practical Experience	2	28 units of Senior courses		
U4.540	Electronics 2	3	U3.540 and U3.511 and U3.512		
U4.549	Electronic Design	4	U3.540 and U3.511 and U3.512		
U4.558	Digital Communication Systems	4	U3.512 and U3.552		
U4.559	Data Communication Networks	4	U3.552		
U4.568	Real Time Computing	4	U3.560		
U4.569	Digital Systems 2	4	U3.560 and U3.540		
U4.589	Thesis	8	24 units of Senior Advanced Electrical Engineering courses		

Course No.	Title	Unit value	Prerequisites* (a)	(b)	Corequisites

A further core requirement is to gain credit for 16 units of electives chosen from the Table of Recommended Elective courses below. Of these, at least 12 units must be chosen from the following set of 4-unit courses, not all of which may be available in a particular year:

U4.544 Microwave Engineering
U4.547 Optical Communication Systems
U4.548 Integrated Circuit Design
U4.555 Advanced Communication Networks
U4.556 Error Control Coding
U4.557 Satellite Communication Systems
U4.563 Advanced Digital Engineering
U4.564 Advanced Real Time Computer Systems
U4.591 Image Processing and Computer Vision

♦For prerequisites in Column (a) a Terminating Pass is not acceptable

RESOLUTIONS OF THE FACULTY OF ENGINEERING relating to Tables 5 (Electrical Engineering) and 5a (Electrical Engineering—Information Systems)

Acceptable alternative courses

Pursuant to Senate Resolution 2(b)(ii), the Faculty has prescribec the following acceptable alternatives to the core courses listed in Tables 5 and 5a:

Core course		*Unit value*	*Acceptable alternative course(s)*		*Unit value*
U2.002	Mathematics 201F		U2.002	Mathematics 210F	
U2.003	Mathematics 202F	14	U2.003	Mathematics 202F	
U2.004	Mathematics 205S		U2.004	Mathematics 205S	16
U2.006	Mathematics 252S		U2.005	Mathematics 251S	
			U2.006	Mathematics 252S	
U2.022E	Physics 201F (mod)	12	U2.022	Physics 201F 1	16
U2.023E	Physics 202S (mod)		U2.023	Physics 202S J	
U2.0402	Computer Science 202F J	4	U2.0401	Comp Science 201F	
U2.0404	Computer Science 204S 1		U2.0402	Comp Science 202F	16
			U2.0403	Comp Science 203S	
			U2.0404	Comp Science 204S	
			or		
			U2.0402	Comp Science 202F	
			U2.0404	Comp Science 204S	14
			U2.0405	Comp Science 205S	
			U2.0406	Comp Science 206S	
U3.561	Computer Architecture	3	U2.0405	Comp Science 205F	6
			U2.0406	Comp Science 206S	
			or		
			U2.0402	Comp Science 202F	
			U2.0404	Comp Science 204S	14
			U2.0405	Comp Science 205S	
			U2.0406	Comp Science 206S	
			or		
			U2.0401	Comp Science 201F	
			U2.0402	Comp Science 202F	16
			U2.0403	Comp Science 203S	
			U2.0404	Comp Science 204S	

Recommended elective courses

Course No.	Title	Unit value	Prerequisites* (a)	(b)	Corequisites
Intermediate elective courses					
U2.0405	Comp Science 205F	**6**	U1.0401; U1.0402; U1.001 and U1.003		U2.0402and U2.0404
U2.0406	Comp Science 206S	**6**	U1.0401; U1.0402; U1.001 and U1.003		U2.0402 and U2.0404
Senior elective courses					
U3.506	Fundamentals of Biomedical Engineering	**4**	U2.511; U2.512 and U2.504		
U3.521	Electrical Systems	**3**	U2.511 and U2.512		
U3.522	Power Electronics and Drives	**4**	U2.511 and U2.512		
U3.523	Topics in Electrical Engineering Design	**3**	U2.511 and U2.512		
U3.554	Speech Processing	**3**			U3.512
Senior Advanced elective courses					
U4.506	Biomedical Engineering Systems	**4**	U3.506		
U4.521	Electrical Systems Control	**4**	U3.521 and U3.530		
U4.522	AdvancedPower Electronics and Drives	**4**	U3.522		
U4.529	Electrical Systems Analysis	**4**	U3.521		
U4.533	Non-linear and Adaptive Control	**4**	U3.530		
U4.539	Control 2	**4**	U3.530		
U4.544	Microwave Engineering	**4**			U4.549
U4.547	Optical Communication Systems	**4**	U3.540 and U3.552		
U4.548	Integrated Circuit Design	**4**	U3.540 and U3.560		
U4.555	Advanced Communication Networks	**4**			U4.559
U4.556	Error Control Coding	**4**			U4.558
U4.557	Satellite Communication Systems	**4**			U4.558
U4.562	Advanced Real Time Computer Systems	**3**			U4.561
U4.563	Advanced Digital Engineering	**4**			U4.569
U4.564	Advanced Real Time Computing	**4**			U4.568
U4.565	Digital Systems 3	**3**			U4.560
U4.566	Adaptive Pattern Recognition	**3**			
U4.567	Machine Intelligence and Pattern Recognition	**3**			
U4.572	Project Management	**4**			
U4.591	Image Processing and Computer Vision	**4**	U3.512 and U3.553		
U4.592	Fuzzy Systems	**4**			
U4.593	Neural Computing	**4**			
U4.594	Adaptive Pattern Recognition	**4**			

Tor prerequisites in Column (a) a Terminating Pass is not acceptable.

Table 6 — Chemical Engineering

Candidates for the degree of Bachelor of Engineering in Chemical Engineering are required to gain credit for the core cotirses set out below. Any additional credit necessary to satisfy the requirements of Resolution 6 shall be gained by completing other courses from Table 1 and/or from the Senior and Senior Advanced elective courses prescribed by the Faculty from time to time.

Junior and Intermediate courses (from Table 1)

U1.000	Mathematics 1	U2.000	Mathematics 2
U1.001	Maths 101F	U2.002	Mathematics 201F
U1.002	Maths 102S	U2.003	Mathematics 202F
		U2.004	Mathematics 205S
		U2.005	Mathematics 251S
		U2.006	Mathematics 252S
U1.010	Mechanics IE	One of the following 2nd Yr Chemistry courses:	
		U2.030A	Chemistry 201F or;
		U2.030B	Chemistry 211F or;
		U2.030C	Chemistry 221F
U1.033A	Chemistry 111F	U2.502	Electrical Technology*
U1.033B	Chemistry 112S		
U1.610	Chemical Engineering 1	U2.610	Chemical Engineering 2
U1.620	Chemical Engineering Applications	U2.611	Fundamentals of Environmental Chemical Engineering
U1.630	Computing for Chemical Engineers		
U1.651	Chemical Process Case Studies	U2.612	Chemical Engineering Computations
		U2.701	Mechanics of Solids 1*

*Students who are planning to major in Biochemical Engineering, and who elect to take the second year Biochemistry courses U2.066A and U2.066B, will be exempt from the core courses U2.502 and U2.701.

Course No.	Title	Unit value	Prerequisites* (a)	(b)	Corequisites
Senior courses					
U3.610	Unit Operations 1	12	U2.610		
U3.621	Thermodynamics	**8**			
U3.626	Reaction Engineering 1	**4**			U3.621
U3.631	Computations and Statistics	**4**		U2.002; U2.003; U2.004; U2.005 and U2.006	
U3.645	Project Economics	**4**		U1.610	
U3.651	Materials and Corrosion	**2**			
U3.660	Process Control 1	**4**		U2.000	U3.631
U3.671	Chemical Engineering Laboratory-	**6**	U2.610		U3.610
Senior Advanced courses					
U4.600	Practical Experience	**8**	28 units of Senior courses		
U4.640	Project Engineering	**4**			
U4.681	Thesis	**8**			U4.684and U4.685
U4.684	Chemical Engineering Design 1	**4**	U3.610		
U4.685	Chemical Engineering Design 2	**8**	U3.610and U3.621		
U4.696	Process Plant Risk Management	**4**			

Togethei with not less than 12 units of Senior Advanced level courses chosen from the elective courses available from time to time and subject to restriction upon combinations as the Head of the Department: of Chemical Engineering may prescribe from time to time.

[+]For prerequisites in Column (a) a Terminating Pass is not acceptable

RESOLUTIONS OF THE FACULTY OF ENGINEERING **relating to Table 6 — Chemical Engineering**

Acceptable alternative courses

Pursuant to Resolution 2, the Faculty has prescribed the following acceptable alternatives to the core courses listed in Table 6:

Core course(s)	*Acceptable alternative(s)*
U1.033A Chemistry 111F and; U1.033B Chemistry 112S	U1.031 Chemistry IE and; U1.032 Chemistry 1ES

RESOLUTIONS OF THE DEPARTMENT OF CHEMICAL ENGINEERING

Suggested elective courses

Course No.	Title	Unit value	Prerequisites* (a)	(b)	Corequisites
Senior elective courses					
U3.067A	Microbiology 203F	**4**			U2.066A and U2.066B
U3.067B	Microbiology 204S	**4**			U2.066A and U2.066B
U3.090	Asian Studies 2	**8**	U2.090		
U3.646	Transport Phenomena	**4**	U2.610 plus 2nd yr WAM of 60% +		
U3.647	Laboratory Projects in Unit Operations	**4**	U2.610		U3.610
U3.900	Innovation and International Competitiveness	**4**			
Senior Advanced elective courses					
U4.005	Partial Differential Equations	**2**	16 units of approved 2nd Yr Maths courses		
U4.080	Computer Based Design	**2**			
U4.090	Asian Studies 3	**8**	U3.090		
U4.071	Human and Industrial Relations	**6**	36 units of Senior courses and completion of Industrial Exp.		
U4.625	Reaction Engineering 2	**•4**	U3.626		
U4.629	Advances in Polymer Engineering	**4**			
U4.630	Mineral Processing (Mineral Dressing)	**4**	U3.610		
U4.631	Mineral Processing (Extractive Metallurgy)	**4**		U3.610	
U4.632	Separation Processes	**4**	U3.610		
U4.633	Advanced Particle Mechanics	**4**	U3.610		
U4.634	Advanced Topics in Environmental Engineering A	**4**	U3.610		
U4.635	Advanced Topics in Environmental Engineering B	**4**	U3.610		
U4.655	Adv. Fluid Dynamics Modelling	**4**			
U4.660	Process Control 2	**4**	U3.660		
U4.679	Major Industrial Project	24			
U4.689	Adv. in Chemical Engineering A	**4**	U3.610		
U4.690	Reservoir Engineering	**4**		U3.610	
U4.691	Process Systems Engineering	**4**		U3.631 and U3.660	U4.660
U4.692	Optimisation Techniques	**4**	U3.631		
U4.694	Environmental Impact Assessment	**4**		U3.610 or U3.420	
U4.695	Biochemical Engineering	**8**		U2.610	U2.066 and U3.067

Course No.	Title	Unit value	Prerequisites* (a)	(b)	Corequisites
U4.697	Professional Option	2	credit for 145 units		
U4.699	Adv. in Chemical Engineering B	4			

[f]For prerequisites in Column (a) a Terminating Pass is not acceptable.

Biochemical Engineering

Students who wish to specialise in biochemical applications of chemical engineering should choose the following courses:

Intermediate Year — U2.066A Biochemistry 211F (4 units) and U2.066B Biochemistry 212S (4 units) in place of U2.502 Electrical Technology (4 units) and U2.701 Mechanics of Solids 1 (4 units).

Senior Year — the elective course U3.067A Microbiology 203F (4 units) and U3.067B Microbiology 204S (4 units). (One or more of the Senior core courses may need to be deferred until the following year.)

Senior Advanced Year — the elective course U4.695 Biochemical Engineering.

Industrial Experience and Perspectives

In addition to having to complete the course U4.600 Practical Experience, students in Chemical Engineering are required to undertake a number of additional activities during their course designed to increase their understanding and experience of practical Chemical Engineering.

1. Design competition

This is a light-hearted exercise in which students of U2.610 Chemical Engineering 2 design, build and operate a simple device to solve an unusual Chemical Engineering problem. Past problems have included the task of producing separated shell, yolk and white from a whole raw egg. A small entry fee is charged and prizes are awarded.

2. Chemical plant inspection tour

For one week of a vacation period during the Senior Year, students visit a number of chemical plants outside the Sydney area. Tours in the past years have been to Southeastern Queensland, Tasmania, Victoria and the Hunter Valley.

3. Mid-term week exercises

A number of one-week exercises are organised during the teaching periods of the Senior Year. Normal classes are suspended during these weeks.

Senior students spend a week working on selected plant problems on major chemical plants in the Sydney area. In these exercises the students work in small groups in cooperation with plant engineers and academic staff to investigate chemical engineering problems in a plant environment.

Table 7—Aeronautical Engineering

Candidates for the degree of Bachelor of Engineering in Aeronautical Engineering are required to gain credit for the core courses set out below. Any additional credit necessary to satisfy the requirements of Resolution 6 shall be gained by completing other courses from Table 1 and/or from the Senior and Senior Advanced elective courses prescribed by the Faculty from time to time.

Junior and Intermediate courses (from Table 1)

U1.001 Mathematics 101F
U1.002 Mathematics 102S
U1.010 Mechanics IE
U1.021 Physics IE
U1.031 Chemistry IE
U1.280 Engineering Programming
U1.281 Computer Graphics
U1.710 Aeronautical Engineering 1
U2.002 Mathematics 201F
U2.003 Mathematics 202F
U2.004 Mathematics 205S
U2.005 Mathematics 251S
U2.006 Mathematics 252S
U2.411 Introductory Thermodynamics
U2.412 Engineering Dynamics
TJ2.441 Mechanical Design IA
U2.502 Electrical Technology
U2.700 Mechanics and Properties of Solids 1
U2.710 Fluid Mechanics
U2.770 Engineering Computation .

Course No.	Title	Unit value	Prerequisites[1,] (a)	(b)	Corequisites
Senior courses					
U3.421	Thermodynamics	4	U2.411	16 units of approved 2nd Yr Maths courses	
U3.431	Mechanical Properties of Materials	4	U2.700	16 units of approved 2nd Yr Maths courses	
U3.720	Aerodynamics 1	4	U2.710 and 16 units of approved 2nd Yr Maths courses		U3.725
U3.725	Aerodynamics 2	4	U2.710 and 16 units of approved 2nd Yr Maths courses		U3.720
U3.730	Aircraft Structures 1	4	U2.700 and 16 units of approved 2nd Yr Maths courses		
U3.735	Aircraft Structures 2	' 4			U3.730
U3.740	Aircraft Design 1	6	U2.441 and U2.700		U3.431 and U3.720and U3.730
U3.750	Flight Mechanics 1	4	U2.412 and 16 units of approved 2nd Yr Maths courses		
U3.755	Flight Mechanics 2	4			U3.750
U3.760	Laboratory	4	U2.770		. U3.725and U3.730
U3.770	Flying Operations	2			U3.750 and U3.755 and 36 units of Senior Aeronautical courses
U3.780	Aviation Technology	4	96 units of Junior and Intermediate courses		
U3.790	Industrial Organisation and Management	4			
Senior Advanced courses					
U4.720	Aerodynamics 3	4	U3.720 and U3.725		
U4.725	Aerodynamics 4	4			U4.720
U4.730	Aircraft Structures 3	8	U3.730 and U3.735		
U4.740	Aircraft Design 2	4	U3.740 and U3.725		
U4.750	Flight Mechanics 3	4	U3.725 and U3.755		
U4.770	Propulsion	4	U3.421 and U3.725		
U4.775	Engineering Experience	4	40 units of Senior courses		
U4.780	Seminar	4	40 units of Senior courses		
U4.785	Thesis	12	40 units of Senior courses		

[+]For prerequisites in Column (a) a Terminating Pass is not: acceptable.

RESOLUTIONS OF THE FACULTY OF ENGINEERING **relating to Table 7 — Aeronautical Engineering**

Acceptable alternative courses

Pursuant to Resolution 2, the Faculty has prescribed the following acceptable alternatives to the core courses listed in Table 7:

Core course	*Acceptable alternative*
U1.201 Physics IE	U1.022 * Physics 101F and U1.023 Physics 103S
U1.031 Chemistry IE	U1.033A Chemistry 111F and U1.033B Chemistry 112S
U1.280 Engineering Programming	U1.0401 Computer Science 101F and
U1.281 Computer Graphics	U1.0402 Computer Scien ce 102S
U4.785 Thesis (12 units)	U5.785 Honours Thesis (16 units)

For students who wish to proceed towards the double degree of BSc BE, the following alternatives are acceptable **with permission from the Head of the Department of Aeronautical Engineering:**

U2.502 Electrical Technology	
U2.411 Introductory Thermodynamics	U2.022 Physics 201F
U2.412 Engineering Dynamics	U2.023 Physics 202S
U2.770 Engineering Computation	

RESOLUTIONS OF THE DEPARTMENT OF AERONAUTICAL ENGINEERING

Recommended elective courses

Course No.	Title	Unit value	Prerequisites* (a)	(b)	Corequisites
Senior Advanced elective courses					
U4.422	Computational Methods for Partial Differential Equations	4		16 units of approved 2nd Yr Maths courses	
U4.434	Aerospace Materials Engineering	4		U3.430or U3.431 and U3.730	
U4.461	Introduction to Operations Research	2		16 units of approved 2nd Yr Maths courses	
U4.790	Rotary Wing Aircraft	4		U3.720 and U3.750	U4.720
U4.791	Advanced Rotary Wing Dynamics	2			U4.790
U4.792	Aviation Operation and Management	2			
U4.793	Probabilistic Design	4			U4.740
U4.795	Flight Mechanics 4	3		U4.750	U3.755
U4.796	Advanced Computational Aerodynamics	2		U3.725	U4.720 and U4.725
U4.797	Unsteady Aerodynamics	2			

[f]For prerequisites in Column (a) a Terminating Pass is hot acceptable.

Mutually exclusive courses

The Faculty has determined that the following courses are mutually exclusive of each other and will attract reduced credit.

Junior *courses*		***Mutually*** *1 exclusive with...*	
U1.022 U1.023	Physics 101F and Physics 103S	U1.021	Physics IE
U1.021	Physics IE	U1.022 U1.023	Physics 101F and Physics 103S
U1.033A U1.033B	Chemistry 111F and Chemistry 112S	U1.031 U1.032	Chemistry IE Chemistry IE Supplementary
U1.031	Chemistry IE	U1.033A U1.033B	Chemistry 111F and Chemistry 112S
U1.032	Chemistry IE Supplementary	U1.033A U1.033B	Chemistry 111F and Chemistry 112S
U1.0401 U1.0402	Computer Science 101F and Computer Science 102S	U1.280 U1.445 U1.630	Engineering Programming Engineering Computing Computing for Chemical Engrs
U1.050A U1.050B	Geology 101F and Geology 102S	U2.051	Engineering Geology A
U1.051	Engineering Geology 1	U1.050A U1.050B	Geology 101F and Geology 102S
U1.100	Manufacturing Technology	U1.410 U1.710	Mechanical Engineering 1 Aeronautical Engineering 1
U1.220	Statics	U1.410 U1.400 U1.710 U1.415	Mechanical Engineering 1 Engineering Mechanics 1 Aeronautical Engineering 1 Engineering Mechanics 1
U1.280	Engineering Programming	U1.0401 U1.0402 U1.445	Computer Science 101F and Computer Science 102S Engineering Computing
U1.281	Computer Graphics	U1.445 U2.0401 U2.0402 U2.0403 U2.0404	Engineering Computing Computer Science 201F Computer Science 202F Computer Science 203S Computer Science 204S
U1.411	Mechanical Engineering 1	U1.100 U1.220 U1.710	Manufacturing Technology 1 Statics Aeronautical Engineering 1
U1.445	Engineering Computing	U1.0401 U1.0402 U1.440 U1.280 U1.281 U1.620 U1.630	Computer Science 101F and Computer Science 102S Computer Science IE Engineering Programming Computer Graphics Chemical Engineering Applications Computing for Chemical Engrg
U1.500	Introd Elec Eng	U1.511 U2.502 U2.511 U2.512	Electrical Engineering 1 Electrical Technology Electrical Engineering 2A Electrical Engineering 2B
U1.511	Electrical Engineering 1	U1.500 U2.502 U1.411	Introductory Electrical Engineering Electrical Technology Digital & Electronics Technology
U1.630	Computing for Chemical Engineers	U1.0401 U1.0402 U1.445	Computer Science 101F and Computer Science 102S Engineering Computing

U1.651 Chemical Process Case Studies	U1.210 Materials 1 U1.410 Mechanical Engineering 1 U1.710 Aeronautical Engineering 1 U2.416 Introduc. Mechanics and Materials
U1.710 Aeronautical Engineering 1	U1.100 Manufacturing Technology U1.210 Materials 1 U1.400 Engineering Mechanics 1 U1.410 Mechanical Engineering 1 U1.415 Mechanical Engineering 1A U2.415 Engineering Mechanics 2
Intermediate courses U2.002 Maths 201F and U2.003 Maths 202F and U2.005 Maths 205S and U2.006 Maths 252S	*Mutually exclusive with...* Any other Intermediate courses In Mathematics
Any other Intermediate course in Physics	U2.475 Physics for Automation
U2.022E Physics 201F (mod) and U2.023E Physics 202S (mod)	Any other Intermediate course in Physics
U2.0405 Computer Science 205F	Any other Intermediate course in Computer Science
U2.0406 Computer Science 206S	Any other Intermediate course in Computer Science
Any other Intermediate course in Computer Science	U1.281 Computer Graphics U3.561 Computer Architecture
U2.052 Engineering Geology 2	U2.050A Geology 201F U2.050B Geology 202S U2.050C Geology 203S U2.052 Engineering Geology B
U2.210 Introduction to Materials U2.221 Structural Mechanics U2.261 Fluids 1 U2.410 Mechanical Engineering 2 U2.411 Introductory Thermodynamics U2.412 Engineering Dynamics	U1.210 Materials 1 U2.220 Structures 1 U3.261 Fluids 1 U2.412 Engineering Dynamics 2 U2.410 Mechanical Engineering 2 U2.410 Mechanical Engineering 2
U2.417 Introductory Mechanics and Materials	U1.210 Materials 1 U1.650 Materials and Corrosion U1.710. Aeronautical Engineering 1 U2.700 Mechanics & Properties of Solids 1 U2.701 Mechanics of Solids 1
U2.440 Mechanical Design 1	U2.441 Mechanical Design 1A U2.443 Mechatronic Design 1
U2.441 Mechanical Design 1A U2.443 Mechatronic Design 1	U2.440 Mechanical Design 1 U2.440 Mechanical Design 1
U2.471 Introductory Mechatronics	U2.510 Electrical Engineering 2 U2.511 Electrical Engineering 2A U4.512 Electrical Engineering 2B
U2.502 Electrical Technology	U1.500 Introductory Electrical Engineering U1.511 Electrical Engineering 1 U2.471 Introductory Mechatronics U2.510 Electrical Engineering 2 U2.511 Electrical Engineering 2A U4.512 Electrical Engineering 2B
U2.504 Electrical and Electronic Engineering	U2.510 Electrical Engineering 2 U2.511 Electrical Engineering 2A U4.512 Electrical Engineering 2B
U2.511 Electrical Engineering 2A	U2.471 Introductory Mechatronics U2.502 Electrical Technology U2.504 Elecl and Electronic Engg U2.510 Electrical Engineering 2

U2.512	Electrical Engineering 2B	U2.502 Electrical Technology U2.504 Elecl and Electronic Engg U2.510 Electrical Engineering 2
U2.700	Mechanics and Properties of Solids 1	U2.701 Mechanics of Solids 1 U2.417 Intro Mechanics & Materials
U2.701 U2.710	Mechanics of Solids 1 Fluid Mechanics	U2.700 Mechanics and Properties of Solids 1 U2.410 Mechanical Engineering 2
Senior courses		*Mutually exclusive with ...*
U3.212 U3.244	Properties of Materials Soil Mechanics A	U3.211 Materials 2 U3.240 Soil Mechanics U4.241 Soil Engineering
U3.245	Soil Mechanics B	U3.240 Soil Mechanics U4.241 Soil Engineering
U3.262 U3.284 U3.420 U3.421	Fluids 2 Risk and Reliability Analysis Thermo-fiuid Engineering Thermodynamics	U4.262 Fluids 2 U3.281 Applied Statistics U3.421 Thermodynamics U3.420 Thermo-fluid Engineering
U3.430	Mechanics and Properties of Solids 2	U3.431 Mech Properties of Materials U3.730 Aircraft Structures 1
U3.431 U3.450	Mechs and Props of Materials System Dynamics and Control	U3.430 Mechs and Props of Solids 2 U3.470 Mechanics 2 U3.750 Flight Mechanics 1
U3.474 U3.476	Electr. Machines and Drives Industrial Electronics	U3.522 Power Electronics and Drives, U2.471, U2.504 U3.540 Electronics 1 U3.560 Digital Systems 1
U3.480	Mechanical Engineering Laboratory	U3.485 Mechanical Eng Laboratory A
U3.530 U3.540 U3.560 U3.561 U3.730	Control 1 Electronics 1 Digital Systems 1 Computer Architecture Aircraft Structures 1	U3.450 System Dynamics and Control U3.476 Industrial Electronics U3.476 Industrial Electronics U2.043 Computer Science 2B, U2.041, U2.040 U3.430 Mechs and Props of Solids 2 U4.432 Mechs and Props of Solids 2A
U3.750	Flight Mechanics 1	U3.450 Mechanical Systems
U3.522	Power Electronic and Drives	U3.474 Electrical Machines and Drives
Senior Advanced courses		*Mutually exclusive with ...*
U4.005	Partial Differential Equations	some options in the Senior Mathematics courses in the Faculty of Science
U4.070 U4.214 U4.236 U4.237 U4.238 U4.246 U4.247 U4.251 U4.260 U4.265 U4.430 U4.433 U4.434	Industrial Ergonomics Materials Aspects in Design Concrete Structures 2 Structural Dynamics Steel Structures 2 Environmental Geotechnics Foundation Engineering Surveying 2 Environmental Fluids 1 Environmental Fluids 2 Applied Numerical Stress Analysis Advanced Engineering Materials Aerospace Materials Engineering	U4.460 Industrial Engineering U4.212 Materials 3 U5.233 Concrete Structures Honours U5.234 Structural Dynamics Honours U5.224 Steel Structures Honours U4.242 Geotechnical Engineering U4.242 Geotechnical Engineering U4.250 Surveying U2.260 Engineering Hydrology U4.263 Fluids Engineering U4.730 Aircraft Structures 3 U4.434 Aerospace Materials Engineering U4.433 Advanced Engineering Materials
U4.460	Industrial Engineering	U4.070 Industrial Ergonomics U4.461 Introduction to Operations Research U4.462 Industrial and Engineering Management
U4.461	Introduction to Operations Research	U4.460 Industrial Engineering

U4.462 Industrial and Eng Management
U4.490 Environmental Engineering

U4.491 Env. Acoustics and

U4.692 Optimisation Techniques
U4.730 Aircraft Structures 3
U5.267 Environmental Fluids Honours
U4.588 Thesis A
U4.589 Thesis

U4.460 Industrial Engineering
U4.491 Env Acoustics and Noise Control (if Acoustics forms part of U4.490)
U4.694 Pollution Control Eng (if Env. Impact Ass. forms part of U4.490)

U4.490 Environmental Engineering (if Control Acoustics forms part of U4.490)
U4.691 Process Systems Engineering
U4.430 Applied Numerical Stress Analysis
U4.265 Environmental Fluids 2
U4.589 Thesis
U4.588 Thesis A

Interpretation of Resolution 6(c) of the Resolutions of the Senate relating to the BE degree

In accordance with the provisions of Resolution 6(c) of the Resolutions of the Senate relating to the degree of Bachelor of Engineering, the Faculty resolves as follows:

As a general principle, a student may be permitted by the Faculty of Engineering to undertake courses at another tertiary institution to be credited towards the student's candidature for the degree of Bachelor of Engineering at this University only if that student is undertaking those studies under the aegis of an official student exchange agreement between The University of Sydney and the other institution concerned. Under certain circumstances, however, the Faculty recognises that there may be good reasons for a student to undertake courses at another tertiary institution, and, on the recommendation of the Head of Department concerned, the Faculty may permit that student to complete courses elsewhere under the provisions of Resolution 6(c). In approving such an application from a student, the Faculty will require: (a) a complete course plan which should, as a general rule, be equivalent to one year of full-time study at the University of Sydney; and (b) that such a plan be submitted and approved before the student's departure.

4 Courses of study

Courses are subject to alteration

Courses and arrangements for courses, including staff allocated as stated in this or any other publication, announcement or advice of the University are an expression of intent only and are not to be taken as a firm offer or undertaking. The University reserves the right to discontinue or vary such courses, arrangements or staff allocations at any time without notice.

On the following pages details of the courses are provided in a form which is convenient for reference. Every care has been taken to ensure that the information given is complete and accurate. However, variations may be made from time to time. These will be announced by the lecturer or posted on the relevant noticeboards. It is the responsibiKty of students, by attendance at lectures and frequent inspection of the noticeboards, to ensure that they have the latest information on any course.

Textbooks

Changes sometimes occur in the selection of prescribed textbooks, or reference books, owing to supply difficulties, or the publication of new and more suitable works. Such changes will be announced by lecturers and it is prudent to check with the relevant lecturer before buying the books you expect to need.

Elective courses in other faculties

The Faculty of Engineering has resolved that students may take any full First-Year Arts, Economics or Science course towards their BE degrees (e.g. Economics 1, Psychology 1, etc.). There is also provision for students to apply to the Faculty of Engineering for special permission to take any other courses which are available in other degree programs towards their BE degrees (e g. Computer Science 3, Economics 2, etc.). Any course which is not listed in the Tables of Courses or in the list of recommended elective courses in this handbook is referred to as a 'non-listed' course by the Faculty.

If you have a strong interest in taking a particular 'non-listed' course, you should consult the relevant faculty handbook for details about it. You will also need to check whether or not there is a quota for this course or any special assumed knowledge/ prerequisite.

There are potential pitfalls for students who take 'non-listed' courses as set out in Chapter 3 with reference to 'one-off enrolments. You should therefore discuss the advisability of taking such a course with the advisers at enrolment time.

If you decide that you wish to enrol in a 'non-listed' course other than a First-Year Arts, Economics or Science course, you will need to apply for special permission to do so. Please ask to see the Chairman of the Committee for Undergraduate Studies or the Faculty Secretary at enrolment time for application procedure.

If you proceed with an enrolment in a 'non-listed' First-Year Arts, Economics or Science course or in any other 'non-listed' course for which you have been granted permission, then you will need to consult the Faculty Secretary for enrolment instructions. 'Non-listed' courses are not held in the Engineering enrolment database in the VAX and enrolments in same have to be added manually on the appropriate form.

Course numbering system

Types of courses

The courses available for the degree are designated Junior, Intermediate, Senior, Senior Advanced or Honours. These names indicate the year of attendance in which the course becomes available to yOu if you are making normal progress.

Course numbers

The letter 'U' prefixes all undergraduate courses.

The first digit of the course number indicates the level of course, as follows:

Number	*Type*	*Available*
1	Junior	in the first or later years
2	Intermediate	in the second or later years
3	Senior	in the third or later years, subject to
4	Senior Advanced	completion of the prerequisite courses
5	Honours	in the final year to Honours candidates

The second digit of the course number indicates the Department responsible for the course, as follows:

0 Departments in the Faculty of Science
1 Departments from outside the University
2 Civil
3 Mining
4 Mechanical
5 Electrical
6 Chemical
7 Aeronautical

The third and fourth digits are serial numbers within the level and department.

For courses taught by departments in the Faculty of Science, the third digit indicates the particular subject:

U-.00 Mathematics
1 Mechanics
2 Physics
3 Chemistry
4 Computer Science
5 Geology
6 Biology, Biochemistry and Microbiology
8 Architectural and Design Science
9 East Asian Studies

The section that follows contains the courses in numerical order:

Courses of study

U1.001 MATH 101F Differential Calculus and Linear Algebra 6 units

AKn HSC 3-unit Mathematics
Classes Sem 1: (4 lec, 2 tut & 1 optional computer lab)/wk
Assessment two 2hr exams, assignments

U 1.001 A MATH 191F Differential Calculus and Linear Algebra (Advanced) 6 units

AKn HSC 4-unit *or* top decile 3-unit Mathematics
Classes Sem 1: (4 lec, 2 tut & 1 optional computer lab)/wk
Assessment two 2hr exams, assignments

U1.002 MATH 102S Integral Calculus and Statistics 6 units

Prereq Mathematics 101 *or* 191 *or* Distinction in Mathematics 111
Classes Sem 2: (4 lec, 2 tut & 1 optional computer lab)/wk
Assessment two 2hr exams, assignments

U1.002A MATH 192S Integral Calculus and Statistics (Advanced) 6 units

Prereq Credit in Mathematics 101 *or* 191
Classes Sem 2: (4 lec, 2 tut & 1 optional computer lab)/wk
Assessment two 2hr exams, assignments

U1.003 MATH 103S Integral Calculus and Discrete Mathematics 6 units

Prereq Mathematics 101 *or* 191 *or* Distinction in Mathematics 111
Classes Sem 2: (4 lec, 2 tut & 1 optional computer lab)/wk
Assessment two 2hr exams, assignments

U1.003A MATH 193S Integral Calculus and Discrete Mathematics (Advanced) 6 units

Prereq Credit in Mathematics 101 *or* 191
Classes Sem 2: (4 lec, 2 tut & 1 optional computer lab)/wk
Assessment two 2hr exams/assignments

U1.010 Mechanics 1E 6 units

Junior core course for the degree in Aeronautical, Chemical and Civil Engineering and in Project Engineering and Management (Civil). The course is provided jointly by the School of Mathematics and Statistics and the School of Physics.

Akn Mathematics 3-unit course and the Science 4-unit course (or the Physics core of 3/4-unit Science) at the HSC
Coreq U1.000 Mathematics 1
Classes Sem 1: (3 lec & 2 tut)/wk and seven 2hr lab sessions
Assessment one 3hr exam at end of Sem 1; lab work will be assessed

Syllabus summary: Vectors, statics, stability of equilibrium, kinematics, dynamics of a single particle, dynamics of particle systems, collisions, two dimensional rigid body dynamics.

Textbook
None
Lecture notes to be purchased from the University Co-operative Bookshop

Reference book
Bullen *An Introduction to the Theory of Mechanics* (Science Press, 1971)
Library classification: U531 (Fisher Library)

First Year Physics Courses

These are offered at two levels: Physics 1 (Advanced) and Physics 1. Both provide a sound foundation for a further study of physics. Physics 1 (Advanced) is available to students with a very good record in Physics (TER at least 95.0 and 2-unit Physics scores at least 90) and proceeds faster than the Regular Strand of Physics 1, covering further and more difficult ground.

Ui. 021 Physics 1E 6 units

Junior core course for the degree in Aeronautical and Mechanical Engineering. Elective course for Chemical and Civil Engineering and for Project Engineering and Management (Civil).

Akn Mathematics 3-unit course and either 2-unit Physics or the Physics core of 3/4-unit Science at the HSC
Mutually exclusive with U1.020 Physics 1
Coreq one of U1.010 Mechanics IE or U1.400 Engineering Mechanics 1 or U1.410 Mechanical Engineering 1 or U1.710 Aeronautical Engineering 1
Classes Sem 2: (3 lec & one 3hr lab or tut)/wk
Assessment one 3hr exam at end of Sem 2; an assessment of lab work, project reports and a written lab exam may also be included

Syllabus summary: Waves, electro-statics, current electricity, magnetism, electro-magnetism, quantum physics.

Textbook
Sears, Zemansky and Young *University Physics* 7th edn (Addison-Wesley, 1987)

Reference books
As indicated during classes
Library classification: U530 (Fisher Library)

U1.022 PHYSICS 101F Physics (Regular) 6 units

AKn HSC Physics or HSC 4-unit Science
Classes Sem 1: (3 lec/tut & 3 prac)/wk
Assessment one 3hr exam, lab & assignments

This course is for students who gained 65 marks or better in HSC 2-unit Physics or equivalent. The lecture course contains three four-week modules on the topics of Mechanics, Fluids and Fields, and Waves.

Textbooks
D. Halliday, R. Resnick and J. Walker *Fundamentals of Physics* 4th edn (John Wiley, 1993)
Physics Laboratory Manuals (School of Physics Publication)

U1.022A PHYSICS 191F Physics (Advanced) A 6 units

Prereq TER at least that for acceptance into BSc (Advanced) program *or* at least 90 in HSC 2-unit Physics *or* a least 180 in HSC 4-unit Physics
Classes Sem 1: (3 lec/tut & 3 prac)/wk
Assessment one 3hr exam, lab & assignments

Physics 191 (Advanced) A is intended for students who have a strong background in Physics and an interest in studying more advanced topics. It proceeds faster than Physics 101 (Regular), covering further and more difficult material. The lecture course contains three four-week modules on the topics of Mechanics, Fluids and Fields, and Waves. The laboratory work also provides an introduction to computational physics using chaos theory as the topic of study.

Textbooks
D. Halliday, R. Resnick and J. Walker *Fundamentals of Physics* 4th edn (John Wiley, 1993)
Physics Laboratory Manuals (School of Physics Publication)

U1.023 PHYSICS 103S Physics (Technological) 6 units

Prereq: Physics 101 *or* 102 *or* 191
Classes Sem 2: (3 lec/tut & 3 prac)/wk
Assessment one 3hr exam, lab & assignments

This course is designed for students majoring in the physical and engineering sciences and emphasis is placed on applications of physical principles to the technological world. The lecture course contains three four-week modules on the topics of electromagnetism, thermal physics, and quantum and materials physics.

Textbooks
D. Halliday, R. Resnick and J. Walker *Fundamentals of Physics* 4th edn (John Wiley, 1993)
Physics Laboratory Manuals (School of Physics Publication)

U1.023B PHYSICS 192S Physics (Advanced) B 6 units

Prereq Physics 191 *or* Distinction or better in Physics 101 *or* 102
Classes Sem 2: (3 lec/tut & 3 prac)/wk
Assessment one 3hr exam, lab & assignments

This course is a continuation of Physics 191 (Advanced) A. Students who have completed Physics 101 (Regular) or Physics 102 (Fundamentals) at Distinction level may enrol. It proceeds faster than Physics 103 (Technological), covering further and more difficult material. The lecture course contains three four-week modules on the topics of electromagnetism, thermal physics, quantum and materials physics, and superconductivity.

Textbooks
D. Halliday, R. Resnick and J. Walker *Fundamentals of Physics* 4th edn (John Wiley, 1993)
Physics Laboratory Manuals (School of Physics Publication)

U1.031 Chemistry 1E 6 units

Junior core course for the degree in all branches of engineering except Chemical, Electrical and Project Engineering and Management (Civil).

Akn Mathematics 2-unit course and a satisfactory knowledge of 2-unit Chemistry or the Chemistry component of the 3 or 4-unit Science HSC course
Mutually exclusive with U1.030 Chemistry 1
Classes Sem 1: (3 lec & one 3hr lab/tut session)/wk
Assessment one 3hr exam at end of course. At the beginning of the course students are informed of other factors that contribute to the final assessment

Syllabus summary: Chemistry IE will consist of the following specially selected topics of importance to engineering, together with sufficient fundamental inorganic, organic and physical chemistry to support these topics. A detailed syllabus is available from the School of Chemistry.

Electrochemistry—Fundamental principles of electrochemistry will be considered in relation to corrosion, energy storage and fuel cells.

Polymer chemistry—A discussion of the formation and structure/properties relationships in common types of polymers.

Materials—The correlation between properties and materials and the chemical structure will be discussed with special reference to electrical conductivity.

Textbooks
A textbook list is available from the School of Chemistry

Special Preparative Studies
As for U1.030 Chemistry 1.

Library classification: U541-U547 (Fisher Library)

U1.032 Chemistry 1E Supplementary 6 units

Junior elective course.
This course is designed to satisfy the prerequisite requirements for the Intermediate Chemistry courses provided by the Faculty of Science for students who have completed the course work for U1.031 Chemistry IE. It may only be taken in the same academic year as U1.031 and is only available to students with an excellent record in U1.031 and then only with the permission of the Dean of the Faculty of Engineering and the Head of the School of Chemistry.

The course consists of the lectures and laboratory exercises of Sem 2 of U1.030 Chemistry 1.

Mutually exclusive with U1.030 Chemistry 1
Classes Sem 2: (3 lec & one 3hr lab)/wk
Assessment one 3hr exam at end of year. At the beginning of the course students are informed of other factors that contribute to the final assessment

Syllabus summary: As for the Sem 2 syllabus of U1.030. There will be some repetition of the material given in U1.031.

Textbooks
A detailed textbook list is available from the School of Chemistry

U1.033A CHEMISTRY 111F Chemistry 1A 6 units

Akn HSC Mathematics 2 unit course; and the Chemistry component of the 4-unit or 3-unit HSC Science course, *or* 2-unit Chemistry
Recommended concurrent course Preferred—Mathematics 101 *or* 191; otherwise—Mathematics 111
May not be counted with Chemistry 101 *or* 191 *or* 193
Classes Sem 1: (3 lec &.3hr prac or tut workshop)/wk

Chemistry IA is built on a satisfactory prior knowledge of the chemistry component of the 4-unit or 3-unit HSC Science course or 2-unit Chemistry. A brief

revision of basic concepts of the high school course is given. Chemistry IA covers chemical theory and physical chemistry.

Lectures, practical work, examinations, textbooks
As for Chemistry 101.

U1.033B CHEMISTRY 112S Chemistry 1B 6 units

Prereq Chemistry 111 *or* a Distinction in Chemistry 101 *or* equivalent
Coreq Chemistry 111 maybe taken if available
Recommended concurrent course Preferred—Mathematics 102 *or* 103 *or* 192 *or* 193; otherwise—Mathematics 104 *or* 112
May not be counted with Chemistry 102 *or* 192 *or* 194
Classes Sem 2: (3 lec & 3hr prac or tut workshop)/wk

Chemistry IB is built on a satisfactory prior knowledge of Chemistry IA and covers inorganic and organic chemistry. Chemistry IB is an acceptable prerequisite for entry into Intermediate Chemistry courses.

Lectures, practical work, examinations, textbooks
As for Chemistry 101.

U1.034A CHEMISTRY 191F Chemistry 1A (Advanced) 6 units

Prereq TER of at least 88 and at least 75% in HSC 2-unit Chemistry or equivalent
Recommended concurrent course Preferred—Mathematics 101 *or* 191; otherwise—Mathematics 111
May not be counted with Chemistry 101 *or* 111 *or* 193
Classes Sem 1: (3 lec & 3hr prac or tut workshop)/wk

Chemistry IA (Advanced) is available to students with a very good HSC performance (typically a TER of 88+) as well as a very good school record in chemistry or science. Students in these categories are expected to do Chemistry IA (Advanced) rather than Chemistry IA.

The theory and practical work syllabuses for Chemistry IA and Chemistry IA (Advanced) are very similar, though the level of treatment in the latter course is more advanced, presupposing a very good grounding in the subject at secondary level. Chemistry IA (Advanced) covers chemical theory and physical chemistry.

Lectures, practical work, examinations, textbooks
As for Chemistry 101.

U1.034B CHEMISTRY 192S Chemistry 1B (Advanced) 6 units

Qual Chemistry 191 *or* 193 *or* Distinction in Chemistry 111 *or* equivalent
Recommended concurrent course Preferred—Mathematics 102 *or* 103 *or* 192 *or* 193, otherwise—Mathematics 112 *or* 104
May not be counted with Chemistry 102 *or* 112 *or* 194
Classes Sem 2: (3 lec & 3hr prac or tut workshop)/wk

Chemistry IB (Advanced) is built on a satisfactory prior knowledge of Chemistry IA (Advanced) and covers inorganic and organic chemistry. Chemistry IB (Advanced) is an acceptable prerequisite for entry into Intermediate Chemistry courses.

Lectures, practical work, examinations, textbooks
As for Chemistry 101.

U 1.0401 COMPUTER SCIENCE 101F Introductory Programming 6 units

Akn HSC 3-unit Mathematics
Classes Sem 1: (3 lec, 1 tut & 2 prac)/wk
Assessment assignments, written exam, prac exam

This course introduces the fundamental skill that underlines all of Computer Science: computer programming. Using the Blue object-oriented programming language, students learn modern programming techniques based on recent developments in the subject. No previous knowledge of computers or programming is assumed.

U1.0402 COMPUTER SCIENCE 102S Introductory Computer Science 6 units

Prereq COMP 101 *or* 191
Classes Sem 2: (3 lec, 1 tut & 2 prac) / wk
Assessment assignments, written exam, prac exam

This course is a continuation of COMP 101. Advanced features of the blue programming languages are presented, and a beginning is made on some topics from the wider field of Computer Science, such as assembly language programming and reasoning about the correctness and efficiency of computer programs.

U1.0491 COMPUTER SCIENCE 191F Introductory Programming (Advanced) 6 units

Akn HSC 3-unit Mathematics (Requires permission by the Head of Department)
Classes Sem 1: (3 lec, 1 tut & 2 prac)/wk
Assessment assignments, written exam, prac exam

This course is the advanced alternative to COMP 101. While the subject matter is the same, a higher degree of elegance and rigour in programming is expected, and the pro gr arnming problems are more challenging, although not more time consuming. No previous knowledge of computers or prograrrtming is assumed.

U1.0492 COMPUTER SCIENCE 192S Introductory Computer Science (Advanced) 6 units

Prereq COMP 191 *or* 101(with sufficient merit)
Classes Sem 2: (3 lec, 1 tut & 2 prac)/wk
Assessment assignments, written exam, prac exam

This course is the advanced alternative to COMP 101. While the subject matter is the same, a higher degree of elegance and rigour in programming is expected, the programming problems are more challenging although not more time consuming, and a deeper approach is taken to the Computer Science topics.

U1.050A GEOLOGY 101F Earth and Its Environment 6 units

Coordinator Dr Keene
Classes Sem 1: (3 lec & prac or tut)/wk
Assessment one 3hr exam, class and field work

The aim of this course is to provide students with an understanding of how the Earth system works, its origin, plate tectonics, surface processes, evolution of life and geologic time. Students will learn techniques

and types of observations used to decipher the history and evolution of the Earth, processes operating in the surface environments and dating sediments and rocks. Laboratory classes and a one day field trip to the south coast will involve exercises in observing and describing Earth materials and in interpreting Earth history from geological information, including fossils and maps.

U1.050B GEOLOGY 102S Earth Processes and Resources 6 units

Coordinator Dr Keene
Classes Sem 2: (3 lec & prac or tut)/wk
Assessment one 3hr exam, class and field work

The aim of this course is to examine the chemical and physical processes involved in mineral formation, the interior of the Earth, volcanoes, and metamorphism. Lectures and laboratory sessions on mountainbuilding processes and the formation of ore deposits will lead to an understanding of the driving forces in geology. The course concludes with the study of Australia's sedimentary basins, their fossil fuel content and implications for our economy and an assessment of our own impact on the Earth together with the role of geologists in protecting and monitoring the environment. In addition to laboratory classes there are two field trips: one weekend excursion to the Hunter Valley and a one day excursion to the Blue Mountains. Students will be required to pay hostel accommodation for one night.

U1.051 Engineering Geology 1 5 units

Junior core course for the degree in Civil Engineering, unless the course U1.050 Geology 1 has been completed.

Mutually exclusive with U1.050 Geology 1
Classes 26hrs lec, 39hrs lab. Field excursions in the Sydney region, as appropriate
Assessment practical laboratory work plus a combined theory and practical exam at the end of semester

Course objectives to introduce basic geology to civil engineering students.

Expected outcomes students should acquire knowledge of the most important rocks and minerals and be able to identify them. They should develop an appreciation of structural geology, as it influences civil engineering works.

Syllabus summary: Basic geological concepts relevant to civil engineering. Introduction to minerals, rocks and soils, their mode of occurrence, formation and significance. General introduction to physical geology and geomorphology, structural geology, tectonics, and hydrogeology. Associated laboratory work on minerals, rocks and mapping.

Textbooks
Press and Seiver *Earth* 4th edn (Freeman)
or
Branagan *Beneath the Scenery* (Science Press)

Reference books
As indicated during classes

Library classification: U550, U551 (Fisher Library)

U1.060A Biology 101F Concepts in Biology 6 units

AKn Biology section of the HSC 3-unit Science course
Classes Sem 1: (3 lec & 3 prac)/wk
Assessment one 2hr exam, assignments, classwork

'Concepts in Biology' is an introduction to the major themes of modern biology. Starting with interactions between organisms in biological communities, we move on to the diversity of microorganisms, plants and animals. This is followed by introductory cell biology, which particularly emphasises how cells obtain and use energy, and leads into an introduction to molecular biology through the role of DNA in protein synthesis and development. The genetics of organisms is then discussed, leading to consideration of theories of evolution and the origins of the diversity of modern organisms. This course is prerequisite for all second semester Biology courses.

U1.060B BIOLOGY 192S Living Systems (Advanced) 6 units

Prereq Biology 101 or 191
Classes Sem 2: (3 lec & 3 prac)/wk
Assessment one 2hr exam, assignments, classwork

Selected students may be invited to participate in a more demanding alternative component of the Living Systems course. The content and nature of this component will be determined each year. Details and selection criteria are announced in the first semester.

U1.060C BIOLOGY 103S Human Biology 6 units

Prereq Biology 101 or 191
Classes Sem 2: (3 lec & 3 prac)/wk
Assessment one 2hr exam, assignments, classwork

This course provides an introduction to human evolution and ecology, cell biology, physiology and anatomy, through both lectures and practical work. It begins with human evolution, human population dynamics and theimpactof people on the environment. The course includes human nutrition, distribution of essential requirements to and from the cells, control of body functions and defence mechanisms. After discussion of reproduction and development, the course concludes with some controversial aspects of human genetics. Enrolment may be restricted by the availability of places. This course provides entry to Intermediate courses in genetics and cell biology in the School of Biological Sciences, butnotto the School's other Intermediate courses.

Textbook
S.S. Mader *Human Biology* 4th edn (Wm. C. Brown, 1995)

U1.100 Manufacturing Technology 4 units

Junior elective course.

Mutually exclusive with U1.410 Mechanical Engineering 1, U1.710 Aeronautical Engineering 1
Classes Sem: approx. one3hr lab atSydney Technical College/ wk
Assessment prac work

Syllabus summary:
(a) Fitting—Measurement, measuring tools, marking tools, testing tools, holding tools, hammers, cutting tools, bolts and studs, tapping and screwing, reaming and scraping.
(b) Machining—Various metals and their machinability, cutting tool materials, cutting tool shape, the machine tools: lathe, mill grinder, drill, shaper, deburring and finishing operations.
(c) Welding—Various welding processes, distortions, flame cutting, resistance welding. Practical work in gas welding and arc welding.
(d) Heat treatment, blacksmithing and forging—> Definition and importance of heat treatment, and the process of forging, normalising hardening, case hardening.
(e) Founding—Materials used in the foundry, moulding and core making, the casting process.

Safety requirements: All students are required to comply with the safety regulations of the Sydney Technical College. Students who fail to do this will not be permitted to enter the workshops. In particular, approved industrial footwear must be worn, and long hair must be protected by a hair net. Safety glasses must be worn at all times.

Library classification: 671

U1.200 Civil Engineering 1 4 units

Junior core course for the degree in Civil Engineering and Project Engineering and Management (Civil). Elective course for the other branches.

Akn Mathematics 3-unit course and a satisfactory knowledge of 2-unit Chemistry or the Chemistry component of the 3 or 4-unit Science HSC course and of the 2-unit Physics course or the Physics component of the 3 or 4-unit Science HSC course
Classes Sem: 13hrs lec, 13hrs tut and 26hrs lab/drawing office
Assessment specified assignments and one 3hr exam at end of course

Syllabus summary:
(a) Engineering Projects—Introduction to the planning, design, construction and operation of engineering projects. Economic and non- economic evaluation of projects.
(b) Elements of Engineering Science—Structures, geomechanics, materials, hydraulics and water resources, environment, systems, management.
(c) Communications—Freehand and scale drawing, engineering plans, shop drawings, techniques for producing drawings. Preparation of reports, verbal and written.

Reference books
Krick *An Introduction to Engineering—Concept, Methods and Issues* (John Wiley and Sons)
Morris *Engineering—A Decision Making Process* (Houghton Mifflin Company)
Hoganand Firkins *Economical Structural Steelwork* (Australian Institute of Steel Construction)
Brown *Getting Across* (Edward Arnold)
Institution of Engineers, Australia *The Australian Engineering Handbook, Part 1—Basic Principles and Techniques* (I.E. Aust.)
Thompson *Organization and Economics of Construction* (McGraw-Hill)
Strunk and White *The Elements of Style* (Macmillan)
Concrete Institute of Australia *Recommended Practice—Reinforced Concrete Detailing Manual* (CIA)
Dandy and Warner *Planning and Design ofEngineering Systems* (Unwin Hyman)
Eagleson *Writing in Plain English* (Aust. Govt Publishing Service)
Library classification: 620.0023,658.15,658.4,744,808

U1.220 Statics 4 units

Junior core course for the degree in Civil Engineering and in Project Engineering and Management (Civil).

Akn Mathematics 3-unit course at the HSC
Mutually exclusive with U1.410 Mechanical Engineering 1, U1.400 Engineering Mechanics 1, U1.710 Aeronautical Engineering 1 and U2.415 Engineering Mechanics 2
Coreq U1.000 Mathematics 1
Classes Sem 2:26hrs lec and 26hrs tut
Assessment class test during sem and one 2hr exam at end of sem

Syllabus summary: Basic concepts: scalars and vectors; units. Statics of the rigid body; forces and moments; systemisolation; free body diagrams, and equilibrium criteria. Principle of virtual work; friction, distributed force systems; beams with distributed loads, sta tically determinate pin-jointed structures.

Textbook
Meriam *Engineering Mechanics* Vol. 1, Statics, SI version (Wiley, 1980)
Library classification: U531-2, U620-1 (Fisher Library)

U1.280 Engineering Programming 3 units

Junior core course for the degree in Aeronautical and Civil Engineering and in Project Engineering and Management (Civil). U1.040 Computer Science 1 and U1.445 Engineering Computing are acceptable alternatives.

Mutually exclusive with U1.040 Computer Science 1 and U1.445 Engineering Computing
Coreq U1.281 Computer Graphics
Classes Sem 1: (1 lec & one 2hr computer lab session)/wk
Assessment one 1.5hr exam at end of sem plus assessment of computer exercises during sem

Syllabus summary: Fundamental instruction in a structured computer language using FORTRAN *77* and/or C. Data types, input and output, operators, expressions, control flow, loops, if else statement, switching, files, functions, subroutines, arrays, compilers, linkers.

Textbook
Page, Didday and Alpert *FORTRAN 77 for Humans* 3rd edn (West Publishing Co., 1986)

Reference book
Kernighan and Ritchie *The CProgramming Language* 2nd edn (Prentice Hall, 1988)
Library classification: U001, U005 (Fisher Library)

U1.281 Computer Graphics 3 units

Junior core course for the degree in Aeronautical and Civil Engineering and in Project Engineering and Management (Civil). U2.040 Computer Science 2 is an

acceptable alternative for the degree in Civil Engineering and in Project Engineering and Management (Civil).

Mutually exclusive with U1.445 Engineering Computing and U2.040 Computer Science 2
Coreq either U1.280 Engineering Programming or U1.040 Computer Science 1
Classes Sem 2: (1 lec & one 2hr computer lab session)/wk
Assessment one 2hr exam at end of sem plus assessment of computer exercises during sem

Syllabus summary: Fundamental instruction in a graphical computer language using the international standard language GKS (Graphical Kernel System).

Graphical contiolfunctions,workstationfunctions, windows and viewpoints, graphical primitives, attribute functions, segments, input functions, grapMcaloutputdevicesincludingplattersandVDU's, graphical input devices including cursers, graphical tablets and mice.

Fundamental instruction in viewing 3-dimensional objects using a 2- dimensional graphics system.

Geometric representation of 3D objects, data structures, perspective projections, 2D translational, scaling and rotational transformations, solid object modelling.

Textbook
Sproull, Sutherland and Ullner *Device Independent Graphics* (McGraw-Hill, 1985)

Reference books
Donald and Hearn *Computer Graphics* (Prentice-Hall, 1986)
SAA AS2880-1986 *Computer Graphics—Graphical Kernel System (GKS) Functional Description*
DEC GKS Fortran Binding Reference Manual
Library classification: U006 (Fisher Library)

U1.411 Mechanical Engineering 1 12 units

Junior core course for the degrees in Mechanical and Mechatronic Engineering.

Mutually exclusive with Ul.10O Manufacturing Technology 1, U1.220 Statics, U1.710 Aeronautical Engineering 1
Coreq Ul.000 Mathematics 1
Classes Sem 1: (three 1hr lec & 3hr lab at Sydney Technical College)/wk; Sem 2: (three 1hr lec & 3hr tut)/wk
Assessment assignments, exam at end of sem 2

Course objectives: To develop an understanding of:
- the role of professional engineers and their responsibilities;
- the machining and manufacturing processes required to make mechanical components; and
- the basic methods required to perform static and dynamic engineering mechanics calculations.

Expected outcomes: Students should develop skills in:
- engineering management techniques;
- working in groups;
- verbal and written communication;
- machining and manufacturing methods;
- solving problems in mechanics;
- analysis of particle kinematics; and
- analysis of static engineering structures.

Syllabus summary:
Semester 1
Professional Engineering (2 units): Structure and management of engineering projects, engineering project planning, engineering economics. Engineering management issues, Total Quality Management, ethics, liability, environment, health, etc. Development of both verbal and written communication skills. Accessing information technology.

Workshop Technology (4 units): Fitting, machining, lathe, mill grinder, drill, shaper, deburring and finishing operations. Welding and fabrication, distortion, flame cutting, resistance welding, practical work in gas and arc welding. Heat treatment, blacksmithing and forging, forging processes, normalising, hardening, case hardening. Founding, materials used in foundry, moulding and core making, casting process. Fundamentals of machining, casting, powder metallurgy, metal working, welding, cutting, polymer processing, bending and composite manufacturing processes.

Safety requirements: All students are required to comply with the safety regulations of the Sydney Technical College. Students who fail to do this will not be permitted to enter the workshops. In particular, approved industrial footwear must be worn, and long hair must be protected by a hair net. Safety glasses must be worn at all times.

Mechanics part A (3 units): Scalar and vectors, units, units and dimensional homogeneity. Gearing, fundamental law of toothed gearing, parallel axis gear trains, epicyclic gear trains, tubular analysis of planetary trains, free body, diagrams power transmission.

Semester 2
Mechanics part B (3 units): Statics of a rigid body; forces and moments; free body diagrams in two and three dimensions; resultants of forces and moments. Equilibrium of rigid bodies; trusses, frames and machines; statically determinate pin-jointed structures. Distributed forces, centroids of lines, areas and volumes; cables. Friction, wedges, screws; flexible belts. Kinetics of systems of particles and virtual forces.

Textbook
Meriam and Kraige *Engineering Mechanics* Vol. 1 *Statics* SI edn (Wiley, 1987)

U1.446 Engineering Computing 8 units

Junior core course for the degree in Mechanical and Mechatronic Engineering. Computer Science 1 is an acceptable alternative. U1.445 Engineering Computing is not an acceptable prerequisite for U2.040 Computer Science 2.

Akn Mathematics 3-unit course at the HSC
Mutually exclusive with U1.040 Computer Science 1, U1.440 Computer Science IE, U1.280 Engineering Programming
Coreq U1.000 Mathematics 1
Classes Yr: (two 1hr lec & 2hr computing lab)/wk
Assessment one 2hr exam at the end of semester 1, one 3hr exam at the end of semester 2, plus programming assignments. Satisfactory computing laboratory performance is also required

Course objectives: To provide an introduction to computer hardware and operating systems, and to their application in solving engineering problems. To introduce spreadsheets and mathematical computing

environments as tools for problem solving. To provide experience in computer program design, and in implementing and validating straightforward programs written in the FORTRAN and C languages.

Expected outcomes: The student will have an appreciation of binary number representation, and of the underlying issues in computer hardware and software. The student will be comfortable and competent with the use of computer workstations and the UNIX operating system, including electronic mail, with the use of spreadsheets and the Matlab environment for solving engineering problems, and with the design and implementation of C and FORTRAN programs of moderate complexity. The student will be able to use these engineering computing tools to solve typical problems encountered in the Junior year.

Syllabus summary:
Sem 1: (3 units) Introduction to workstations. Fortran programming, program structure, input/output, documentation, variables, branching, logical operations. Programming: character strings, arrays, structured list, subroutines and functions. Hardware, logic circuits and binary storage of data. Engineering applications: system of linear equations, non-linear equations, derivatives, integrations, binary search, sort tree. Advanced programming: files, parameter passing, optimisation issues, debugging techniques, program design and philosophy. New elements introduced by Fortran 90.

Sem 2: (5 units) Computer architecture, logic and logical operations, Boolean algebra. Spreadsheet calculations. Introduction to Matlab environment on PC and workstation. Programming and metafiles. Application toolboxes. Engineering applications: equations solving, graphics, rotation and scaling, eigenvalue problems, algebraic manipulations.

Introduction to C: preprocessor, tokens, storage classes and types. Basic I/O. Assignments: arithmetic, relational and bit manipulation operators. Control flow: if and switch statements. Arrays, for do and while loops. Pointers and character strings. Functions, parameter passing. Derived storage classes, structures, unions and bit-fields. File I/O. Software project management, debugging techniques, user interfaces and event-driven programming.

Reference books
The Student Edition of MATLAB (Prentice Hall, 1995)
Kernighan and Ritchie *The CProgramming Language* 2nd edn (Prentice Hall, 1988)
McConnell *Code Complete* (Microsoft Press, 1994)
Page, Didday and Alpert *Fortran 77 for Humans* 3rd edn (West Publishing Co., 1986)
Etter Engineering problem solving with MATLAB (Prentice Hall, 1993)
Library classifications: 001.6424,005.133,005.1,517.6

U1.500 Introductory Electrical Engineering 4 units

Junior core course for the degrees in Civil Engineering, Project Engineering and Management (Civil) and Mechanical and Mechatronic Engineering.

Mutually exclusive with U1.511 Electrical Engineering 1, U2.502 Electrical Technology
Coreq U1.000 Mathematics 1
Classes Sem: 2 lec/wk and nine 3hr lab/tut
Assessment one 2hr exam at end of sem; lab reports; and mid-sem tests. 80% exam, 20% lab

Syllabus summary: Electricity: definitions and conventions. SI units. Charge and energy conservation laws. Electrical energy sources. Ohm's law. Voltage and current measurements. Conductivity and resistance. Power dissipation. Kirchhoff's laws. Current and voltage dividers. Potentiometers. Measurement ofresistance. Thevenin's theorem. Loop currents and node voltages. Reciprocity theorem. Linearity and principle of superposition. Voltage-to-current source conversion. Delta-star conversion. Loading effect of a voltage source. Combined voltage supply circuits. Time varying voltages and currents. Average and effective values. Energy dissipation and storage. Capacitance, inductance. Steady-state DC behaviour of capacitors and inductors. Natural response of first order circuits. Transients. C and L response to square and triangular voltages.

Alternating current quantities. Magnitude, period, frequency and phase. Complex algebra. AC behaviour ofresistance, inductance and capacitance. Introduction to AC circuits. RL and RC series circuits. Impedence concept. Phasor and locus diagrams. Equivalent series and parallel impedences. Admittance. Power in AC circuits. Power triangle. Power factor. RLC series circuit behaviour. Series resonance. Introduction to AC network.

Analysis. RLC parallel circuit. Parallel resonance. Series-parallel circuits. Introduction to filters. Single phase transmissionline. Domestic distribution. Wiring and grounding. Dual-voltage AC supply. Power factor correction. Nonlinear circuit elements. Introduction to semiconductors. Diodes. Transistors. V-I characteristics. Nonlinear circuit analysis. Load line and operating point.

Reference book
Smith and Dorf *Circuits, Devices and Systems* 5th edn

U1.511 Electrical Engineering 1 14 units

Junior core course for the degree in Electrical Engineering.

Mutually exclusive with Digital and Electronics Technology (Science Faculty), U1.500 Introductory Electrical Engineering, and U2.502 Electrical Technology
Coreq U1.000 Mathematics 1
Classes 8 contact hours per week in Sem 1 and 6 per week in Sem 2 combining lectures, laboratory work, computing, tutorials and presentations
Assessment presentations, reports and assignments plus a 1hr exam and two 2hr exams at the end of Sem 1, and two 2hr exams at the end of Sem 2

Syllabus summary: The course consists of three modules:

Introductory Electronic Systems (6 units): has three contact hours per week over the year. An integrated course, it combines computer-based problem solving and simulation with linear DC circuits, DC switching, transients, AC circuits, frequency response, non-linear circuits, operational amplifier functions and electrical safety. The supportinglaboratoriesincludeinstrumentation and computer-based instrument emulation.

Introductory Digital Systems (6 units): has three contact hours per week over the year. An integrated course, it combines construction and manufacturing techniques for digital systems, schematic capture, simulation and printed circuit board software with number representation, combinatorial logic design, sequential logic design, registers, counters, ROM and RAM elements Generic Array Logic (GAL) integrated circuits and synchronous sequential circuits. The associated laboratories include a team-based digital design, construct and test project.

Communication Skills (2 units): has 2 contact hours per week over the first semester. The course includes reinforcement of skills in English expression and report writing, while introducing the necessary elements of engineering drawing, graphical drawing, spread-sheets, graphics, documentpreparation and document control. The course provides a framework for the introduction of total quality management (TQM) concepts.

U1.610 Chemical Engineering 1 8 units

Junior core course for the degree in Chemical Engineering. Elective course for other branches.

Akn Mathematics 3-unit course and a satisfactory knowledge of 2-unit Chemistry or the Chemistry component of the 3- or 4-unit Science HSC course and of the 2-unit Physics course or the Physics component of the 3- or 4-unit Science HSC course

Classes Yr: (3hr of lec & one 2hr tut)/wk

Assessment one 3hr exam at end of Sem 1; project and one 2hr exam at end of Sem 2, continuous assessment of assignments

Syllabus summary: Introduction to large-scale chemical processing; discussion of typical flowsheets for the manufacture of basic chemicals. The application of physico-chemical principles to materials and energy balance calculations.

A major assignment involves the computation of material and energy balances for a complete flow sheet.

Textbook

Felder and Rousseau *Elementary Principles of Chemical Processes* 2nd edn (Wiley, 1986)

Reference book

Perry and Chilton (eds) *Chemical Engineers Handbook* (McGraw-Hill, 1984)

U1.620 Chemical Engineering Applications 4 units

Junior core course for the degree in Chemical Engineering. Elective course for other branches.

Classes Sem: (2 lec & one 3hr tut or lab)/wk

Assessment lab, tut work and one 2hr exam at end of Sem 1

Syllabus summary:

(a) What is chemical engineering? A survey of the nature of chemical engineering, of the nature of the Australian process industries, and of the main professional activities of chemical engineers. Lectures are given by invited speakers from government, industry and academia. Visits to works in the Sydney region are undertaken with tutorial exercises based on these visits.

(b) Chemical engineering applications laboratory. An appreciation of: (i) the methods and materials of construction of items of process equipment, (ii) the role of this equipment in building up an entire chemical processing plant, (iii) its operation and maintenance and (iv) safety requirements and procedures. Students will dismantle, reassemble and operate items of process equipment. They will present written answers to questions supplemented by drawings.of process flow-sheets, diagrams of dismantled equipment, and discussions of heat and mass balances and of process parameter values.

Reference book

Field *Chemical Engineering: Introductory Aspects* (MacMillan, 1988)

Reference material will be identified during the course

U1.630 Computing for Chemical Engineers 2 units

Junior core course for the degree in Chemical Engineering.

Mutually exclusive with U1.040 Computer Science 1 and U1.445 Engineering Computing

Classes Sem: (1 lec & one 2hr tut)/wk

Assessment assignments and one 1hr exam

Syllabus summary: Introduction to personal computers, MS-DOS, Lotus 123 and Excel. Application to chemical engineering problems.

U1.651 Chemical Process Case Studies 4 units

Junior core course for the degree in Chemical Engineering.

Mutually exclusivewith U1.210 Materials l,U1.410Mechanical Engineering 1, U1.710 Aeronautical Engineering 1 and U2.416 Introductory Mechanics and Materials

CZfisses Sem: (2 lec & one 2hr tut/lab)/wk

Assessment one 3hr exam plus assignments

Syllabus summary:

ChemicalProcessCaseStudieswillintroducestudents to the major processes of the contemporary chemical industry, and the economic and environmental constraints that shape them. The case study format will be used to develop a number of professional skills in the student—team work, use of library and computer resources and presentation skills.

U1.710 Aeronautical Engineering 1 12 units

Junior core course for the degree in Aeronautical Engineering.

Mutually exclusive with U1.100 Manufacturing Technology, U1.210 Materials 1, U1.400 Engineering Mechanics 1, U1.410 Mechanical Engineering 1, U1.415 Mechanical Engineering IA and U2.415 Engineering Mechanics 2

Coreq U1.000 Mathematics 1

Classes Sem 1: one 3hr lab at Sydney Technical College/wk; Sem 2: (5 lec, one 2hr tut & one 1hr tut)/wk and two 3hr labs/sem

Assessment prac work in Sem 1; one 3hr, one 2hr exam at end of Sem 2; assignment work in Sem 2

Syllabus summary:
Semester 1: **Manufacturing Technology (3 units)**
(i) Fitting—Measurement, measuring tools, marking tools, testing tools, holding tools, hammers, cutting tools, bolts and studs, tapping and screwing, reaming and scraping.
(ii) Machining—Various metals and their machirnability, cutting tool materials, cutting tool shape, the machine tools: lathe, mill grinder, drill, shaper, deburring and finishing operations.
(iii) Welding—Variousweldingprocesses,distortions, flame cutting, resistance welding. Practical work in gas welding and arc welding.
(iv) Heat treatment, blacksmithing and forging—Definition and importance of heat treatment, and the process of forging, normalising, hardening, case hardening.
(v) Founding—Materials used in the foundry, moulding and core making, the casting process.

Safety requirements: All students are required to comply with the safety regulations of the Sydney Technical College. Students who fail to do this will not be permitted to enter the workshops. In particular, approved industrial footwear must be worn, and long hair must be protected by a hair net. Safety glasses must be worn at all times.

Semester 2:
(a) **Mechanics part B (3 units):** Statics of the rigid body; forces and moments; free body diagrams in two and three dimensions, resultants of forces and moments. Equilibrium of rigid bodies, trusses, frames and machines, statically determinate pin-jointed structures. Distributed forces, centroids of lines, areas and volumes, cables. Friction, wedges, screws, flexible belts. Kinematics of systems of particles and virtual forces.
(b) **Materials (3 units):** Materials classification. Materials cycle, energy content of materials, relative price of materials, consumption of resources. Mechanical properties of materials. Elastic moduli, stress and strain. Yield and tensile strength, hardness, testing methods, data. Plastic deformation. Fracture and toughness. Fatigue failure. Creep deformation and fracture, temperature effects, testing, diffusion aspects. Friction and wear, lubrication. Ceramic materials. Materials in hostile environments, role of temperature, presence of oxygen, aqueous media, other gaseous media, liquids other than water, radiation. Aqueous corrosion, oxidation, creep.
(c) **Introductory Aeronautics (3 units):** Classification of aircraft, fixed-wing, rotary wing, aerostats, surface effect vehicles. Glossary of terms for aircraft and their components. Introduction to mechanics of flight, aerodynamics, airframe structures, materials and propulsion systems. Elementary aircraft performance calculations, operating characteristics. Modern developments in aviation.

Reference books

Ashby and Jones *Engineering Materials—An Introduction to their Properties and Applications* (Pergamon, 1981)
Crawford *Basic Engineering Processes* IS edn (Hodder and Stoughton)
Cutler *Understanding Aircraft Structures* (BSP Professional, 1988)
Jane's *All the World's Aircraft* (Annual)
Meriam and Kraige *Engineering Mechanics Vol. I Statics* IS edn (Wiley, 1980)
Stinton *The Anatomy of the Aeroplane* (Collins, 1985)
~VanV\ackMaterialsforEngineering—Concepts and Applications (Addison-Wesley, 1982)

U2.002 MATH 201F Vector Calculus and Complex Variables 4 units

Qual Mathematics 102 *or* 103 *or* 192 *or* 193
Classes Sem 1: (3 lec & 1 tut)/wk
Assessment one 2hr exam, assignments, tutorial participation

U2.003 MATH 202F Matrix Applications 4 units

Qual Mathematics 101 *or* 191 *or* Distinction in Mathematics 111
Classes Sem 1: (2 lec, 1 tut & 1 computer lab)/wk
Assessment one 2hr exam, assignments, tutorial participation

U2.004 MATH 205S Fourier Series and Differential Equations 4 units

Prereq Mathematics 201 *or* 291
Classes Sem 2: (3 lec & 1 tut)/wk
Assessment one 2hr exam, assignments

U2.005 MATH 251S Linear Programming and Numerical Solution of Boundary Value Problems 2 units

Syllabus summary not yet available.

U2.006 MATH 252S Numerical Methods 2 units

Syllabus summary not yet available.

Advanced courses (Pure)

U2.007 MATH 291F Vector Calculus and Complex Variables (Advanced) 4 units

Qual Mathematics 192 *or* 193 *or* Credit in either Mathematics 102 *or* 103
Classes Sem 1: (3 lec & 1 tut)/wk
Assessment one 2hr exam, assignments

U2.008 MATH 292F Linear Algebra (Advanced) 4 units

Qual (Mathematics 191 *or* Credit in 101) and (Mathematics 192 *or* 193 *or* 194 *or* Credit in one of 102 *or* 103 *or* 104)
Classes Sem 2: (3 lec & 1 tut)/wk
Assessment one 2hr exam, assignments

U2.009 MATH 297S Analysis (Advanced) 4 units

Prereq Mathematics 291 *or* Credit in 201
Cfasses Sem 2: (3 lec & 1 tut)/wk
Assessment one 2hr exam, assignments

U2.010 MATH 253S Differential Equations (Advanced) 2 units

(Not available to Electrical Engineering students).

Syllabus summary not yet available.

U2.011 MATH 295S Mathematical Methods (Advanced) 4 units

Prereq Mathematics 291 *or* Credit in Mathematics 201
Classes Sem 2: (3 lec & 1 tut)/wk
Assessment one 2hr exam, assignments

U2.022 PHYSICS 201F Physics (Technological) A 8 units

Dr Tango
Qual Physics 103 *or* 104 *or* 192
Prereq 12 units of Junior Mathematics other thanMathematics 111 and 112 (Mathematics 101 *or* 191 plus 102 *or* 192 recommended) *or* Credit or better in Mathematics 111 and 112
Classes Sem 1: (3 lec, 3 prac & 2 microlab)/wk
Assessment one 3hr exam, microlab (report & test)

Lectures
This course is designed for students majoring in the physical and engineering sciences. The lecture topics are quantum mechanics, with applications to solid state and particle physics, astronomy, and introductory electromagnetic theory.

Practical work
Experimental physics is taught as a laboratory course of three-hour sessions and includes experiments in the areas of instrumentation , quantum physics, properties of matter and environmental sensing and measurement. The course is based on mastery of the material, with marks awarded on completion of each experiment. Assessment is also based on reviews of the students' logbooks.

Microlab
Computational Physics is taught in ten two-hour sessions in a PC based computing laboratory. An introductory session is held at the beginning of the semester for students who are not familiar with personal computers. Students work in teams of three and using simple Pascal programming they develop computational solutions to problems in quantum mechanics. Computational physics is assessed by a short written report and a one-hour test administered individually.

Textbooks
R. Eisberg and R. Resnick *Quantum Physics* (Wiley, 1985)
J. CCByrne (ed.) *Experimental'Physks Notes* (School of Physics)

U2.022A PHYSICS 291F Physics (Advanced) A 8 units

Dr Tango
Qual Physics 192 *or* Credit or better in Physics 103 *or* 104
Prereq 12 units of Junior Mathematics other than Mathematics 111 and 112 (Mathematics 101 *or* 191 plus 102 *or* 192 recommended) *or* Credit or better in Mathematics 111 and 112
Classes Sem 1: (3 lec, 3 prac & 2 microlab)/wk
Assessment two 2.5hr exam, microlab (report & test)

Lectures
The advanced Intermediate courses are intended for students who have a strong interest in Physics. The advanced lecture subjects are generally more rigorous and cover material in greater depth than is done in the regular lecture series. The assessment of the advanced subjects will reflect the more challenging nature of the material presented. The lectures in Physics 291 include advanced quantum mechanics, astronomy, and an introduction to advanced electrodynamics.

Practical work
As for Physics 201.

Microlab
As for Physics 201.

Textbooks
R. Eisberg and R. Resnick *Quantum Physics* (Wiley, 1985)
J. CByrne (ed.) *Experimental Physics Notes* (School of Physics)

U2.022E PHYSICS 201F Physics (modified) 6 units

For Electrical Engineering students only.

Syllabus as for U2.022 minus Computational Physics A and Astronomy.

U2.023 PHYSICS 202S Physics (Technological) B 8 units

Dr Tango
Qual Physics 103 *or* 104 *or* 192
Prereq 12units of Junior Mathematics other than Mathematics 111 and 112 (Mathematics 101 *or* 191 plus 102 *or* 192 recommended) *or* Credit or better in Mathematics 111 and 112
Classes Sem 2: (3 lec, 3 prac & 2 microlab)/wk
Assessment two 2.5hr exam, 2 prac reports, microlab (report & test)

Lectures
This course is designed for students majoring in the physical and engineering sciences. The lecture topics are electromagnetic properties of matter, instrumentation for the physical and environmental sciences, and optics for communications and sensing.

Practical work
As for Physics 201, except that in the second semester course students will be asked to submit one or two written and oral reports on selected experiments.

Microlab
The computational physics component is similar to that of Physics 201, except that the material for the course will be drawn from the optics textbook.

Textbook
J. O'Byrne (ed.) *Experimental Physics Notes* (School of Physics)

Reference book
E. Hecht *Optics* (Addison-Wesley, 1987)

U2.023A PHYSICS 292S Physics (Advanced) B 8 units

Dr Tango
Qual Physics 192 *or* Credit or better in Physics 103 *or* 104
Prereq 12units of Junior Mathematics other thanMathematics 111 and 112 (Mathematics 101 "*or* 191 plus 102 *or* 192 recommended) *or* Credit or better in Mathematics 111 and 112
Classes Sem 2: (3 lec, 3 prac & 2 microlab)/wk
Assessment two 2.5hr exam, 2 prac reports, microlab (report &test)

Lectures
Refer to Physics 291 for an overall description of the advanced Intermediate program. The lectures in Physics 292 include advanced electrodynamics, advanced optics, and instrumentation for the physical and environmental sciences.

Practical work
As for Physics 202.

Microlab
As for Physics 202.

Textbooks
D.J. Griffiths *Introduction to Electrodynamics* (Prentice Hall, 1989)
J. CByrne (ed.) *ExperimentalPhysics Notes* (School of Physics)

Reference Book
E. Hecht *Optics* (Addison-Wesley, 1987)

U2.023E PHYSICS 202S Technological B (modified) 6 units

For Electrical Engineering students.

Syllabus as for U2.023 minus AC Circuit Theory.

U2.030A CHEM 201F Chemistry 2 (Life Sciences) 8 units

Prereq Chemistry 112 *or* 192 *or* 194 and 12 units of Junior Mathematics courses
May not be counted with Chemistry 211 *or* 221 *or* 231 *or* 291 *or* 252
Classes Sem 1: (4 lec & 4hr prac)/wk
Assessment exam (67%), lab exercises (33%)

Lectures and tutorials
In addition to the core, the remaining 20 lectures are distinct for this course and apply the core knowledge to chemical problems in Life Sciences. Areas covered include: structure and thermodynamics of bio-molecules and biomaterials, and biological organic chemistry. Non-compulsory tutorials will also be provided at a rate of one per week.

Practical work
Practical work entails 4 hours per week for 14 weeks during the semester. Students must ensure that one complete afternoon from 1pm to 5pm, free from other commitments, is available for this practical work.

Additional information
The aim of this course is to provide students interested in life sciences with the chemical knowledge required for an understanding of the subject.

Textbooks
To be advised

U2.030B CHEM 211F Chemistry 2 (Environmental) 8 units

Prereq Chemistry 112 *or* 192 *or* 194 and 12 units of Junior Mathematics courses
May not be counted with Chemistry 201 *or* 221 *or* 231 *or* 291 *or* 252
Classes Sem 1: (4 lec & 4hr prac)/wk
Assessment exam (67%), lab exercises (33%)

Lectures
In addition to the core, the remaining 20 lectures are distinct for this course and apply the core knowledge to chemical problems in Environmental Science.

Practical work
As for Chemistry 201.

Additional information
The aim of this course is to provide students interested in environmental science with the chemical knowledge required for an understanding of the subject

Textbooks
To be advised

U2.030C CHEM 221F Chemistry 2 (Materials) 8 units

Prereq Chemistry 112 *or* 192 *or* 194 and 12 units of Junior Mathematics courses
May not be counted with Chemistry 201 *or* 211 *or* 231 *or* 291 *or* 252
Classes Sem 1: (4 lec & 4hr prac)/wk
Assessment exam (67%), lab exercises (33%)

Lectures
In addition to the core, the remaining 20 lectures are distinct for this course and apply the core knowledge to chemical problems in Materials Science.

Practical work
As for Chemistry 201.

Additional information
The aim of this course is to provide students interested in materials science with the chemical knowledge required for an understanding of the subject.

Textbooks
To be advised

U2.030D CHEM 222S Chemistry 2 (Principles) 8 units

Prereq Chemistry 201 *or* 211 *or* 221 *or* 231 *or* 252
May not be counted with Chemistry 232 *or* 292
Classes Sem 2: (4 lec & 4hr prac)/wk
Assessment exam (67%), lab exercises (33%)

Lectures
This course consists of: 18 lectures in which the structure, bonding and properties of inorganic compounds and complexes will be presented; 18 lectures of physical chemistry on statistical thermo-dynamics and thermodynamics; and 18 lectures in organic chemistry which will include amine chemistry, electrophilic substitution and the chemistry of aromatics, the chemistry of carbonyls, nucleophilic organometallic reagents and organic synthesis and synthetic methods.

Practical work
As for Chemistry 201.

Additional information
Chemistry Principles is designed for students who wish to continue to Senior chemistry courses after taking the more descriptive Intermediate courses in first semester.

U2.030E CHEM 231F Chemistry 2A 8 units

Prereq Chemistry 112 *or* 192 *or* 194 and 12 units of Junior Mathematics courses
May not be counted with Chemistry 201 *or* 211 *or* 221 *or* 252 *or* 291
Classes Sem 1: (4 lec & 4hr prac)/wk
Assessment exam (67%), lab exercises (33%)

Lectures and tutorials
A course of 18 lectures in inorganic chemistry, 18 lectures in organic chemistry and 18 lectures in physical/theoretical chemistry. Non-compulsory tutorials will also be provided at a rate of one per week.

Practical work
As for Chemistry 201.

Additional information
This is the main chemistry course for students expecting to major in chemistry.

Textbooks
To be advised

U2.030F CH EM 232S Chem istry 2B 8 u n its

Prereq Chemistry 201 *or 111 or* 221 *or* 231 *or* 252
May not be counted with Chemistry 222 *or* 292
Classes Sem 2: (4 lec & 4hr prac)/wk
Assessment exam (67%), lab exercises (33%)

Lectures
This course consists of: 18 lectures in which the structure, bonding and properties of inorganic compounds and complexes will be presented; 18 lectures of physical chemistry on statistical thermo-dynamics and thermodynamics; and 18 lectures in orgarucchemistrywMchwmincludearnine chemistry, electrophilic substitution and the chemistry of aromatics, the chemistry of carbonyls, nucleophilic organometallic reagents and organic synthesis and synthetic methods.

Practical work
As for Chemistry 201.

Additional information
Main chemistry course for students expecting to major in chemistry.

Textbooks
To be advised

U2.030G CHEM 252S Chemistry 2 (Forensic) 8 units

Prereq Chemistry 112 *or* 192 *or* 194
May not be counted with Chemistry 201 *or* 211 *or* 221 *or* 231 *or* 291
Classes Sem 2: (4 lec & 4hr prac)/wk
Assessment exam (67%), lab exercises (33%)

Lectures
In addition to the core, the remaining 20 lectures are distinct for this course and apply the core knowledge to chemical problems in Forensic Science.

Practical work
As for Chemistry 201.

Additional information
The aim of this course is to provide students interested in forensic science with the chemical knowledge required for an understanding of the subject.

Textbooks
To be advised

U2.036A CHEM 291F Chemistry 2A (Advanced) 8 units

Prereq WAM greater than 80 and a Distinction average in Chemistry(lllorl91orl93)andin(112orl92orl94);and 12 units of Junior Mathematics courses. Entry to this course is by invitation. Students in the Faculty of Science Talented Students Program are automatically eligible
May not be counted with Chemistry 201 *or* 211 *or* 221 *or* 231 *or* 252
Classes Sem 1: (5 lec & 3hr prac)/wk
Assessment exam (67%), lab exercises (33%)

Lectures and tutorials
Lectures and tutorials in Chemistry 291 (Advanced) comprise two sets: Four lectures per week in common with any other Intermediate Chemistry course and one lecture per week of advanced lectures on topics that are complementary to the other courses.

Practical work
Practical work entails 3 hours per week during the semester. For 8 weeks students take practical exercises in common with any other Intermediate Chemistry course; for 6 weeks special advanced project-oriented exercises are offered.

Additional information
The number of places in Chemistry 291 (Advanced) is limited. Applications are invited from students with a high WAM and an excellent record in a Junior Chemistry course. Places are restricted to students enrolled in the Faculty of Science except by permission of the Head of the School of Chemistry. Students in the Faculty of Science Talented Student Program who are enrolled in the BSc or BSc(Adv) degree are automatically eligible. Students enrolled in other Advanced degree programs within the Faculty are not normally admitted because of timetabling.

Textbooks
To be advised

U2.036 CHEM 292S Chemistry 2B (Advanced) 8 units

Prereq Chemistry 291, but see *Additional information* below
May not be taken with Chemistry 222 *or* 232
Classes Sem 2: (5 lec & 3hr prac)/wk
Assessment exam (67%), lab exercises (33%)

Lectures and tutorials
Lectures and tutorials in Chemistry 292 (Advanced) comprise two sets: 4 lectures and 1 tutorial per week in common with any other Intermediate Chemistry course; and 1 lecture per week of advanced lectures on topics that are complementary to the other courses.

Practical work
Practical work entails 3 hours per week during the semester. For 10 weeks, students take practical exercises in common with any other Intermediate Chemistry course; for 4 weeks, special advanced project-oriented exercises are offered.

Additional information
The number of places in Chemistry 292 (Advanced) is limited. Normally entry to this course is restricted to those students enrolled in Chemistry 291. However, a student who has performed particularly well in another first semester Chemistry course may be invited by the Head of School to enrol in Chemistry 292S (Advanced). See the Intermediate Chemistry Course Coordinator for further information.

Textbooks
To be advised

U2.0401 COMPUTER SCIENCE 201F Computer Systems 4 units

Qual COMP 102 *or* 192
Classes Sem 1: (2 lec, 2 prac)/wk
Assessment assignments, written exam

An overview of the aspects of computer hardware that are important for understanding the function and performance of software. The course consists of two principal components. Machine Principles: In this section we discuss the organisation of a computer central processing unit, CPU, and the assembly and machine language commands that control it. We also pay particular attention to the different data types supported, such as two's complement integers and floating point. System Structures: In this section we discuss the low-level organisation of system software including the organisation and action of a simple compiler and its run-time environment, and the system call and interrupt handling mechanisms.

U2.0402 COMPUTER SCIENCE 202F Design and Data Structures 4 units

Qual COMP 102 *or* 192
Classes Sem 1: (2 lec & 1 tut)/wk
Assessment assignments, written exam

When there is numerous data, its structure (arrangement) determines what operations can be done with it. For example, the Sydney telephone directory may be used to find out a subscriber's telephone number, but not which subscriber has a given number. Many data structures have been developed over the years, each suited to a particular set of operations. This course introduces the most frequently used ones, including the array, linked list, binary tree, B-tree, hash table, heap, adjacency matrix, and adjacency lists. It shows how to implement them, verify their correctness, calculate their time complexity, and decide when to use them. More generally, this focus on data and its associated operations will lead to a productive approach to the design of large programs: data abstraction.

U2.0403 COMPUTER SCIENCE 203S Languages and Logic 4 units

Qual COMP 102 *or* 192
Prereq COMP 202 *or* 292, (MATH 103 *or* 104 *or* 193 *or* 194)
Classes Sem 2: (2 lec & 1 tut)/wk
Assessment assignments, written exam

All communication requires a language. People communicate with each other in a natural language such as English; they communicate with computers in a formal language such as Pascal. This course studies two important kinds of formal languages (called regular and context-free), and the algorithms, or automata, that are used to recognise them. On the theoretical side, several ways to represent languages are presented, and their capabilities and limitations discovered; on the practical side, sound and indeed foolproof methods are derived for writing programs to recognise formal languages such as Pascal. Considerable emphasis is also put on the use of logic (both prepositional and first-order), which provides a powerful design tool for hardware implementations of automata.

U2.0404 COMPUTER SCIENCE 204S Programming Practice 4 units

Qual COMP 102 *or* 192
Prereq COMP 202 *or* 292
Classes Sem 2: (2 lec & 1 tut) / wk
Assessment assignments, written exam

In this course we attack the task of the programmer from an engineering viewpoint. This means that a major focus is on using existing tools as building blocks to complete a task. This course will teach C programming, its idiom and its considerable array of powerful programming tools. In addition, students will study the implementation of some of the library tools so that they gain an appreciation of how much better these are than a typical programmer would be able to create. In addition, it will introduce students to some of the very elegant ideas from computer science that have been applied in the construction of the tools.

Advanced Options are available for U2.0401 - U2.0404 inclusive. Entryrequirementsand syllabus summaries available from Computer Science

U2.0405 COMPUTER SCIENCE 205F Computer Systems (EE) 3 units

For Electrical Engineering students only.

Syllabus available from Computer Science.

U2.0406 COMPUTER SCIENCE 206S Languages and Logic (EE) 3 units

For Electrical Engineering students only.

Syllabus available from Computer Science.

Intermediate Geology courses

Only part of geology can be learned from books and laboratory research, the rest has to be investigated in the field. The courses designated Geology 201, 202 and 203 all contain a field work component.

For further details of the following courses consult the pamphlet on the Intermediate courses in Geology, obtainable from the Enquiry Office in the Edgeworth David Building.

U2.050A GEOLOGY 201F Plate Tectonics and Materials 8 units

Coordinator Dr Klepeis
Prereq Geology 102 *or* Environmental Science 101
Classes Sem 1: (4 lec & 2 prac or tut)/wk
Assessment two 2hr theory, lab exam, class work

This course introduces students to new practical techniques that provide a heightened understanding of the concepts introduced in the Junior courses in Geology. The principal objectives of this course are: (1) to explore the quantitative tectonophysical approach to global plate tectonics, (2) to introduce students to the analysis and interpretation of geological structures, (3) to provide a theoretical and practical introduction to the use of the polarising microscope in mineralogy and petrography, (4) to provide an introduction to the methods of optical crystallography and optical mineralogy, (5) to investigate the fundamental processes responsible for the origin and evolution of the main types of rocks, and (6) to use the polarisingmicroscope to reveal the textures and phases present in the common igneous, sedimentary and metamorphic rocks.

U2.050B GEOLOGY 202S Resource Exploration 4 units

Coordinator Dr Birch
Prereq Geology 201
Classes Sem 2: (2 lec & 1 prac or tut)/wk
Assessment one 3hr exam, class work

Mining is an important and essential part of the Australian economy. This course reviews the various economic mineral deposits that are currently mined in Australia. It shows how the geological concepts developed in Geology 201 can be applied to the study of fuels and ore deposits. The course also includes an introduction to the techniques used in geophysical exploration.

U2.050C GEOLOGY 203S Fossils and Time 4 units

Coordinator Dr Buick
Prereq 24 units of Science courses
Classes Sem 2: (2 lec & 1 prac or tut)/wk
Assessment one 3hr theory, lab exam, class work

This palaeontology and stratigraphy course is aimed at geoscientists, archaeologists, biologists, geographers and others who use fossils or stratigraphic data to determine ages, environments or evolutionary lineages. Itprovidesanoverview of fossil biodiversity, concentrating on invertebrate animals but also covering vertebrates, plants and microorganisms, with the emphasis on those groups that are most environmentally or stratigraphically useful. It also considers the main methods of stratigraphic age determination.

U2.052 Engineering Geology 2 5 units

Intermediate core course for the degree in Civil Engineering, unless the course U2.050 Geology 2 has been completed.

Mutually exclusive with U2.050 Geology 2, U2.052 Engineering Geology B
Prereq either U1.050 Geology 1 or U1.051 Engineering Geology 1
Coreq nil
Classes 26hrs lec, 39hrs lab. Field excursions in the Sydney region, as appropriate
Assessment practical lab work plus one 3hr exam at the end of the semester. Assignment work may also be included in the final assessment, as advised at the commencement of the course

Course objectives: To introduce and emphasise the role of geology in civil engineering projects.

Expected outcomes: Students should gain an appreciation of the importance of geology in the planning and execution of civil engineering projects, and be able to apply their knowledge of geology to the solution of soil and rock engineering problems.

Syllabus summary: Application of geological principles and practices to solving problems in civil engineering. Surface and sub-surface geological, geophysical and remote sensing techniques for evaluation of ground conditions. Introductory rock mechanics, clay mineralogy and behaviour. Natural materials for construction purposes.

Reference books
F.C. Beavis *Engineering Geology* (Blackwell)
A.B.A. Brink *Engineering Geology of South Africa*
P.J.N. Pells (ed.) *Engineering Geology of the Sydney Region* (Balkema)
Library classifications: 552,624.15

U2.065A Biochemistry 201F: Genes and Proteins 8 units

Dr Denyer, Mrs Loke, Biochemistry staff
Qual 12 units of Junior Chemistry which must include Chemistry 112 or 192 or 194
Prereq 12 units of Junior courses in either Biology or Physics
Classes Sem 1: (3 lec & 5 prac)/wk
Assessment one 3hr exam, one 2hr theory of prac exam, prac tasks

The lecture course introduces the main principles of biochemistry i.e. the molecular basis of life. In the beginning the course concentrates on proteins and, in particular, the mechanism of action of enzymes in the light of what we know of their structures. The second half of the course concentrates on nucleic acids (DNA and KNA) as the molecules of heredity and gene expression, and includes asectionon DNA replication, transcription and translation. The processes of replication and transcription are highly controlled in multicellular organisms and these control mechanisms are discussed. The last section of the course will describe how these processes are put together in a whole organism in order to maintain life; the anabolism and catabolism of fuels under normal conditions and under conditions of starvation or exercise.

The practical course aims to teach basic biochemical skills. The emphasis is on obtaining quality data by individual and cooperative interactions within groups for problem solving.

Textbooks
To be advised

U2.065B Biochemistry 202S Molecules, Metabolism and Cells 8 units

Dr Denyer, Mrs Loke, Biochemistry staff
Qual Biochemistry 201 *or* 291
Classes Sem 2: (3 lec & 5 prac)/wk
Assessment one 3hr exam, one 2hr theory of prac exam, prac tasks

This course aims to describe, at the molecular level, how cells work. The chemical reactions which occur inside cells is described in the first series of lectures, Cellular Metabolism. Aspects of the molecular architecture of cells which enable them to function and communicate are described in the second half of the course, Molecular Aspects of Cell Biology. At every stage the course relates how the function of each individual cell is coordinated and integrated with other cells especially in humans.

Cellular Metabolism

How cells extract energy from fuel molecules like fatty acids and carbohydrates. The regulation of energy extraction. How the body selects which fuels to use under different circumstances such as starvation and exercise. The metabolic inter-relationships of the muscle, brain, adipose tissue and liver. The role of hormones in coordinating the regulation of fuel utilisation and the mobilisation of fuel stores. How cells lay down stores of fuels. The synthesis and storage of fat and carbohydrate. The digestion of fats, starches and sugars and the use of ingested materials to make new cellular components. Synthesis and use of biochemical building blocks. The chemistry of life: the strategies and mechanisms involved in biochemical reactions and the involvement of coenzymes and vitamins in biological inter-conversions.

Molecular Aspects of Cell Biology

Sub-cellular engineering; cy toskeleton and molecular motors. Intracellular motion and the mechanism of muscle contraction. Cell membranes and cell walls. Transport across cell membranes. Communication between cells via cell surface receptors. The molecular mechanism of hormone action and the transduction of cellular signals.

The practical course builds on the skills acquired in Biochemistry 201. The work is more complicated and more structured.

Textbooks
To be advised

U2.066A Biochemistry 211F Genes and Proteins Theory 4 units

Dr Denyer, Biochemistry staff
Qua! 12 units of Junior Chemistry which must include Chemistry 112 or 192 or 194
Prereq 12 units of Junior Biology or 12 units of Junior Physics
Classes Sem 1:3 lec /wk
Assessment one 3hr exam

This course comprises just the lecture course component of Biochemistry 201.

Textbooks
To be advised

U2.066B Biochemistry 212S Molecules, Metabolism and Cells Theory 4 units

Dr Denyer, Biochemistry staff
Qual Biochemistry 201, 211 or 291
Classes Sem 2: 3 lec/wk
Assessment one 3hr exam

This course comprises just the lecture course component of Biochemistry 202.

Textbooks
To be advised

U2.090 Asian Studies 1 8 units

Intermediate elective course.

Classes Yr: one 2hr class/wk in the early evening and a 3-week full-time intensive course in the July vacation. Attendance is required at all lectures and classes
Assessment oral tests, written assignments, and one 2hr written exam in each of June and November

Syllabus summary: language study (75%), general culture (15%), business culture (10%) for the country chosen.

U2.210 Introduction to Materials 4 units

Intermediate core course for the degree in Civil Engineering.

Mutually exclusive with U1.210 Materials 1
Classes 40hrs lec & approx. 12hrs lab
Assessment one 3hr exam at end of course. Satisfactory lab work is a requirement for passing the course and it is included in the final assessment.
Course objectives: To develop an understanding of the microstructure and mechanical properties of metals, ceramics, polymers and their composites.

Course outcomes: Ability to describe the influence of microstructure of metals, ceramics, polymers upon their strength, elastic, plastic and creep behaviour.

Syllabus summary: Microstructure and bonding of metals, ceramics, polymers and composites and their influence upon the mechanical properties of these materials (i.e. strength, elasticity, plasticity, creep, etc.).

Textbooks
To be advised

Reference books
van Vlack Ma teriaZs/or Engineering—*Concepts and Applications* (Addison-Wesley, 1982)
Ashby and Jones *Engineering Materials—An Introduction to their Properties and Applications* (Pergamon, 1981)
Flinn and Trojan *Engineering Materials and their Applications* (Houghton-Miflin, 1981)
Wulf *et al. The Structures and Properties of Materials* Vols I to IV (Wiley, 1965)
Ralls *et al. Introduction to Materials Science* (Wiley, 1976)
Jastrzebski *The Nature and Properties of Engineering Materials* (Wiley, 1977)
Library classification: U620.11-19, U668.4, U669 (Fisher Library)

U2.221 Structural Mechanics 5 units

Intermediate core course for the degree in Civil Engineering.

Mutually exclusive with U2.220 Structures 1
Prereq U1.000 Mathematics 1, U1.010 Mechanics IE and U1.220 Statics
Classes 39hrs lec, 26hrs tut ,
Assessment class assignments and one 3hr closed-book exam covering the whole syllabus at the end of semester

Course objectives: To provide a basic understanding of the principles of elementary stress and stiffness analyses of simple structural elements under static loading and to be able to use these principles to analyse simple structural elements using hand computation methods.

Expected outcomes: Proficiency in basic methods of simple structural analysis and interpretation of results.

Syllabus summary: Review of basic statics; elementary elasticity, geometric properties of plane areas, axial loading, flexure in beams, shear stresses in beams, uniform torsion, bending deflections, elementary instability, influence lines, triangulated frames and trusses, combined stresses, continuum mechanics—stresses and strains in 2D, failure theories for materials.

Textbook
Megson *Strength of Materials for Civil Engineering* 2nd edn (Arnold)

Reference books
Gordon *Structures* (Penguin, 1978)
Shanley *Mechanics of Materials* student edn (McGraw-Hill, 1967)
Library classification: U624.17 (Fisher Library)

U2.261 Fluids 1 — 5 units

Intermediate core course for the degree in Civil Engineering.

Mutually exclusive with U3.261 Fluids 1
Prereq U1.000 Mathematics 1
Classes 26hrs lec, 39hrs lab/tut
Assessment one 3hr exam covering the whole syllabus at the end of semester. Satisfactory laboratory and tutorial performance is also a requirement. Credit will be given for laboratory and tutorial submissions, as indicated at the commencement of the course

Course objectives: To develop an understanding of: patterns of movement of fluid particles and associated force and energy relationships; applications of basic concepts to cases of fluids in containers and conduits.

Expected outcomes: Students should gain the ability: to determine fluid movements and forces in pipes and open channels and around bodies in fluid streams.

Syllabus summary: Equations of motion. Velocity patterns. One-dimensional flow principles. Flow measurements. Viscous and turbulent flow. Resistance to flow of fluids. Flowin closed conduits. Open channel flow.

Textbooks .
Hydraulics Data Sheets (School of Civil and Mining Engineering, University of Sydney)
Rouse *Elementary Mechanics of Fluids* (Dover)
or
Streeter and Wylie *Fluid Mechanics* (McGraw-Hill)
or
Douglas, Gasiorek and Swaffield *Fluid Mechanics* (Pitman)
or
Vennard and Street *Elementary Fluid Mechanics* (Wiley)
Library classification: 532

U2.272 Engineering Communications 1 — 2 units

Intermediate core course for the degree in Civil Engineering.

Classes 12hrs lec, 14hrs discussion/oral presentation
Assessment based on three written reports and three oral presentations. Extra credit for some or all oral presentations may be given for verifiable public speaking activities with the students' section of the Institution of Engineers, Australia, the University of Sydney Debating Society or equivalent organisation. Students are encouraged to engage in these activities

Course objectives: To develop effective written and oral communication skills.

Expected outcomes: Ability to make written and oral presentations on topics of general, technical and/or social significance to small peer groups.

Syllabus summary: 12 hours of lectures on effective report writing and oral presentation. Written reports and oral presentation on three topics of general, technical and/or social significance of 5, 10 or 15 minutes' duration. Oral presentation in groups of eight students in a lecture or round-table discussion format.

Reading material
According to chosen topic in consultation with academic staff

U2.290 Structural Design — 4 units

Intermediate core course for the degree in Civil Engineering.

Prereq U1.000 Mathematics 1, U1.010 Mechanics IE and U1.220 Statics
Coreq U2.221 Structural Mechanics
Classes 26hrs lec, 26hrs design classes
Assessment design class assignments and one 3hr closed-book exam covering the whole syllabus on steel and concrete design at the end of semester

Course objectives: To provide a basic understanding of design concepts and the design of steel and concrete elements to current code criteria.

Expected outcomes: Proficiency in the design of simple structural elements in steel and concrete.

Syllabus summary: Steel and concrete structures; introduction to the behaviour, analysis and design of simple elements. Introduction to the concepts of design through case histories and a design competition.

Textbooks
SAA HB2.2—*Australian Standards for Civil Engineering Students: Part 2: Structural Engineering*
or
SAA AS4100—*Steel Structures Code*
SAA AS3600—*Concrete Structures Code* and
SAA AS1170—*Loading Code, Parts I and II*
Buckle *The Elements of Structures* 2nd edn (Pitman International)
Schodek *Structures* (Prentice-Hall)

Reference books
Cowan *The Design of Reinforced Concrete* student edn (Sydney U.P.)
Ferguson *Reinforced Concrete Fundamentals* student edn (Wiley)
Gordon *Structures—or Why Things Don't Fall Down* (Pelican)
Park and Paulay *Reinforced Concrete Structures* (Wiley)
Trahair and Bradford *Beliaviour and Design of Steel Structures* 2nd edn (Chapman and Hall)
Warner, Rangan and Hall *Reinforced Concrete* (Pitman)
Library classification: U624.182: U624.183 (Fisher Library)

U2.410 Mechanical Engineering 2 10 units

Intermediate core course for the degree in Aeronautical, Mechanical and Mechatronic Engineering.

Mutually exclusive with U2.412 Engineering Dynamics 2
Prereq U1.000 Mathematics 1 and either U1.410 Mechanical Engineering 1 or U1.710 Aeronautical Engineering 1
Classes Sem 1: (3 lec & one 3hr lab or tut)/wk; Sem 2: (2 lec & one 3hr lab or tut)/wk
Assessment one 3hr exam at end of Sem 1; one 2hr exam at end of Sem 2; and associated coursework over course

Desired outcomes: Good understanding of the basic laws of thermodynamics and fluid mechanics. Capability to apply these laws in the analysis of simple engineering problems.

Syllabus summary:
Semester 1 (6 units)—
(a) Thermodynamics—concepts, work and heat, property of substances, 1st law of thermodynamics, control mass and control volume analysis of power and refrigeration cycles; thermal efficiency, entropy and 2nd law of thermodynamics, reversible and irreversible processes, isentropic efficiency.
(b) Fluids—fluid properties, pressure, shear, hydrostatics, forces, moments, buoyancy, stability, continuity equations, streamlines, Euler, Bernoulli equations, linear momentum, propulsion, angular momentum, turbomachinery, dimensional analysis, boundary layers, pipe flow and friction.

Semester 2 (4 units)—
Kinematics of bodies; frames of reference, velocity and acceleration; angular velocity and acceleration; rotating frame of reference; relative velocity and acceleration; gyroscopic acceleration. Kinetics of rigid bodies; linear momentum and Euler's first law; angular momentum and Euler's second law; centre of mass; moments of inertia; parallel-axis and parallel-plane theorems; principal axes and principal moments of inertia; rotation about an axis; impulse and momentum; work and energy; kinetic and potential energies. Applications to orbital and gyroscopic motion. Planar mechanisms; linkages; mobility; instant centres of rotation; Kennedy's theorem, velocity and acceleration polygons. Introduction to Lagrangian methods. Tutorial problems will include Matlab computing environment.

Objectives: To understand the governing laws of thermodynamics, fluid mechanics and kinematics. To be able to apply these laws to common engineering problems.

Outcomes: (i) ability to apply the first and second laws of thermodynamics to a range of engineering situations including power and refrigeration cycles; (ii) ability to determine loads on dam walls, stability of ships, to calculate thrust of jets, output from windpower generators; to predict drag of bodies from scale model testing, to predict pressures, forces and velocities in fluid flow; (iii) ability to formulate and solve one- and two-dimensional dynamic problems, including those involving moving frame of reference. Ability to construct velocity and acceleration diagrams for a planar mechanism.

Reference books
Smith and Smith *Mechanics* 2nd edn (Wiley, 1990)
Mabie and Reinholtz *Mechanisms and Dynamics of Machinery* 4th edn (Wiley, 1987)
Shigley and Vicker *Theory of Machines and Mechanisms* International Edn (McGraw-Hill, 1981)

U2.411 Introductory Thermodynamics 4 units

Intermediate core course for the degree in Aeronautical Engineering.

Mutually exclusive with U2.410 Mechanical Engineering 2
Prereq U1.000 Mathematics 1; and either U1.410 Mechanical Engineering 1 or U1.710 Aeronautical Engineering 1
Classes Sem 1: (2 lec & one 3hr lab/tut)/wk
Assessment one 2hr exam at end of Sem 1 and associated coursework over course

Syllabus summary: Thermodynamics—concepts, work and heat, property of substances, 1st law of thermodynamics, control mass and control volume analysis of power and refrigeration cycles; thermal efficiency, entropy and 2nd law of thermodynamics, reversible and irreversible processes, isentropic efficiency.

Textbook
Van Wylen and Sonntag *Fundamentals of Classical Thermodynamics* SI edn (Wiley)

U2.412 Engineering Dynamics 4 units

Intermediate core course for the degree in Aeronautical Engineering.

Mutually exclusive with U2.410 Mechanical Engineering 2
Prereq UI.000 Mathematics 1; and either U1.410 Mechanical Engineering 1 or U1.710 Aeronautical Engineering 1
Classes Sem 2: two 2hr lec/wk; three 3hr lab and ten 2hr tut
Assessment exam at end of Sem 2

Syllabus summary: Kinematics of bodies; frames of reference, velocity and acceleration; angular velocity and acceleration; rotating frame of reference; relative velocity and acceleration; gyroscopic acceleration. Kinetics of rigid bodies; linear momentum and Euler's first law; angular momentum and Euler's second law, centre of mass, moments of inertia; parallel-axis and parallel plane theorems; principal axes and principal moments of inertia; rotation about an axis; impulse and momentum, work and energy; kinetic and potential energies. Applications to orbital and gyroscopic motion. Planar mechanisms; linkages; mobility; instant centres of rotation; Kennedy's theorem; velocity and accelerationpolygons. Introduction to Lagrangian methods. Tutorial problems will include examples in Matlab computing environment.

Outcomes: Able to formulate and solve one- and two-dimensional dynamic problems, including those involving moving frame of references able to construct velocity and acceleration diagrams for a planar mechanism.

Reference books
Smith and Smith *Mechanics* 2nd edn (Wiley, 1990)
Mabie and Reinholtz *Mechanisms and Dynamics of Machinery* 4th edn (Wiley, 1987)
Shigley and Vicker *Theory of Machines and Mechanisms* International Edn (McGraw-Hill, 1981)

U2.417 Introductory Mechanics and Materials 8 units

Intermediate core course for the degrees in Mechanical and Mechatronic Engineering.

Mutually exclusive with: U1.210 Materials 1: Ul.650 Materials and Corrosion; U1.710 Aeronautical Engineering; U2.700 Mechanics and Properties of Solids 1 and U2.701 Mechanics of Solids 1

Prereq U1.000 Materials I

Classes Sem 1: (5 lec & 3 hrs tut)/wk plus three 3hr lab sessions

Assessment one 3-hr exam at end of Sem 1 plus assignment work

Course objectives: (a) To understand the classification of engineering materials, their properties in relation to microstructure; and (b) to understand simple stress systems and material response.

Expected out comes: Students should be able to appreciate the properties of a range of engineering materials and how and why these are connected withmicrostructures and forming and treatment methods. They should also be capable of selecting materials for mechanical design involving simple stress systems and different service conditions.

Syllabus summary: Materials classification; understanding materials properties and their relation to structure as a function of forming methods and heat treatment processes; materials behaviour in service; selection criteria and ease studies for engineering applications. Properties of engineering materials. Simple stress systems an material response; elastic and inelastic behaviour. Relation of mechanical behaviour to structures. Fracture, fatigue and toughness. Degradation of materials : corrosion and oxidation.

Textbooks

Callister*JTMaterials Scienceand Engineering—An Introduction* 3rd edn (John Wiley, 1994)

R.C. Hibbler *Mechanics of Materials* 2nd edn (McMillan, 1994)

Reference books

Grandall *et at. An Introduction to the Mechanics of Solids* 2nd edn (McGraw Hill, 1978)

Ashby and Jones *Engineering Materials 1—An Introduction to their Properties and Applications* (Pergamon, 1981)

Ashby and Jones *Engineering Materials 2—An Introduction to Microstructures, Processing and Design* (Pergamon, 1986)

Bailey *The Role of Microstructure in Metal* (Metallurgical Services, 1966)

Bailey *Introductory Practical Metallography* (Metallurgical Services, 1966)

Bailey *The Structure and Strength of Metal* (Metallurgical Services/1967)

John *Understanding Phase Diagrams* (Macmillan, 1974)

Library Classification: 620,624,666-679

U2.440 Mechanical Design 1 8 units

Intermediate core course for the degree in Mechanical and Mechatronic Engineering.

Mutually exclusive with U2.441 Mechanical Design IA and U2.443 Mechatronic Design 1

Coreq U2.700 Mechanics and Properties of Solids 1 or U2.417 Introductory Mechanics and Materials

Classes Sem 2: (4 lec/ tut, one 2hr & one 3hr drawing office session)/wk

Assessment assignments and quizzes

Course Objectives:To develop an understanding of:

- the need for and use of standard drawings in the communication and definition of parts and assemblies,
- creativity,
- the design process from initial idea to finished product,
- methods use to analyse designs,
- standard components, and
- the use of analog and digital electronic components and sensors in a mechanical dseign environment.

Expected Outcomes: Students should develop skills in:

- working in teams,
- freehand sketching and drafting practices,
- idea generation methods,
- design analysis techniques and layout,
- design development and testing,
- written and graphical communication, and
- Incorporating electronic components and sensors in the design of simple mechanical systems.

Syllabus summary:

(a) Machine Drawing—freehand sketching of machine components. Drafting techniques and standard drawing methods. Orthogonal projections and sections. Dimensioning, tolerancing, conventional symbols, detail and assembly drawings and descriptive geometry.

(b) Machine Design—engineering innovation, creativity. Teamwork. Design process, problem specification, conceptual techniques and design evaluation. Ergonomic manufacturing and assembly considerations.

Detail design of components including: design loads, failure and factor of safety; calculation approach and presentation conventions; stress effects in shape definition and material selection; introduction to engineering hardware including fasteners, bearings and mechanical power transmission. Introduction to involute gears and gear trains (including epicyclic).

(c) Mechatronic Design—Introduction to design of mechatronic systems. Elements of mechatronic systems; actuators, sensors, interfacing electronics. Industrial examples.

Textbooks

Boudny *Engineering Drawing* (McGraw-Hill)

Shigley *Mechanical Engineering Design* (McGraw-Hill)

U2.441 Mechanical Design 1A 6 units

Intermediate core course-iox the degree in Aeronautical Engineering.

Mutually exclusive with U2.440 Mechanical Design 1

Coreq U2.700 Mechanics and Properties of Solids 1 or U2.417 Introductory Mechanics and Materials

Classes Sem 2: (2 lec, one 2hr & one 3hr drawing office session)/wk

Assessment assignments and quizzes

Course Objectives: To develop an understanding of:

- the need for and use of standard drawings in the communication and definition of parts and assemblies,
- creativity,
- the design process from initial idea to finished product,

- methods use to analyse designs,
- standard components, and
- the use of analog and digital electronic components and sensors in a mechanical design environment.

Expected Outcomes: Students should develop skills in:
- working in teams,
- freehand sketching and drafting practices,
- idea generation methods,
- design analysis techniques and layout,
- design development and testing, and
- written and graphical commumcationincorporating electronic components and sensors in the design of simple mechanical systems.

Syllabus summary:
(a) Machine Drawing—Freehand sketching of machine components. Drafting techniques and standard drawing methods. Orthogonal projections and sections. Dimensioning, tolerancing, conventional symbols, detail and assembly drawings and descriptive geometry.
(b) Machine Design—Engineering innovation, creativity. Teamwork. Design process, problem specification, conceptual techniques and design evaluation. Ergonomic manufacturing and assembly considerations.

Detail design of components including: design loads, failure and factor of safety; calculation approach and presentation conventions; stress effects in shape definition and material selection; introduction to engineering hardware including fasteners, bearings and mechanical power transmission. Introduction to involute gears and gear trains (including epicyclic).

Textbooks
Boundy *Engineering Drawing* (McGraw-Hill)
Shigley *Mechanical Engineering Design* (McGraw-Hill)

U2.443 Mechatronic Design 1 2 units

Intermediate core course for Mechanical/Mechatronic Engineering students doing the Bachelor of Engineering/Bachelor of Science double degree.

Mutually exclusive with U2.440 Mechanical Design 1
Coreq U2.441 Mechanical Design IA
Classes Sem 2: (one 2hr lec/tut)/wk
Assessment assignments and quizzes

Course objectives: To provide a basic understanding of the use of analog and digital electronic components and sensors in a mechanical design environment.

Expected outcomes: The development of some of the skills required to incorporate electronic components and sensors inthe design of simple mechanical systems.

Syllabus summary: Introduction to design of mechatronic systems. Elements of mechatronic systems; actuators, sensors, interfacing electronics. Industrial examples.

U2.471 Introductory Mechatronics 6 units

Intermediate core course for the degree in Mechanical Engineering (Mechatronics).

Mutually exclusive with U2.510 Electrical Engineering 2; U2.511 Electrical Engineering 2A, U2.512 Electrical Engineering 2B and U3.500 Industrial Electronics
Prereq U1.410 Mechanical Engineering 1
Coreq U2.504 Electrical and Electronic Engineering
Classes Sem 2: (3 lec & one 3hr lab/tut)/wk
Assessment one 3hr exam at end of Sem 2 plus lab reports and mid-semester tests

Syllabus summary:
Circuit theory. Linear network analysis: complex frequency representation; complete response; special circuits; complex power; network functions; stability.

Aspects of machine control: review of electric motor types (DC and SC) and their characteristics; protection of machines: thermal overload switches, relays, fuses, circuit breakers and electronic protection; electronic control: SCRs, Triacs, GTOs, IGBTs. Controlled rectifiers and inverter circuits; harmonics, power factor; application of power control to electric motor drives.

Digital systems: concepts in digital design; combinational circuit design; sequential circuit design; algorithms and architectures; design decisions and implementation; computer aids and design process.

U2.502 Electrical Technology 4 units

Intermediate core course for the degrees in Chemical and Aeronautical Engineering.

Mutually exclusive with U1.500 Introductory Electrical Engineering U1.511 Electrical Engineering 1, U2.471 Introductory Mechatronics, U2.510 Electrical Engineering 2, U2.511 Electrical Engineering 2A, U2.512 Electrical Engineering 2B
Prereq U1.000 Mathematics 1
Classes Sem: 2 lec/wk and nine 3hr tut/lab sessions
Assessment one 2hr exam at end of sem; lab reports; and mid-sem tests

Syllabus summary: Basic AC and DC circuits. Elementary electronics. Operational amplifiers. Diodes and transistors. Electromechanical energy conversion. Principles of electric energy generation and distribution. Elementary digital systems.

U2.504 Electrical and Electronic Engineering 6 units

Intermediate core course for the degrees in Mechanical and Mechatronic Engineering.

Mutually exclusive with U2.510 Electrical Engineering 2, U2.511 Electrical Engineering 2A, U2.512 Electrical Engineering 2B
Prereq U1.410 Mechanical Engineering 1
Classes Sem 1: (3 lec & 3hrs lab/tut)/wk
Assessment one 3hr exam at end Sem 1 plus lab reports and mid-semester tests

Syllabus summary: Polyphase energy generation. Three phase systems. Star and delta connected systems. Balanced and unbalanced loads. Magnetic fields. Solenoid and toroid. Magnetic circuit calculations. AC excitations of a magnetic circuit. Magnetising curve. Hysteresis and eddy current losses. Ideal and real transformers. Model and phasor diagram of a transformer.

Principle of electromagnetic energy conversion. . Production of a rotating magnetic field. Principles of AC machines. Synchronous machines. Induction motors. Equivalent circuits. Slip-torque characteristics.

Methods of starting and speed control. DC machines. Shunt-existed generator. Shunt- and series-connected motors. Efficiency of DC machines.

Semiconductor devices: Diode, BJT and FET characteristics. Small-signal models. Basic circuits. Amplifiers and biasing; rectifiers. Linear power supplies. Thyrisor devices, applications to motor. control.

Operational amplifiers: Characteristics, ideal and real. Feedback. Design with op amps: inverting, non-inverting and differential amplifiers; integrator and differentiator; simple filters, comparator and Schmitt trigger.

Digital electronics: Numbering systems. Gates and combinational logic. Latches, synchronous and asynchronous counters. Flip-flops and memory. TTL and CMOS logic families. Practical design examples.

Microprocessor fundamentals: architecture of a standard 8-bit microprocessor. Instruction set and addressing modules. Assembly language programming. Clock and reset circuits. Memory and I/O interfacing.

Textbooks
Smith, RJ and Dorf, RC *Circuits Devices and Systems* 5th edn (John Wiley & Sons, ISBN 0-471-55221-6)

U2.511 Electrical Engineering 2A 8 units

Intermediate core course for the degree in Electrical Engineering.

Mutually exclusive with U2.471 Introductory Mediatronics, U2.502 Electrical Technology, U2.504 Electrical and Electronic Engineering
Prereq U1.511 Electrical Engineering 1
Classes 51ec/wk plus 36hrs of lab/tut
Assessment two 2hr exams plus reports and assignments

Syllabus summary:
Circuits and energy conversion—Transient and steady state responses of electric circuits. Complex frequency analysis, phasors. Laplace transform, transfer functions and frequency response. Transformers. Two port networks. Introduction to energy conversion; balanced three phase circuits. Modelling and simulation using Matlab.

Digital systems—Computer architecture and assembly language programming. Microprocessor and microcontroller systems, memory and IO interfacing, serial and parallel communications; real time control; system design decision, implementation and debugging.

Engineering development and structure—Engineering in history; early electical engineering; engineering in Australia; industry and the economy; Australian economy in a world context; electrical engineering and economic development.

U2.512 Electrical Engineering 2B 8 units

Intermediate core course for the degree in Electrical Engineering.

Mutually exclusive with U2.502 Electrical Technology, U2.504 Electrical and Electronic Engineering .
Prereq U1.511 Electrical Engineering 1
Coreq U2.021 Physics 2EE
Classes 51ec/wk plus 36hrs of lab/tut
Assessment two 2hr exams plus reports and assignments

Syllabus summary:
Electronics—Basics of semiconductors, diodes, transistors; small-signal and large-signal models, rectification, biassing, gain; FET and BJT circuits, introduction to operational amplifiers.

Signals and communications—Time and frequency representations of elementary signals and periodic and non-periodic signals. Fourier series and transform. Linear systems: impulse and frequency response. System functionsof analog niters. Communication system fundamentals: channels, baseband communication of analog signals and binary data, amplitude and frequency modulation and demodulation.

Product innovation—The product innovation process; role of the engineer in innovation.

U2.610 Chemical Engineering 2 8 units

Intermediate core course for the degree in Chemical Engineering.

Prereq U1.000 Mathematics 1
Coreq U1.610 Chemical Engineering 1
Classes Yr: (2 lec & 1 tut)/wk; plus 5 lab sessions in Sem 2
Assessment lab reports; assignments; and 2 exam papers, one at end of each sem

Syllabus summary: An integrated introductory treatment of the transport of momentum, heat and mass.

Fluid statics: application to pressure measurement and forces on storage vessels. Inviscid flow theory: application to flow measurement and enlargement losses. Laminar flow of Newtonian fluids in pipes: derivation of velocity profile, flow rate and frictional loss. Turbulent flow in pipes: application of dimensional analysis, frictionfactors; energy balances for pipe flow systems. Pumps: theory of reciprocating and centrifugal pumps; cavitation and NPSH.

Heat conduction: rectilinear and cylindrical geometry. Convection: concept and use of the heat transfer coefficient. Dimensional analysis and dimensionless correlations for heat transfer in pipe flow. Natural convection. Simple heat exchangers.

Diffusion models and examples. Convection and dilute diffusion. Diffusion coefficients in gases, liquids and polymers. Mass transfer coefficients, interfacial conditions. Dimensional analysis, correlations. Heat and mass transfer analogies. Absorption of dilute and concentrated vapours. Heat and mass transfer, wet-bulb temperature.

Design competition

This is a light-hearted exercise in which students of U2.610 Chemical Engineering 2 design, build and operate a simple device to solve an unusual Chemical Engineering problem. Past problems have included the task of producing separated shell, yolk and white from a whole raw egg. A small entry fee is charged and prizes are awarded.

Textbooks
Hewitt, Shire and Bott *Process Heat Transfer* (CRC Press, Begel House, 1994)
Others as advised during classes

U2.611 Fundamentals of Environmental Chemical Engineering 4 units

Intermediate core course for the degree in Chemical Engineering.

Prereq UlOOO Mathematics 1, U.031 Chemistry IE, U1.610 Chemical Engineering 1
Coreq U2.610 Chemical Engineering 2
Classes Sem: 4hrs lec & tut/wk
Assessment tut assignments and one 2hr exam at end of course

Objectives: to acquaint the student with environmental pollutants and their effects; to introduce the application of engineering concepts to the analysis of pollution problems and their control; to introduce common processes and technologies designed to reduce pollution or its impact on the environment.

Syllabus summary: History of environmental pollution. Introduction to environmental pollutants and their regulation. Engineering concepts of importance to the analysis and resolution of environmental problems. Environmental transport processes. Environmental processes of air pollutants. Air pollution source control technologies. Environmental processes of water pollutants. Water pollution source control technologies. Environmental processes of soil/sediment pollutants. Soil/sediment pollution remediation and control.

Textbook
Course notes (Department of Chemical Engineering) based on: Reible *Fundamentals of Environmental Engineering* (in preparation)

U2.612 Chemical Engineering Computations 4 units

Intermediate core course for the degree in Chemical Engineering.

Prereq UlOOO Mathematics 1, U1.630 Computing for Chemical Engineers
Classes Sem: 4hrs lec & tut/wk
Assessment tutorial assignments and one 2hr exam at end of course

Syllabus summary: The need and role of numerical computations in chemical engineering. Solution of linear and non-linear algebraic equations. Numerical differentiation and integration. Solution of ordinary differential equations. Linear programming and optimisation. Use of software packages. Review of extension of first-year statistics and computing (with an emphasis on chemical engineering applications).

Textbook
Course notes (Department of Chemical Engineering)

U2.700 Mechanics and Properties of Solids 1 6 units

Intermediate core course for the degree in Aeronautical Engineering.

Mutually exclusive with U2.701 Mechanics of Solids 1 or U2.417 Introductory Mechanics and Materials
Prereq UlOOO Mathematics 1
Classes Sem 1: (3 lec & one 2hr tut)/wk plus three 3hr lab sessions
Assessment one 3hr exam at end of course

Syllabus summary:
Mechanics of Solids—Concepts of equilibrium, compatibility, stress and strain; study of internal stress systems due to tension, bending, torsion and shear; statistically determinate and indeterminate structural elements; concepts of energy methods, displacement analysis; simple buckling. Presentation and emphasis based on type of structure common to mechanical, aeronautical, mining and engineering in general.

Properties of Materials—Dislocation in materials; heat treatment and metalworking processes; fundamentals of corrosion and oxidation.

Textbook
Fenner *Mechanics of Solids* (Blackwell Scientific Publication, 1989)

Reference books
There are about 30 different texts in the Engineering Library with titles such as 'Strength of materials', 'Mechanics of Solids' and 'Properties of Materials'. Students will see from perusal of these, different ways of describing the contents of this course
Bailey *The Role of Microstructure in Metal* (Metallurgical Services, 1966)
Bailey *Introductory Practical Metallography* (Metallurgical Services)
Bailey *The Structure and Strength of Metals* (Metallurgical Services)
Fontana and Green *Corrosion Engineering* (McGraw-Hill, 1967).
Hull and Bacon *Introduction to Dislocations* (Pergamon, 1984)
John *Understanding Phase Diagrams* (Macmillan, 1974)
Popov *Mechanics of Material's* IS edn (Prentice-Hall, 1978)
Library classification: 620.11

U2.701 Mechanics of Solids 1 4 units

Intermediate core course for the degree in Chemical Engineering.

Mutually exclusive with U2.700 Mechanics and Properties of Solids 1
Prereq UlOOO Mathematics 1
Classes Sem 1: (2 lec & one 2hr tut)/wk
Assessment one 2hr exam at end of course

Syllabus summary: Concepts of equilibrium, compatibility, stress and strain; study of internal stress systems due to tension, bending, torsion and shear; statistically determinate and indeterminate structural elements; concepts of energy methods, displacement analysis; simple buckling. Presentation and emphasis based on type of structure common to mechanical, aeronautical, mining and Engineering in general.

Textbook
Fenner *Mechanics of Solids* (Blackwell Scientific Publication, 1989)

Reference books
There are about 30 different texts in the Engineering Library with titles such as 'Strength of Materials', 'Mechanics of Solids' and 'Properties of Materials'. Students will see from perusal of these, different ways of describing the contents of this course
Bailey *The Role of Microstructure in Metals* (Metallurgical Services, 1966)
Bailey *Introductory Practical Metallography* (Metallurgical Services)
Bailey *The Structure and Strength of Metals* (Metallurgical Services)

Fontana and Green *Corrosion Engineering* (McGraw-Hill, 1967)
Hull and Bacon *Introduction to Dislocations* (Pergamon, 1984)
John *Understanding Phase Diagrams* (Macmillan, 1974)
Popov *Mechanics of Materials* IS edn (Prentice-Hall, 1978)
Library classification: 620.11

U2.710 Fluid Mechanics 4 units

Intermediate core course for the degree in Aeronautical Engineering.

Mutually exclusive with U2.410 Mechanical Engineering 2
Classes Sem 1:1 lec/wk and associated tut; Sem 2:2 lec/wk and associated tut
Assessment one 1.5hr exam at end of Sem 1; one 2hr exam at end of Sem 2

Syllabus summary: Properties of a fluid; definition of pressure, temperature, density, viscosity, surface tension, etc., perfect gas laws. Definition of a continuum; Newtonian and non-Newtonian fluid behaviour; flow similitude and governing non-dimensional parameters; Reynolds number; Froude number; Weber number; Mach number.

Fluid statics. Basic hydrostatic equations; buoyancy; stability of floating bodies. Pressure measuring devices; barometers; manometers. Properties of the atmosphere.

Fluid dynamics. Conservation of mass, momentum and energy equations. Continuity equation; Bernoulli equation; Euler equation. Applications in flow rate and velocity measuring devices; venturi; pitot-static tube; orifice plate. Velocity potential equation for flow modelling; internal flows, external flows around immersed bodies and ground-water flows. Equations for steady flow in open channels; calculation of free surface; hydraulic jump; critical flow rate.

Viscosity and compressibility effects. Skin friction: boundary layer flows; laminar and turbulent flows; flow in pipes and ducts; friction losses. Speed of sound of waves in a fluid medium; effects of Mach number; introduction to supersonic flow; shock waves.

Reference books
Houghton and Brock *Aerodynamics for Engineering Students* (Edward Arnold, 1988)
Ower and *FarikhxastThe Measurement of Air Flow* (Pergamon 1977)
Sabersky, Acosta and Hauptmann *Fluid Flow* (Macmillan, 1989)
Streeter and Wylie *Fluid Mechanics* (McGraw-Hill, 1981)

U2.770 Engineering Computation 4 units

Intermediate core course for the degree in Aeronautical Engineering.

Prereq U1.280 Engineering Programming and U1.281 Computer Graphics
Classes Sem 2: (1 lec & one 3hr computer lab)/wk
Assessment one 2hr exam at the end of Sem 2 and computer programming assignments during sem

Syllabus summary:
Application of numerical solution techniques to solve problems in engineering. Numerical techniques for matrix multiplication; matrix inversion; solution of simultaneous linear equations. Calculation of eigenvalues and eigenvectors; discrete Fourier transforms. Procedures for iteration; numerical integration and differentiation. The sotirage of data in efficient file or memory structure; data retrieval; sorting algorithms. Randomnumbergenerationandstatistical analysis.

The use and evaluation of package software; benchmarking; determination of limits and applicability. Usage of spreadsheets, databases, word processors, mathematical symbol manipulation; CAD/CAM, graphing programs and engineering analysis programs. Definitions for user-friendly interfaces; output format requirements.

Students will be required to carry out programming examples, in a variety of programming languages. These sample applications will cover topics such as the numerical solution of governing equations for fluid statics and fluid dynamics; numerical calculations of structural behaviour and force equilibrium; numerical simulation of the motion of simple kinematic systems; numerical modelling of simple thermodynamic cycles.

Reference books
Press *et al. Numerical Recipes, the Art of Scientific Computing* (Cambridge Press, 1986)
The Student Edition of MATLAB (Prentice-Hall, 1992)

U2.800 Engineering Construction 1 4 units

Intermediate core course for the degree in Civil Engineering and in Project Engineering and Management (Civil). Elective course for other branches.

Prereq U1.000 Mathematics 1
Classes Sem: 26hrs lec & 26hrs tut
Assessment one 3hr exam at end of course and assignments

Syllabus summary: Introduction to construction engineering fundamentals. Techniques for analysis of construction systems; productivity and cost evaluation. Selection and evaluation of plant and methods. Materials handling with special reference to earth and rock moving.

Library classification: 624, 624.068

U2.820 Engineering Economics 4 units

Intermediate core course for the degree in Project Engineering and Management (Civil). Elective course for other branches.

Coreq U2.000 Mathematics 2
Assessment coursework and written examination

Syllabus summary: Engineering economy problems and alternatives, the decisionmakingprocess, equivalence, discounted cash flow analyses, introduction to depreciation accounting, inflation, break-even analysis, probability in economy studies, appraisal of public projects, introduction to risk analysis.

U2.821 Engineering Accounting 4 units

Intermediate core course for the degree in Project Engineering and Management (Civil). Elective course for other branches.

Coreq U2.820 Engineering Economics
Assessment coursework and written examination

Syllabus summary: Accounting fundamentals, business and accounting procedures, taxation, financial

statements, financial ratios, management uses of financial information, cash flow and profitability management.

U3.607A MICR 203F Theoretical Microbiology A — 4 units

Coordinator Mrs Dalins
Mrs Dalins, Prof. Reeves, Dr New, Dr Carter, Dr Duxbury
Qual 12 units of Junior Biology
Prereq Chemistry 112 *or* 192 *or* 194 and Mathematics (101 *or* 111 *or* 191) and 102 *or* 104 *or* 112 *or* 192 *or* 194
Classes 3 lec/wk
Assessment one 3hr exam

This course is suitable for students who are majoring in other aspects of biology and who wish to acquire a broad background knowledge of microbiology. Students attend the same lectures as those enrolled in Microbiology 201. There is no practical work and no tutorial component.

Textbook
As for Microbiology 201

U3.607 B MICR 204S Theoretical Microbiology B — 4 units

Coordinator Mrs Dalins
Mrs Dalins, Dr Carter, Prof. Reeves, Dr Humphery-Smith, Dr Duxbury
Prereq Microbiology 201 *or* 203 *or* 291
Classes 3 lec/wk
Assessment one 3hr exam

This course is suitable for students who are majoring in other aspects of biology and wish to expand their knowledge of microbiology beyond that acquired in Microbiology 201,203 or 291 with further theoretical considerations of the subject. Students attend the same lectures as those enrolled in Microbiology 202. There is no practical or tutorial component.

Textbook
As for Microbiology 201

U3.090 Asian Studies 2 — 8 units

Senior elective course.

Prereq U2.090 Asian Studies 1.
Classes Yr: one 2hr class/wk and a three-week study tour of the country being studied in the July vacation. Students unable to participate in the study tour will have alternative classwork assigned
Attendance is required at all lectures and classes
Assessment oral tests, written assignments and one 2hr written exam in each of June and November

Syllabus summary: language study (60%), general culture (15%), business culture (25%) for the country chosen.

U3.212 Properties of Materials — 4 units

Senior core courses for the degree in Civil Engineering.

Mutually exclusive with U3.211 Materials 2
Prereq U2.210 Introduction to Materials
Classes 40hrs lec & 12hrs lab
Assessment one 3hr exam covering the whole syllabus. Satisfactory lab work is a prerequisite for passing the exam

Course objectives: To develop an understanding of the relationship between microstructure and mechanical properties of metals, cement-based materials, timber and masonry.

Course outcomes: Ability to select the material best suited for a particular design application.

Syllabus summary: Relationship between micro-structure and mechanical properties of metals, hardened cement paste, mortar, concrete, timber, masonry. In particular, properties of structural steels, welding and hydrogen embrittlement, cements and their hydration, minerals and other admixtures in concrete, mix design.

Textbooks
Campbell-Allen and Roper *Concrete Structures: Materials Maintenance and Repair* (Longman Scientific and Technical)—preferred text
Soroka *Portland Cement Paste and Concrete* (Macmillan Australia, 1979)
Akroyd *Concrete—Its Properties and Manufacture* (Pergamon)
and/or
Troxell *Composition and Properties of Concrete* 2nd edn (McGraw Hill)
U.S. Bureau of Reclamation *Concrete Manual*
Czernin *Cement Chemistry and Physics for Civil Engineers* (Lockwood)
Relevant SAA Specifications

Reference books
Taylor *Concrete Technology and Practice* (Angus & Robertson)
Lea and Desch *Chemistry of Cement and Concrete* (Arnold)
Dieter *Mechanical Metallurgy* 3rd edn (McGraw-Hill)
Popov *Mechanics of Materials* (Prentice-Hall)
Jaeger and Cook *Fundamentals of Rock Mechanics* (Methuen)
Reiner (ed.) *Building Materials: their Elasticity and Inelasticity* (North-Holland)
Polakowski and Ripling *Strength and Structure of Engineering Materials* (Prentice-Hall)
Honeycombe *The Plastic Deformation of Metals* (Arnold)
Easterling *Introduction to the Physical Metallurgy of Welding* (Butterworths)
Library classification: 620.11-19

U3.222 Structural Analysis — 6 units

Senior core course for the degree in Civil Engineering.

Prereq U2.221 Structural Mechanics and U2.000 Mathematics 2
Classes 42hrs lec & 42hrs tut
Assessment one 3hr exam at end of semester plus assessment of assignments

Course objectives: To provide an understanding of the principles of (a) the force and displacement methods for analysing redundant trusses and beams, and (b) the lower and upper bound methods for the plastic analysis of beams and frames. To be able to apply computer methods to structural analysis and to check the validity of such solutions.

Expected outcomes: To be able to apply the manual methods of analysis taught in the course to simple structures. To be able to apply and check computer analyses of structures.

Syllabus summary: Analysis of statically redundant trusses and frames using the force and displacement

methods. Internal forces and deflections of statically redundant trusses and frames. Lack of fit. Virtual work principles: principle of virtual forces and principle of virtual displacements. Computer methods for analysing plane frames and trusses. Programs PRFSA and PTSA. Plastic analysis of beams and frames. Upper and lower bound theorems.

Textbooks
Rasmussen *Structural Analysis 1* (University of Sydney)
Popov *Introduction to the Mechanics of Solids* (Prentice-Hall)
Parkes *Braced Frameworks* (Pergamon)
Timoshenko and Young *Theory of Structures* (McGraw-Hill)
Library classification: 624.17

U3.232 Concrete Structures 1 6 units

Senior core course for the degree in Civil Engineering.

Prereq U2.000 Mathematics 2, U2.221 Structural Mechanics and U2.290 Structural Design
Coreq U3.212 Properties of Materials and U3.222 Structural Analysis
Classes 42hrs lec, 42hrs tut/lab/drawing office
Assessment two 3hr exams plus design project

Course objectives: To provide a basic understanding of the behaviour of reinforced concrete members and structures; to provide a basic understanding of standard methods of analysis and design of reinforced concrete behaviour ((including an understanding of capabilities and limitations); to provide basic design training in a simulated professional engineering environment.

Expected outcomes: Proficiency in basic methods of reinforced concrete analysis and interpretation of results; proficiency in basic reinforced concrete design.

Syllabus summary: The behaviour and design of reinforced concrete members and structures.

Behaviour—introduction, material properties, 'elastic' analysis (stresses/deformations), ultimate strength of beams (flexure/shear/torsion), ultimate strength of columns (short and slender), introduction to behaviour of reinforced concrete slabs, introduction to prestressed concrete.

Design—design of typical elements of a reinforced concrete building, structural modelling, analysis of load-effects (incl. earthquakes), design criteria (for durability, fire-resistance, serviceability and strength), design calculation procedures, reinforcement detailing, structural drawings.

Textbooks '
Warner *el al. Reinforced Concrete* (Pitman)
Standards Australia Specifications—current editions
AS1170 *Loading Code—Parts 1,2 & 4*
AS3600 *Concrete Structures Code*
AS HB2.2 *Structural Engineering Standards*

Reference books
Park and Paulay *Reinforced Concrete Structures*
Warner and Faulkes *Prestressed Concrete* (Longman Cheshire)
Concrete Design Handbook (Cement and Concrete Association of Australia)
Reinforcement Detailing Handbook (Concrete Institute of Australia)
Library classification: 624.183

U3.235 Steel Structures 1 6 units

Senior core course for the degree in Civil Engineering.

Prereq U2.221 Structural Mechanics, U2.290 Structural Design and U2.000 Mathematics 2
Coreq U3.212 Properties of Materials and U3.222 Structural Analysis
Classes 42hrs lec, 42hrs tut/lab/drawing office
Assessment one 2hr exam at the end of each semester plus assessment of design assignments

Course objectives: To provide a basic understanding of the behaviour and design of steel members and structures.

Expected outcomes: The development of some of the skills required for the design of practical steel structures.

Syllabus summary: The behaviour and design of steel members and structures—design concept loads and load combinations, strength, stability and service-ability criteria, safety and reliability, practical steel structures, properties of cross-sections, local buckling, elastic beams, plastic beams, tension members, compression members, effective lengths and elastic in-plane frame buckling, lateral buckling of beams, in-plane bending of beam-columns, lateral buckling of beam-columns, biaxial bending of beam-columns, bolted and welded connections.

Textbooks
BHP *Hot Rolled and Structural Products Handbook*
Bradford, Bridge and Trahair *Worked Examples for Steel Structures* (AISC, 1992)'
Standards Australia Specifications—current editions
AS1170 *Parts 1 and 2 Loading Code,* and
AS4100 *Steel Structures Code;* or
AS HB2.2 *Structural Engineering Standards*
Trahair and Bradford *Behaviour and Design of Steel Structures* (Chapman and Hall, 1991)
Reference books
AISC *Design Capacity Tables for Structural Steel*
Bresler *et al. Design of Steel Structures* (Wiley)
Gaylord and Gaylord *Design of Steel Structures* IS edn (McGraw-Hill)
Lothers *Advanced Design in Steel Structures* (Longmans)
McGuire *Steel Structures* (Prentice Hall)
Other books as indicated in classes
Library classification: 624.17, 624.182

U3.244 Soil Mechanics A 4 units

Senior core course for the degree in Civil Engineering.

Mutually exclusive with U3.240 Soil Mechanics, U4.241 Soil Engineering
Prereq U2.210 Introduction to Materials, U2.221 Structural Mechanics, U1.000 Mathematics 1
Classes 26hrs lec, 26hrs lab/tut
Assessment one 3hr exam covering the whole syllabus at the end of semester. Satisfactory laboratory performance is also a requirement. Credit will be given for laboratory and tutorial submissions, as indicated at the commencement of the course

Course objectives: To develop an understanding of: the nature of soils as engineering materials; the common soil classification systems; the importance of water in the soil and the engineering effects of water movement; the factors controlling soil settlements.

Expected outcomes: Students should gain the ability: to predict the engineering behaviour of soils based on soil classification; to quantify the effects of water in the soil; to predict soil settlement.

Syllabus summary: Soil structure and engineering classification of soils. Compaction. Effective stress concept. Analysis of steady state seepage. One-dimensional consolidation theory. Stresses beneath loaded areas! Analysis of soil settlement.

Textbook
Soil Mechanics Data Sheets (School of Civil and Mining Engineering, University of Sydney)

Reference books
Scott *An Introduction to Soil Mechanics* (Applied Science)
or
Lambe and Whitman *Soil Mechanics* (Wiley)
Library classification: 624.151.

U3.245 Soil Mechanics B 4 units

Senior core course for the degree in Civil Engineering.

Mutually exclusive with U3.240 Soil Mechanics, U4.241 Soil Engineering
Prereq U2.210 Introduction to Materials, U2.221 Structural Mechanics, U1.000 Mathematics 1
Coreq U3.244 Soil Mechanics A
Classes 26hrs lec, 26hrs lab/tut
Assessment one 3hr exam covering the whole syllabus at the end of semester. Satisfactory laboratory performance is also a requirement. Credit will be given for laboratory and tutorial submissions, as indicated at the commencement of the course

Course objectives: To develop an understanding of the concept of soil strength, and how this can be used in estimating the stability of soil constructions.

Expected outcomes: Students should gain an understanding of: the strength of soil masses and the factors that control the strength; the basic theories of bearing capacity and slope stability. In particular, students should gain the ability: to interpret soil strength tests; to predict the strength and stability of soil.

Syllabus summary: Shear strength of soils. Earth pressure theories. Elementary bearing capacity theory. Slope stability analysis.

Textbook
Soil Mechanics Data Sheets (School of Civil and Mining Engineering, University of Sydney)

Reference books
Scott *An Introduction to Soil Mechanics* (Applied Science)
or
Lambe and Whitman *Soil Mechanics* (Wiley)
Library classification: 624.151

U3.250 Surveying 1 4 units

Senior core course for the degree in Civil Engineering.

Mutually exclusive with U3.250 Surveying 1
Prereq U1.000 Mathematics 1
Classes 32hrs lec, 20hrs fieldwork/ tut
Assessment fieldwork, reports, tutorials, and one 3hr exam at the end of the course

Course objectives: To introduce students to basic distance, angle, and height measurement; to give students sufficient knowledge to achieve basic computational, analytical, and interpretational skills based on the measurements; to introduce students to basic electronic field equipment; to give students an insight into future trends in measurement technologies.

Expected outcomes: Students should gain ability to: undertake basic angle and distance measurement; undertake appropriate calculations and checks involving observed data; understand errors associated with measurement; select the correct measurement alternatives for simple measurement problems.

Syllabus summary: Introduction to engineering surveying, distance measurement (steel band), angle measurement (theodolite), levelling, measurement errors, traversing, topographic surveys, optical distance measurement, error analysis, electronic surveying equipment, future surveying technologies.

Textbook
Fryer and Elfick *Elementary Surveying* 7th edn (Harper & Row)
or
Uren and Price *Surveying for Engineers* 2nd edn (Macmillan)
Library classification: 526.9

U3.262 Fluids 2 4 units

Senior core course for the degree in Civil Engineering.

Mutually exclusive with U4.262 Fluids 2
Prereq U2.261 Fluids 1
Classes 26hrs lec, 26hrs prac work/tut
Assessment one 3hr exam covering the whole syllabus at the end of semester. Credit will be given for practical work and tutorial submissions, as indicated at the commencement of the course

Course objectives: To develop anunderstanding: of theory and practical aspects of analysis of fluid behaviour in pipes and open channels, and of fluid machines.

Expected outcomes: Students should gain the ability: to calculate heads and flows through pipe and open channel systems for steady and for unsteady conditions; and to determine machine requirements for various systems.

Syllabus summary: Open channel flow. Pipe networks. Floating vessels. Hydro and aero-foils. Pumps and turbines. Compressible flow. Unsteady flows. Flow similitude and models.

Textbooks
As for U2.261 Fluids 1

U3.271 Transportation Engineering and Planning 2 units

Senior core course for the degree in Civil Engineering and in Project Engineering and Management (Civil). *Senior elective course* for the degree inMechanical Engineering.

Classes 26hrs lec
Assessment one 2hr exam and assignments

Syllabus summary: Elementary transport economics: capital and operating costs; capital recovery. Mode characteristics. Costs and benefits of road improvements. Parking. Functions of railway track components and track properties. Modern rail classification yards. Airport general layout, runway and terminal design.

Design of ports and port structures in relation to ships and cargo handling. Containerisation and container facilities. Data collection and presentation for transport planning; gravity models. Environmental factors. Geometric design of roads. Road pavement design: flexible and rigid.

Reference books
Hay *Introduction to Transportation Engineering* (Wiley)
Wright and Ashford *Transportation Engineering—Planning and Design* (Wiley, 1989)
ICAO Airport Planning Manual Rural Road Design (Austroads 1989)
Pavement Design (Austroads 1992)
Library classification: 385, 625

U3.275 Engineering Communications 2 2 units

Senior core course for the degree in Civil Engineering.

Prereq U2.272 Engineering Communications 1
Classes 26hrs discussion/oral presentation
Assessment based on two written reports and two oral presentations. Extra credit for one or both oral presentations may be given for verifiable public speaking activities with students' section of the Institution of Engineers, Australia, or the University of Sydney Debating Society, or equivalent organisation. Students are encouraged to engage in these activities

Course objectives: To develop effective written and oral communication, and advocacy and interpersonal skills.

Expected outcomes: Ability to argue in writing and orally for (or against) topics of general, technical and/or social significance to large peer groups.

Syllabus summary: Written reports and oral presentations on two topics of general, technical and/or social significance. Oral presentation in a formal meeting or debating format. Each student is assigned to a group of four which argues both for and against a motion (topic) on two separate occasions each of 30 minutes' duration.

Reading material
According to chosen topic in consultation with academic staff

U3.284 Risk and Reliability Analysis 2 units

Senior core course for the degrees in Civil Engineering.

Mutually exclusive with U3.281 Applied Statistics.
Prereq U1.000 Mathematics 1, U2.221 Structural Mechanics, U2.290 Structural Design
Classes 16hrs lec; 12hrs tut
Assessment one 3hr exam plus assignments

Course objectives: To provide a basic understanding of the principles of statistical decision theory, probabilistic risk assessment and structural reliability analysis; to develop proficiency in basic methods of risk and reliability analysis, including event trees, fault trees and decision trees and First Order Second Moment methods of structural reliability analysis; to develop an understanding of the principles of reliability-based design.

Expected outcomes: Proficiency in basic methods of risk and reliability analysis and interpretation of results.

Syllabus summary: Review of basic statistical methods of analysis (including significance testing, and linear regression); probability concepts, Bayes' Theorem, statistical decision theory, preposterior analysis; probability measures, types of uncertainty, principles of probabilistic risk assessment, event trees, risk acceptance criteria; structural safety and reliability; First Order Second Moment methods of reliabiUty analysis, the Safety Index, the design point, reliability-based design, simulation methods, system effects.

Reference books
Blockley (ed.) *Engineering Safety* (McGraw-Hill, 1992)
Madsen, Krenk and Lind *Methods of Structural Safety* (Prentice-Hall, 1986)
Melchers *Structural Reliability Analysis and Prediction* (Ellis Horwood/Wiley, 1987)
Library classification: 624.171

U3.420 Thermo-fluid Engineering 10 units

Senior core course for the degree in Mechanical Engineering.

Mutually exclusive with U3.421 Thermodynamics
Prereq U2.410 Mechanical Engineering 2 and U2.000 Mathematics 2
Classes Sem 1: (3hrs lec & tut)/wk; Sem 2:5hrs/wk; plus lab work
Assessment one 2hr exam at end of each component of the course

Syllabus summary:
Thermodynamics—Availability, statistical entropy and second law of thermodynamics, generalised charts for properties, engine characteristics, gas mixtures, psychrometry, air conditioning and refrigeration, thermodynamics of combustion.

Heat transfer—Plane and cylindrical conduction convection, thermal networks, fins, heat exchangers, LMTD and NTU methods, unsteady conduction, forced and natural convectionheat transfer coefficients, dimensional analysis, radiation introduction.

Fluid mechanics
Navier-Stokes equations—derivation, significance and fundamental importance.
Closed solutions—Poiseuille flow, Couette flow, lubrication theory.
Potential flow—stream function and potentials, Laplace's Equation, some basic building blocks. Flow around a cylinder, lift, drag, etc.
Boundary layers—derivation of equations, solution procedures for Laminar case, introduce the concept of turbulence, transition.
Turbulence—concept, properties of turbulence, eddy viscosity, more advanced approaches.
Turbulent flow near a wall—law of the wall, pipe flow velocity profiles, turbulent jet entrainment.
Channel flow—flow in a channel, weir, hydraulic jump, etc.
Compressible flow—sound waves, normal shock, nozzle flow, shock tube.

Objectives: To develop an understanding of: (i) the thermodynamics of practical devices, air conditioning and combustion systems; (ii) all types of heat transfer

situations involving conduction, convection and radiation; (iii) pipe flow, pumps, free surface flow, boundary layers, drag, lift and turbulent flow.

Outcomes: Ability to tackle and solve a range of heat transfer, thermodynamics and fluid flow problems including: (i) finned heat exchangers, coolingby fluids, quenching, insulation, and solar radiation; (ii) complex thermodynamics cycles, air conditioning, combustion, chemical equilibrium, problems involving gas mixtures; (iii) an intuitive understanding of force and energy balances in fluid mechanics. Ability to design pipe networks and determine pump requirements; to determine and optimise the drag on streamlined and bluff bodies, to apply basic turbulence models.

Textbooks
Cengel and Boles *Thermodynamics, an Engineering Approach* (McGraw-Hill)
Incropera and *DeWittFundamentals of Heat and Mass Transfer* (Wiley)
Sabersky, Acosta and HauptmanriF/ufd *Flow—a First Course in Fluid Mechanics* (Macmillan)

U3.421 Thermodynamics 4 units

Senior core course for the degree in Aeronautical Engineering.

Mutually exclusive with U3.420 Thermo-fluid Engineering
Prereq U2.411 Introductory Thermodynamics and U2.000 Mathematics 2
Classes Sem 1: (3hrs lec & tut)/wk plus lab work
Assessment one 2hr exam at end of course

Syllabus summary: Thermodynamics—Availability, statistical entropy and second law of thermodynamics, generalised charts for properties, engine characteristics, gas mixtures, psychrometry, air conditioning and refrigeration, thermodynamics of combustion.

Textbook
Cengel and Boles *Thermodynamics, an Engineering Approach* (McGraw-Hill)

U3.430 Mechanics and Properties of Solids 2 8 units

Senior core course for the degree in Mechanical Engineering.

Mutually exclusive with U3.431 Mechanical Properties of Materials, U3.730 Aircraft Structures 1
Prereq U2.000 Mathematics 2 and either U2.700 Mechanics and Properties of Solids 1 or U2.417 Introductory Mechanics and Materials
Classes Yr: (2 lec & 2 tut)/wk
Classes Sem 1:4 lec/wk and associated tut and lab classes
Assessment one 2hr exam at the end of each semester plus assignments as specified at the commencement of each semester

Course objectives: To understand (a) how to evaluate the behaviour of solid materials subjected to stress and deformation, (b) how to find the relationship between properties of materials and their microstructures, and (c) how to improve a mechanical design with the knowledge of mechanics and properties of solids.

Expected outcomes: Students should gain the ability: (a) to analyse simple engineering problems in terms of strength, stress, and deformation in relation to properties of materials, and (b) to select proper materials for simple mechanical designs.

Syllabus summary:
(a) Sem 1: Short-term and long-term mechanical properties, failure analysis, introductory fracture mechanics, single- and multi-phase alloys, phase diagrams, polymers and polymer composite materials, structure-property relationships.

(b) Sem 2: Stress and strain, linear elasticity and fundamental plasticity, primary solution strategy, introduction to variational methods, introduction to numerical stress analysis, case studies.

Textbooks
Lecture notes

Reference books
Callister, Jr *Materials Science and Engineering: an introduction* 3rd edn (John Wiley & Sons, 1994)
Chakrabarty *Theory of Plasticity* (McGraw-Hill, 1987)
Chandrupatla and Belegundu *Introduction to Finite Elements in Engineering* (Prentice Hall, 1991)
Courtney *Mechanical Behaviour of Materials* (McGraw-Hill Publishing Company, 1990)
Crandall, Dahl and Lardner *An Introduction to the Mechanics of Solids* (McGraw-Hill, 1978)
Hertzberg *Deformation and Fracture Mechanics of Engineering Materials* 3rd edn (John Wiley & Sons, 1989)
Timoshenko and Goodier *Theory of Elasticity* (McGraw-Hill, 1951)

U3.431 Mechanical Properties of Materials 4 units

Senior core course for the degree in Aeronautical Engineering and Mechanical Engineering (Mechatronics).

Mutually exclusive with U3.430 Mechanics and Properties of Solids 2
Prereq U2.000 Mathematics 2 and either U2.700 Mechanics and Properties of Solids 2 or U2.417 Introductory Mechanics and Materials
Classes Sem 1: (2 lec & 2 tut)/wk
Assessment one 2hr exam at the end of Sem 1 plus assignments as specified at the commencement of the semester

Course objectives: (a) To understand the relationship between properties of materials and their microstructures; and (b) to improve mechanical design based on knowledge of mechanics and properties of materials.

Expected outcomes: Students should gain the capabilities: (a) to analyse simple engineering problems in terms of strength, stress, and deformationinrelation to properties of materials, and (b) to select proper materials for simple mechanical design.

Syllabus summary: Short-term and long-term mechanical properties, dislocations, introductory fracture and fatigue mechanics, polymers and polymer composite materials, ceramics and glasses, high temperature deformation and failure, structure-property relationships, selection of materials in mechanical design.

Textbooks
Lecture notes

Reference books
Ashby *Materials Selection in Mechanical Design* (Pergamon, 1993)
Ashby and Jones *Engineering Materials 2—an introduction to microstructures, processing and design* (Pergamon 1986)
Bolton *Engineering Materials Technology* 2nd edn (Butterworth-Heinemann, 1993)
Callister Jr *Materials Science and Engineering: an Introduction* 3rd edn (John Wiley & Sons, 1994)
Courtney *Mechanical Behaviour of Materials* (McGraw-Hill, 1990)
Hertzberg *Deformation and Fracture Mechanics of Engineering Materials* 3rd edn (John Wiley & Sons, 1989)
Higgins *Properties of Engineering Materials* 2nd edn (Edward Arnold, 1994)
Library classification: 620, 624, 666-679

U3.440 Mechanical Design 2 8 units

Senior core course for the degrees in Mechanical and Mechatronic Engineering.

Prereq U2.440 Mechanical Design 1 or U2.441 Mechanical Design IA
Classes Sem 1: (2 lec & two 3hr drawing office sessions)/wk
Assessment assignments and quizzes

Syllabus summary: In this course selected components and whole machines are examined. Their uses, functions and evolution are considered. A synthesis of modelling, stress and deflection analysis, together with practical considerations, is emphasised in arriving at design solutions. Moderate scale realistic problems areultimatelyintroducedrequiringinventivesolutions and comprising several detail designs and assemblies selection. The material covered includes: welded and bolted joints, power screws, shafts, flexible mechanical elements and other torque transmission components, brakes and clutches, rolling element and hydrodynamic bearing, springs, involute and cycloidal gears and scheduling. CAD (computer aided drafting and designing) is used in several problems, highlighting areas of advantage. Application to prograrnrning in CAD is introduced.

The importance of management in design is highlighted where relevant, i.e. relationship with drafting and manufacturing personnel, effective communication with suppliers and subcontractors, planning and scheduling a project. Aspects of acceptable design for the client. Product reliability and quality.

Textbook
Shigley *Mechanical Engineering Design* (McGraw-Hill)

Reference books
Orlov *Fundamentals of Machine Design* (M.I.R.)
Deutschman *et al. Machine Design* (Collier-Macmillan)
Groover and Zimmers *CAD/CAM Computer Aided Design and Manufacturing* (Prentice-Hall)
Reference may also be made to other texts during lectures
Library classification: 621.815, 001.6443

U3.451 System Dynamics and Control 6 units

Senior core course for the degrees in Mechanical and Mechatronic Engineering.

Mutually exclusive with U3.750 Mechanics of Flight 1
Prereq U2.000 Mathematics 2 and U2.410 Mechanical Engineering 2 or U2.412 Engineering Dynamics
Classes Yr: (2 lec & 1 tut)/wk
Assessment two 3hr exams plus assignments

Syllabus summary:
(a) Dynamics: Mechanical, electrical, pneumatic and hydraulic systems. Modelling and linearisation of systems. Laplace transform and Fourier methods of solution. Transfer functions. State space representation for dynamic systems. Linear system analysis in frequency and time domain. Computer simulations of systems; matrix formulation; modal analysis. Introduction to distributed systems, shaft whirl, vibrations of beams and simple structures.
(b) Control: Modelling and linearisation. Feedback control systems. Basic control actions. Performance and stability criteria. Linear system design and analysis via root locus. Bode diagrams and Nyquist methods. Computer simulation. Introduction to computer controlled systems.

Objectives: To provide students with techniques from mechanics and linear system theory applicable to mechanical systems (machines and structures), and to introduce them to classical control theory.

Outcomes: Students will be competent in modelling mechanical and electro-mechanical systems and setting up their governing equation, and will be able to solve them numerically or analytically. They will be familiar with the occurrence, isolation, and measurement of vibration, and with the analysis and design of linear feedback controllers for common mechanical systems.

Reference books
Rao *Mechanical Vibrations* (Addison-Wesley, 1986)
Ogata *System Dynamics* 2nd edn (Prentice-Hall, 1992)
Library Classification 531.32, 620.1, 620.101,620.3, 629.8

U3.460 Manufacturing Engineering and Management 10 units

Senior core course for the degree in Mechanical Engineering and Mechanical Engineering (Mechatronics).

Prereq U1.410 Mechanical Engineering I
Classes Sem 1: 3hrs lec:/wk; Sem 2: 3hrs lec/wk; plus an average of 2hrs/wk throughout the year for tut, lab and works visits, the latter mainly in Sem 2
Assessment to be advised at beginning of course

Syllabus summary:
Manufacturing processes—several manufacturing processes will be considered from the points of view of fundamentals of the process, limitations on the productionrates and runs and product quality, general purpose and specialised machinery, automation, numerical control and computer-aided manufacture. Processes considered include machining, casting, powder metallurgy, metal working, welding, cutting, polymer processing, bending and.composite manufacture.

Manufacturing systems—economics of automation, flexible manufacturing, Justin Time, group technology, materials requirements planning, quality control, introduction of new technology, human factors, plant layout.

Industrial hazards—(a) Recognition of hazards presented by chemical and physical agents: nature, mode of entry and effects of toxic substances; adverse effects of noise, work physiology and thermal stress. (b) Evaluation of hazards: survey design, hygienic standards and interpretation of results, (c) Principles of hazard control: industrial ventilation, personal protective equipment, safety organisation and the prevention of industrial accidents, stress in the workplace.

Industrial organisation and management—Micro-economics, the Australian business environment, the role of government, accounting systems and procedures, the accounting cycle, financial statements, internalperforrnance,firtancialstructUres, intellectual property, contract law, legal obligations of business, capital budgeting and investment analysis, introduction to contract administration. Social responsibility in engineering, including professional responsibility and liability, social and environmental issues and ethics of engineering practice.

Textbooks
Samson *Management for Engineers* (Longmans, 1990)
Clark *Student Economics Brief* (Fairfax)

Reference books
Stanley *How toReadand Understand a Balance Sheet* (Schwartz & Wilkinson, Melbourne)
The Small Business Handbook (Small Business Development Corporation, Victoria)
Eyre *Mastering Basic Management* (Macmillan)
Stoner, Collins, Vetton *Management in Australia* (Prentice-Hall)
Blank and Tarquin *Engineering Economy* (McGraw-Hill)

U3.461 Manufacturing Engineering 5 units

Senior core course for students doing the double degree BE(Mechanical or Mechatronics) and BCom.

Mutually exclusive with U3.460 Manufacturing Engineering and Management
Prereq U1.410 Mechanical Engineering I
Classes Sem 1:3hrs lec/wk; plus an average of 2hrs/wk for tut, lab and works visits
Assessment to be advised at beginning of course

Syllabus summary:
Manufacturing processes—several manufacturing processes will be considered from the points of view of fundamentals of the process, limitations on the productionrates and runs and product quality, general purpose and specialised machinery, automation, numerical control and computer-aided manufacture. Processes considered include machining, casting, powder metallurgy, metal working, welding, cutting, polymer processing, bending and composite manufacture.

Manufacturing systems—economics of automation, flexible manufacturing, Justin Time, group technology, materials requirements planning, quality control, introduction of new technology, human factors, plant layout.

Reference books
S.Ka\pak)TanManufacturingProcessesforEngineeringMaterials 2nd edn (Addison-Wesley Publishing Co., 1991)
E. DeGarmo, J.T. Black and R. A. *KobseiMaterials and Processes in Manufacturing* 7th edn (Macmillan Publishing Co., 1990)

U3.465 Project and Practice 6 units

Senior core course for the degrees in Mechanical and Mechatronic Engineering.

Coreq for Mechanical students: U3.420 Thermo-Fluid Engineering; U3.430 Mechanics and Properties of Solids 2; U3.450 System Dynamics and Control and U3.460 Manufacturing Engineering and Management
For Mechatronics students: U3.431 Mechanical Properties of Materials, U3.451 System Dynamics and Control, U3.476 Industrial Electronics and U3.460 Manufacturing Engineering and Management
Classes Project: 1hr/wk for team consultations and several lectures on relevant topics; presentations in final two weeks of Sem 1;
Laboratory: Yr: approx. twenty 3hr lab sessions
Assessment Project: (2 units) on the basis of progressive contribution to the group effort and on the quality of the final presentations
Laboratory: (4 units) throughquizzingduringlab sessions, on the basis of lab reports and on the basis of quality of report writing

Syllabus summary:
Project—Teambuilding, considerations of conceptual design, economic analysis, project management outline, environmental impact and consideration of benefits to society in major projects. This part of the course will culminate in team presentations at the end of Sem 1.
Laboratory—A range of experimental investigations to complement the Senior Year courses. The section includes trainingin written communication and report presentation. Several detailed reports need to be presented.

Objectives:
To plan a multidisciplinary project, to consider technical, managerial, economic, environmental and societal factors in bringing a project from concept to conclusion and to make a verbal presentation. To work as a team in practical sessions and to carry out experimental investigations in order to form technical conclusions and to present reports.

Outcomes:
Students will learn how to work in a team, to plan and assign responsibilities and to achieve common objectives. Tasks will include information searches, conceptual planning and design and consideration of all the complexities of modern project planning. Students will gain practical and analytical experience from the experimental laboratory tasks. The project and laboratory sections of the course will require students to learnhow to make effective writtenreports and verbal presentations.

U3.474 Electrical Machines and Drives 4 units

Senior core course for the degree in Mechanical Engineering (Mechatronics).

Mutually exclusive with U3.522 Power Electronics and Drives
Prereq U2.471 Introductory Mechatronics and U2.504 Electrical and Electronic Engineering
Classes Sem 2: (2 lec & one 3hr lab/tut)/wk
Assessment to be advised by Electrical Engineering

Syllabus summary: Applications and historical context, principles of electronic control of power flow, power semiconductors, phase-controlled rectifiers and derivatives, AC-DC phase control, DC-DC converters.

Electromagnetic transducers, rotating magnetic field principles, synchronous machines, induction machines, DC and AC servo motors, electronically-controlled machine operation.

Textbook
To be advised by Electrical Engineering

U3.476 Industrial Electronics 10 units

Senior core course for the degree in Mechatronic Engineering.

Mutually exclusive with U3.540 Electronics 1, U3.560 Digital Systems 1
Prereq U2.471 Introductory Mechatronics and U2.504 Electrical and Electronic Engineering
Classes Sem 1: (2 lec & one 2hr lab/tut) / wk (Digital Systems); Sem 2: (3 lec & one 3hr lab/tut)/wk (Electronics)
Assessment one 3hr exam at end of Sem 1 and Sem 2, plus lab reports and mid-semester tests

Syllabus summary: BJT and FET amplifiers, coupling, stability, multi-stage amplifiers, FETs as digital and analogue switches. Differential amplifiers, current source, active load. Power amplifiers: class A, B, AB, C, D. Power MOSFETs. Operational amplifiers: practical examples of design of linear and non-linear circuits. Feedback in amplifiers—BJT, FET and op-amp. Frequency response, stability and compensation. High frequency and low noise amplifiers, power op-amps.

Filters—passive RC and LC filters, design of high-order active filters, time and phase circuits.

Oscillators—A/D and D/A converters; sample and holds; applications.

Transducers—principles of operation, signal conditioning and interfacing for measurement of position, velocity, pressure, strain, force and temperature.

Optoelectronics—LED and displays, photodiode, phototransistor, optocouplers and isolation.

Electromagnetic noise—EMI control, guarding, earthing.

Power supplies—linear unregulated and regulated, thermal design and protection, switch-mode power supplies.

Structure of digital systems, programmable logic, array logic and technologies; logic minimisation; combinational logic with PLDs; synchronous machines and PLA-based sequences; state machine design; datapath functions, counters and arithmetic; testing and testability; asynchronous design; specification languages and simulation.

Textbooks
To be advised by Electrical Engineering

U3.506 Fundamentals of Biomedical Engineering 4 units

Senior elective course.

Prereq U2.510 Electrical Engineering 2 or U2.504 Electrical and Electronic Engineering
Classes Sem 1: (2 lec & one 2hr tut/lab)/wk
Assessment lab reports and one 2hr exam at end of Sem 1

Syllabus summary: Physiology and anatomy of respiratory, cardiovascular, central nervous and musculo-skeletal systems. Cell biology—membrane physiology and biochemistry, glucose metabolism. Operational amplifiers, active filters, electrodes. Electrocardiogram, vector cardiogram, defibrillation, pacemakers. Electroencephalogram, electromyogram, electroneurogram. Diagnostic imaging systems—principles of CT scanning, ultrasonic, nuclear and magnetic resonance imaging. Laboratory work on data handling and processing by computer using Matlab, ECGs, nerve conduction.

U3.511 Circuit Theory 4 units

Senior core course for the degree in Electrical Engineering and the degree in Electrical Engineering (Information Systems Engineering).

Prereq U2.511 Electrical Engineering 2A, U2.512 Electrical Engineering 2B and U2.000 Mathematics 2 or U2.001 Mathematics 2EE
Classes Sem 1: (2 lec & one 2hr tut)/wk
Assessment assignments, one 1hr mid-term exam and one 3hr exam at the end of the Semester

Syllabus summary: Main aim of the course is to teach tools of passive circuit analysis and synthesis. Topics covered include: multi-port networks and their port descriptions such as impedance, admittance, scattering etc.; concepts of passivity and losslessness; state-space descriptions of passivecircuits;positivereal functions; Foster and Cauer realizations for special passive 1-ports; Brune synthesis for general passive 1-ports.

Reference books
Brief notes will be issued. No textbook will be employed. Numerous references will be given to a wide range of books

U3.512 Signals and Systems 5 units

Senior core course for the degree in Electrical Engineering and the degree in Electrical Engineering (Information Systems Engineering).

Prereq U2.510 Electrical Engineering 2; and U2.000 Mathematics 2 or U2.001 Mathematics 2EE
Coreq U3.511 Circuit Theory
Classes Sem 1: (2.5 lec & 2.5hr Iab/tut)/wk
Assessment lab reports, assignments and one 2hr exam at end of Sem

Syllabus summary:
Part A—Signals: classification, basic signals and their properties, representation of signals using orthogonal functions. Fourier series: definition, finding the coefficient and basic operation, effects of symmetry. Fourier transform: definition of Fourier integral, properties of Fourier transform, examples. Linear systems: modellingof electrical system, time-invariant, time-varying, causal and non-causal systems, impulse response and frequency response of the linear time-invariant system, convolution theorem, time convolution and frequency convolution, properties of convolution, cross-correlation and linear systems, power signals and linear systems. Filters: types of filters, ideal filters and causality, specifications of filters, phase response and group delay. Linear modulation: type of modulation, amplitude (DSB-LC

and DSB-SC), frequency and phase modulation, frequency domain analysis of AM modulation, power of a modulated signal. Discrete-time systems: Z-transform—region of convergence, properties of Z-transform, inverting Z-transform, frequency response of discrete time system, convolution of discrete system. Discrete transforms: discrete-time Fourier transform—its properties, finite length sequence and frequency resolution, discrete Fourier transform—decimation-in-time, decimation-in-frequency, spectral estimation, spectral leakage and windowing, digital filtering.

Part B—stochastic systems—Introduction to probability and random variables: probabilities of random events, axioms, joint and conditional probability, statistical independence. Cumulative distribution function, probability density function, statistical averages, standard distributions (uniform, binomial, Poisson, Gaussian), transformations or random variables, joint and conditional density functions, correlation between random variables. Power and energy spectral sensitivities. Random processes—stationary and ergodic processes, auto-correlation and power spectra, cross correlation. Statistical representation of random noise.

Introduction to sampled data systems and ideal reconstruction, spectrum of sampled signal, aliasing. Sampled data systems—linear, time-invariant, causal, impulse response, finite difference equations, FIR and HR systems.

U3.522 Power Electronics and Drives 4 units

Senior elective course for the degrees in Electrical Engineering and ISE stream.

Mutually exclusive with U3.474 Electrical Machines and Drives
Prereq U2.510 Electrical Engineering 2
Classes Sem 2: (2 lec & one 2hr lab/tut)/wk
Assessment lab reports, assignments and one 2hr exam at end of Sem

Syllabus summary: Applications and historical context, principles of electronic control of power flow, power semiconductors, phase controlled rectifiers and derivatives, AC-AC phase control, DC-DC converters, DC-AC converters.

Electromagnetic transducers, rotating magnetic field principles, synchronous machines, induction machines, electronically controlled machine operation.

U3.523 Topics in Electrical Engineering Design 3 units

Senior elective course for the degree in Electrical Engineering and the degree in Electrical Engineering (Information Systems Engineering).

Prereq U2.510 Electrical Engineering 2
Classes Sem 2: (1 lec & one 2hr lab)/wk
Assessment assignment and one 1hr exam at end of Sem

Syllabus summary: Illumination concepts, photometric units, the lumen method, lighting design, ferromagnetics, ferrites, magnetic information storage, transformer design. Thermal design, heat loss mechanisms, finned structures. Protection design, the electric arc in circuit interruption, fuses, circuit breakers.

U3.529 Electrical Systems 3 units

Senior elective course for the degree in Electrical Engineering and the degree in Electrical Engineering (Information Systems Engineering).

Prereq U2.510 Electrical Engineering 2.
Classes Sem 2: (2 lec & 1hr lab/tut)/wk
Assessment assignments and one 2hr exam at end of Sem 2

Syllabus summary: Systems consisting of electro-mechanical converters (electrical machines), electrochemical converters (batteries, fuel cells) and electronic converters as well as basic circuit elements. An introduction to conventional and alternative renewable/non-renewable energy sources, energy transmission, markets and distribution. Basic techniques of systems modelling and analysis including per unit systems, transformers, lines, interference, power flows, transients, balanced faults, control of real and reactive power. Applications to household, transport, industrial and high voltage systems. Use of MATLAB as a modelling and simulation tool.

Textbook
Glover and Sarma *Power System Analysis and Design* (P.W.S. Publ. Co., 1994)

U3.530 Control 1 4 units

Senior core course for the degree in Electrical Engineering and the degree in Electrical Engineering (Information Systems Engineering).

Mutually exclusive with U3.450 System Dynamics and Control
Prereq U2.510 Electrical Engineering 2
Coreq U3.511 Circuit Theory
Classes Sem 2: (2 lec & 2hrs of lab or tut work)/wk
Assessment one 2hr exam at end of sem, plus assessment of lab work

Syllabus summary: History and review of control.

Modelling of physical processes, state variables and differential equations. Dynamic response, review of Laplace transform, transfer functions and block diagrams, poles and zeros, design specifications in the time domain.

Basic feedback principles, closed loop systems, effect of feedback on sensitivity and disturbance rejection, steady state accuracy, stability, the Routh criterion, basic proportional, integral and derivative control.

Design using the root locus, rules for sketching root locus, lead and lag compensators, analogue and digital implementation of controllers.

Frequency response design methods, review of Bode diagrams, designspecifications, Nyquist stability criterion, gain and phase margins, closed loop frequency response, compensator design.

Study of some design applications.

An introduction to state space, equations for single input single-output systems, relation to transfer functions, eigenvalues, brief description of state variable feedback.

Textbook
Franklin, Powell and Emami-Naeni *Feedback Control and Dynamic Systems* 3rd edn (Addison-Wesley, 1994)

U3.540 Electronics 1 — 10 units

Senior core course for thedegree in Electrical Engineering and the degree in Electrical Engineering (Information Systems Engineering).

Mutually exclusive with U3.476 Industrial Electronics
Prereq U2.510 Electrical Engineering 2
Coreq U3.511 Circuit Theory, U3.512 Signals and Systems
Classes Yr: (2 lec & one 3hr lab class or tut)/wk
Assessment one 3hr exam at end of each sem plus lab report marks

Syllabus summary: Revision of devices, diode, BJT, FET, MOSFET circuits and op. amps, measuring instruments and techniques. Advanced device models. Differential pair, Darlington pair, cascode, multi-transistor amps. Bootstrapping. IC bias. Frequency response, gain-bandwidth product. Feedback, effect on input and output impedances and gain, stability, compensation, gain and phase margins. Oscillators sinusoidal, phase-shift, Wien bridge, Colpitts, multivibrators, crystal oscillators. Power supplies/ power electronics—linear, switched mode, protection. Tuned amplifiers, simple op. amp. filters. Power amplifiers, class A,B,AB,C, protection, output driver power dissipation. SPICE models. IC layout and fabrication, analogue IC design HF amplifier and oscillator design, s-parameters, striplines.

U3.551 Engineering Electromagnetics — 4 units

Senior core course for the degree in Electrical Engineering and the degree in Electrical Engineering (Information Systems Engineering).

Prereq U2.510 Electrical Engineering 2
Coreq U3.511 Circuit Theory
Classes Sem 1: (2 lec& 2 hr lab/tut)/wk
Assessment tutorialsand assignments plus one2hr exam at end of Sem

Syllabus summary: Transmission lines (in which circuit theory is used to derive EM wave phenomena in distributed circuits)—revision of circuit elements and static fields; distributed circuits, characteristic impedance, waves, reflections, VSWR, impedance transformation, and matching; use of the Smith chart.

Fields and waves (in which Maxwell's equations are used to derive EM wave phenomena in general and the interaction of EM waves with various ma terials such as conductors, dielectrics, etc.)—revision of vector algebra, static fields and boundary problems; Maxwell's equations, plane EM waves in various media; reflections of waves at boundaries, electro-magnetic compatability, atmospheric wave propagation; waveguides and components (RF and optical); antennas and arrays, numerical methods.

Textbook
Narayana Rao *Elements of Engineering Electromagnetics* (Prentice Hall)

U3.552 Communications 1 — 6 units

Senior core course for the degree in Electrical Engineering and the degree in Electrical Engineering (Information Systems Engineering).

Prereq U2.510 Electrical Engineering 2
Coreq U3.512 Signals and Systems, U3.540 Electronics 1, U3.551 Engineering Electromagnetics
Classes (3 lec & 3 hr lab/tut)/wk in Sem 2
Assessment lab reports, assignments and one 3hr exam at end of Sem

Syllabus summary: Components of communication systems—basic properties of signals, noise and communication channels; analog modulation—amplitude and frequency modulation principles and common applications; baseband transmission of binary digital signals, equalisation, transmission coding and introductory error control coding; introduction to modulated carrier data transmission; digital transmission of analog signals—pulse code modulation and delta modulation; performance of modulation schemes in noise; information theory.

Textbook
M.S. Roden *Analog and Digital Communication Systems* 4th edn (Prentice Hall, 1996)

Reference books
L.W. Couch *Digital and Analog Communication Systems* (Macmillan, 1993)
F.G. Stremler *Introduction to Communication Systems* 3rd edn (Addison Wesley, 1990)
B.P. Lathi *Communication Systems* (Wiley, 1983)
J. Gibson *Principles of Digital and Analog Communications* (Macmillan)
H. Taub and D.L. Schilling *Principles of Communication Systems* 3rd edn (McGraw-Hill, 1986)
B. Sklar *Digital Communications-.Fundamentalsand Applications* (Prentice-Hall, 1988)

U3.553 Digital Signal Processing — 4 units

Senior core course for thedegreein Electrical Engineering (Information Systems Engineering) and *Senior elective course* for the degree in Electrical Engineering.

Prereq U2.511 Electrical Engineering 2 A and U2.512 Electrical Engineering 2B
Coreq U3.5.12 Signals and Systems
Classes Sem 2: (2 lec & 2hr lab/tut)/wk
Assessment lab reports, assignments and one 2hr exam at end of Sem

Syllabus summary: Introduction to DSP hardware. Architecture, data structure, processing unit of general and special purpose DSP hardware (ADSP by Analog Devices in particular), and associated programming language. Discrete and fast Fourier transforms. Discrete convolution by discrete Fourier transform, deciniate-in-timeFFT,decrmate-in-frequencyFFT,FFT in convolution and filtering. FIR and HR filters design. Filter specification, coefficient calculation, realisation, implementation and performance analysis of various FIR and HR filters. Adaptive and statistical filters. Conceptof adaptive filtering, basic Weiner filter, recursive least squares algorithm, application examples. Spectrum estimation and analysis. Traditional methods, modern parametric estimation methods, application examples. Introduction to two-dimensional signal processing. Two-dimensional sampling, spatial filtering, image enhancement.

U3.554 Speech Processing 3 units

Senior elective course for the degree in Electrical Engineering and the degree in Electrical Engineering (Information Systems Engineering).

Coreq U3.512 Signals and Systems
Classes Sem 2: (2 lec & 1hr lab/tut)/wk
Assessment assignments, project work and a 2hr exam at end of Sem

Syllabus summary: Introduction to speech waveforms and spectra; acoustic phonetics and phonology, the linear speech production model. Speech coding: methods based on the linear production model including LPC and CELP, multi-band coding. Speech synthesis: formant synthesis models; concatenative synthesis; segmental and suprasegmental aspects of text-to-teach conversion. Speech recognition principles: the problems; feature extraction; dynamic time warping and Hidden Markov modelling. Language analysis and representation in computing systems; parsing techniques; application to speech synthesis and recognition systems.

Computer-based laboratory, tutorial and project work will use MATLAB signal processing and special purpose speech processing software packages.

Textbook
Holmes *Speech Synthesis and Recognition* (Van Nostrand Reinhold, 1988)
Comprehensive notes will be provided for the course

Reference book
Deller, Proakis and Hansen *Discrete-time Speech Digital Processing* (Macmillan, 1993)

U3.560 Digital Systems 1 4 units

Senior core course for the degree in Electrical Engineering and the degree in Electrical Engineering (Information Systems Engineering).

Mutually exclusive with U3.476 Industrial Electronics
Prereq U2.510 Electrical Engineering 2
Classes Sem 1: (2 lec & 2hrs of lab or tut)/wk
Assessment lab reports and one 2hr exam at end of Sem 1

Syllabus summary: Structure of digital systems, programmable logic, array logic and technologies; logic rninirnisation; combinational logic with PLDs; synchronous machines and PLA-based sequences; state machine design; datapath functions, counters and arithmetic; testing and testability; asynchronous design; specification languages and simulation.

U3.561 Computer Architecture 3 units

Senior core course for the degree in Electrical Engineering (Information Systems Engineering) and *Senior elective course* for the degree in Electrical Engineering.

Mutually exclusive with U2.043 Computer Science 2B, U2.041 Computer Science 2EE and U2.040 Computer Science 2
Prereq U2.042 Computer Science2A or U2.504 Electrical and Electronic Engineering
Coreq U3.560 Digital Systems 1 or U3.476 Industrial Electronics
Classes Sem 2: (2 lec & one 1hr tut)/wk
Assessment assignments; and one 2hr exam at end of the course

Syllabus summary: Introduction, perspectives, abstractions and technology. Performance measurement and evaluation. Instruction set architectures and instruction set design. Processor implementation techniques. Enhancing performance: pipelines, superscalar CPUs. The memory hierarchy: cache, ram, disk, archive; memory protection. Interfacing, bus systems and peripherals. Introduction to parallel processing. A look at selected processors.

U3.562 Engineering Software 3 units

Senior core course forfhedegreein Electrical Engineering (Information Systems Engineering).

Prereq U2.510 Electrical Engineering 2, U2.042 Computer Science 2A
Classes Sem 2: (1 lec & one 2hr tut/lab)/wk
Assessment one 2hr exam at the end of the course plus assignment(s)

Syllabus summary: Introduction to Software Engineering; software design process; software testing and maintenance; configuration management. Software techniques: software prototyping; numerical methods; table driven routines; optimisation; multitasking; parallel programming. Software/ hardware interfaces.

U3.571 Management for Engineers 3 units

Sen ior core course for the degree in Electrical Engineering and also the ISE stream.

Classes Sem 1: (2 lec & one 1hr tut)/wk
Assessment tutorials, assignments and one 2hr exam at the end of Sem 1

Syllabus summary: Engineers and management, microeconomics, macroeconomics, managerial decisionmaking. Behaviour of people in organisations, human resource management for engineers, strategic management, accounting and management, operations management, marketing for engineers, the legal environment of business, industrial relations, engineering project management.

Chemical Engineering—Core requirements for Senior and Senior Advanced students

Chemical plant inspection tour

For one week of a vacation period during the Senior Year, students visit a number of chemical plants outside the Sydney area. Tours in the past years have been to south-eastern Queensland, Tasmania, Victoria and the Hunter Valley.

Mid-semester week exercises

One or two one-week exercises are organised during the teaching periods of the Senior Year. Normal classes are suspended during these weeks.

Senior students spend a week working on selected plant problems on major chemical plants in the Sydney area. In these exercises the students work in small groups in cooperation with plant engineers and academic staff to investigate chemical engineering problems in a plant environment.

U3.610 Unit Operations 1 12 units

Senior core course for the degree in Chemical Engineering.

Prereq U2.610 Chemical Engineering 2.
Classes Yr: (3 lec & 3hrs tut)/wk
Assessment tut assignments and exams at end of each Sem

Syllabus summary: The course is conducted in four main parts. Two parts will be taught and examined each semester.

(a) Mass transfer—
Distillation: history and introduction; VLE in ideal systems; VLE in non-ideal systems; Tx, Hx diagrams; theoretical single stage; thermodynamic efficiency; flash distillation; Ponchon-Savarit, reflux; minimum reflux, total reflux; McCabe-Thiele; overall column efficiency; heat loads, cost, short cuts; flooding; Naphtali-Sandholm method, computer methods.

Extraction: immiscible systems; McCabe-Thiele construction; partially miscible; packed columns; application in processing industries.

Gas absorption: packed columns; volumetric MT coefficients; depth of packing; flooding.

(b) Heat transfer—
Forced convection: dimensionless groups, correlations.

Heat exchanger performance analysis and effectiveness—NTU approach. Design and rating problems.

Shell-and-tube heat exchangers: 1-2, 2-4 and other contacting schemes. Thermal analysis. Heat recovery. Estimation of heat transfer rates and pressure drop. Fouling. Practical considerations in design and selection.

Condensation heat transfer mechanisms: Nusselt analysis. Correlations. Design and practical applications.

Boiling heat transfer mechanisms: nucleate and flow boiling. Evaporators. Reboilers.

Radiation fundamentals: black and non-black radiation and absorption. Radiation interchange between black and grey bodies. Electrical analogues. Reradiating surfaces. Gas radiation. Furnace calculations.

(c) Particle mechanics—
Introduction to particulate systems, particle size and shape parameters, size distributions and statistical properties, test sieve analysis. Screening, particle-screen mechanics, efficiency of screening. Size reduction, energy requirements, classical laws, product size distribution. Motion of a particleinafluid, terminal velocity, hindered settling. Phase separations, classification, elutriation, thickening, gas and liquid cyclones, centrifuging. Motion of fluids in particle beds, two phase flow in packings, filtration, batch and rotary filters, fluidisation concepts. Methods of sub-sieve sizmgmcludmgsedimentation, photo-extinction, direct counting and gas absorption methods.

(d) Fluid mechanics—
Compressible flow: isothermal and adiabatic flow in pipes; choking. Non-Newtonian flow: classification of fluids; measurement of model parameters; application to laminar and turbulent flow. Mixing and agitation: dimensional analysis; power curves; mixing time. Two-phase flow: flow regimes; models of two-phase flow; calculations for two-phase flow in pipelines.

Textbooks
Perry and Green *Chemical Engineers Handbook* 6th edn (McGraw-Hill, 1984)

for (a)
Furzer *Distillation for University Students* (published by the author, Department of Chemical Engineering, The University of Sydney)

for(b)
Hewitt, Shire and Bott *Process Heat Transfer* (CRC Press—Begel House, 1994)
Coulson, Richardson and Sinnott *Chemical Engineering, Vol. 6* (Pergamon, 1985)

for (c)
Coulson and Richardson *Chemical Engineering, Vol. 2* (Pergamon, 1983)

for (d)
Coulson and Richardson *Chemical Engineering, Vol. 1* 5th edn (Pergamon, 1996).

Reference books
for (a)
Kister *Distillation Design* (McGraw-Hill, 1990)

for (b)
OzisikHeatTransfer—ABasic Approach (McGraw-Hill, 1985)

for (c)
Allen *Particle Size Measurement* (Chapman and Hall, 1981)
Svarovsky *Solid-Liquid Separation* (Butterworths, 1977)

for (d)
Levenspiel *Engineering Flow and Heat Exchange* (Plenum, 1986)
Wallis *One Dimensional Two-Phase Flow* (McGraw-Hill, 1969)

U3.621 Thermodynamics 8 units

Senior core course for the degree in Chemical Engineering.

Classes Yr: (2 lec & one 1hr tut)/wk
Assessment tut assignments and one 3hr exam at the end of each sem

Syllabus summary:
First and Second Law applications; energy equations for steady flow and transients in process systems; thermochemistry; compressible flow; heat engines; refrigeration cycles, liquefaction processes; availability; isentropic and polytropic efficiencies for compressions and turbines.

Estimation of thermodynamic properties: (i) using simple fluid models (ideal gas, incompressible liquid), (ii) using charts and tables, (hi) using equations of state.

P-V-T relationships for real gases; relationship between thermodynamic properties; calculation of residual anthalpies, entropies, etc. based on a V-explicit equation of state; application of P-explicit equations of state in computer methods for property prediction.

Partial molal properties; fugacity. Solution properties; chemical potential; activity; solution models.

Equilibrium criteria. Phase equilibrium: cases involving fluids for which a single equation of state is valid; cases where separate liquid and gas models are used. Computer methods.

Chemical equilibrium: homogeneous and heterogeneous reactions.

Textbook
Smith and Van Ness *Introduction to Chemical Engineering* (McGraw-Hill, 1987)

U3.626 Reaction Engineering 1 4 units

Senior core course for the degree in Chemical Engineering.

Coreq U3.620 Thermodynamics
Classes Sem 2: (12 lec & 6 tut)/9wks
Assessment tut assignments, project and one 3hr exam at end of course

Syllabus summary: Reaction kinetics. **Homogeneous reactions:** development of a rate expression, elementary and non-elementary reaction, reaction mechanism, typical kinetics of important industrial reactions. **Chemical equilibrium:** estimation of equilibrium constants; equilibrium in multireaction systems. **Rate data analysis:** integral and differential method of data analysis, methodologies for rate data analysis and interpretation. **Heterogeneous reactions:** chemical kinetics, catalysis, rate expressions, rate controlling step. Role of mass transfer, internal and external diffusion, effectiveness factor; multiple products. **Ideal reactors:** ideal batch and continuous (tubular and stirred tank) reactions. Steady-state behaviour of ideal reactors. **Non-isothermal reactors:** energy balance, equilibrium effects; kinetics.

Textbook
Fogler *Elements of Chemical Reaction Engineering* (Prentice-Hall, 1990)

U3.631 Computations and Statistics 4 units

Senior core course for the degree in Chemical Engineering.

Prereq U2.000 Mathematics 2
Classes Sem: (6hrs lec/tut)/wk
Assesstnent tut assignments and one 3hr exam

Syllabus summary: Uses for process modelling. Process optimisation. Dimensionless correlations. Empirical modelling (line of best-fit, variable transformations, multilinear regression). Linear programming. Steady-state and dynamic mechanistic (heat and mass balance based) modelling. Numerical methods relevant to model solution. Use of software packages for model solution.

Textbooks
Walpole and Myers *Probability and Statistics for Engineers and Scientists* 4th edn (Collier Macmillan)
Gerald and Wheatley *Applied Numerical Analysis* 3rd edn (Addison-Wesley, 1984)

Reference books
As indicated during classes

U3.645 Project Economics 4 units

Senior core course for the degree in Chemical Engineering.

Prereq U1.610 Chemical Engineering 1
Classes Sem 1: (4hrs lec/tut)/wk
Assessment one 3hr exam at end of course plus assignments

Syllabus summary: Project evaluation—cashflows, time value of money, economic criteria, depreciation and taxation, capital and operating costs, comparison of alternatives, risk and uncertainty, project finance.

Reference book
Helfert *Techniques of Financial Analysis* (Irwin, 1982)

U3.646 Transport Phenomena 4 units

Senior elective course for the degree in Chemical Engineering.

Prereq U2.610 Chemical Engineering 2; plus second year WAM > 60%
Classes Sem 2: (4hrs lec/tut)/wk
Assessment assignments plus one 3hr exam at end of course

Syllabus summary: Constitutive equations for momentum, heat and mass transfer. Momentum, heat and mass transfer analogies. The nature of diffusion; time-dependent diffusion. Diffusion and convection; forced convection, Stefan flow. Boundary-layer theory; boundary-layer development. Dispersion and turbulence; eddy viscosity; Reynolds stress; averaging; closure. Mass transfer: models; influence of reaction, solubility, stirring.

Reference books
Cussler *Diffusion: Mass Transfer in Fluid Systems* (C.U.P., 1984)
Brodkey and Hershey *Transport Phenomena: A Unified Approach* (McGraw-Hill, 1988)

U3.647 Laboratory Projects in Unit Operations 4 units

Senior elective course for the degree in Chemical Engineering.

Prereq U2.610 Chemical Engineering 2
Coreq U3.610 Unit Operations 1
Classes Sem 2: 5hr/fn
Assessment lab reports, oral presentation and general skill shown in planning and executing lab experiments

Syllabus summary: This laboratory course extends the range of experiments illustrating the principles of mass transfer, heat transfer and particle mechanics. Three lab experiments will be undertaken by students during the semester. Two written reports and one oral presentation will be required from each student. Each student will carry out a laboratory class every two weeks. The same level of preparation is required for this course as for U3.670 Chemical Engineering Laboratory. Specifically, students are required to: (1) familiarise themselves with the background theory; (2) understand the operation of the experimental apparatus and the correspondence between the apparatus and thatdescribed in thebackground theory; and (3) define the experimental aim, rangeof measurements to be made and how these measurements will be processed in the light of the background theory and the aim.

The analysis and interpretation of the experimental data are of great importance in the assessment, as is the ability to present the results clearly/logically and precisely either as a technical report or an oral presentation.

Textbook
Printed laboratory notes
Perry and Green *Chemical Engineer's Handbook* (McGraw-Hill, 1984)

Reference books
Reference documentation appropriate to each laboratory exercise is available for borrowing

U3.651 Materials and Corrosion 2 2 units

Senior core course for the degree in Chemical Engineering.

Classes Sem: 2hr of lec & rut/wk
Assessment one 2hr exam

Syllabus summary: The major forms of corrosion and the mechanisms by which they occur. Aqueous corrosion. Chemical and electrochemical thermodynamics of corrosion, stability diagrams. Electrode kmetira.Polarisanon.AppUciontocorrosionkinetics. Passivation. Corrosion types protection and case studies. Materials selection and design. High temperature corrosion and oxidation.

Textbook
Fontana *Corrosion Engineering* 3rd edn (McGraw-Hill, 1986)

Reference books
Uhlig and Revie *Corrosion and Common Control* 3rd edn (Wiley, 1985)
PourbidxAtlasofElectrochemicalEquilibriainAqueoiisSolution (NACE, 1974)

U3.660 Process Control 1 . 4 units

Senior core course for the degree in Chemical Engineering.

Prereq U2.000 Mathematics 2
Coreq U3.630 Computations and Statistics
Classes Sem: 4hrs of lec, tut and lab work/wk
Assessment tut assignments, lab reports and one 3hr exam

Syllabus summary: The role of control in chemical processes. Development of dynamic models. Analytical and numerical solution of dynamic models. Laplace Transform. Transfer functions. Dynamic analysis of first order, second order and higher order systems. Introduction to feedback control. Types of controllers, closed-loop fundamental equations. Stability analysis, controller design. Process reaction curve method. Use of MATLAB.

Textbook
Stephanopoulos *Chemical Process Control: An Introduction to Theory and Practice* (Prentice-Hall, 1984)

Reference books
As indicated during lectures

U3.671 Chemical Engineering Laboratory 6 units

Senior core course for the degree in Chemical Engineering.

Prereq U2.610 Chemical Engineering 2
Coreq U3.610 Unit Operations 1
Classes Sem 1: 7hr/fn
Assessment lab reports and oral presentation, plus general skill shown in planning and executing lab experiments

Syllabus summary: This laboratory course complements the course U3.610 Unit Operations 1 on the principles of mass transfer, heat transfer and particle mechanics.

As part of the preparation for an experiment, the student will be expected specifically to:

1. familiarise himself or herself with the background theory;
2. understand the operation of the experimental apparatus; and
3. define the experimental aim, range of measurements to be made and how these measurements will be processed.

Considerable importance is attached to the analysis and interpretation of the experimental data and to the writing of a clear, logical and concise technical report.

Textbooks
Perry and Green *Chemical Engineer's Handbook* 6th edn (McGraw-Hill, 1984)
Printed laboratory notes

Reference books
As indicated during classes

U3.720 Aerodynamics 1 4 units

Senior core course for the degree in Aeronautical Engineering.

Prereq U2.000 Mathematics 2 and U2.710 Huid Mechanics
Coreq U3.725 Aerodynamics 2
Classes Sem 1:4 lec/wk and associated tut
Assessment written exam at end of sem

Syllabus summary: An introduction to the technology of aeronautics. Aerodynamic characteristics of aircraft components. Lift, drag and pitching moment behaviour of fuselage, wings and aerofoils. Two-dimensional aerofoil theories; conformal mapping; Joukowski transformation; thin aerofoil theory.

Introduction to aircraft performance. General aircraft performance; steady level fight force balance, take-off, climb, landing and cruise performance. Range calculations. Manoeuvre performance.

Basic equations governing aerodynamics. Reynolds and Mach numbers; dimensional analysis; continuity; momentum and energy equations; Bernoulli, Euler and Navier-Stokes equations.

Potential flow solutions for Laplace equation. Vorticity; circulation; modelling of solid bodies in two-dimensional flow. Prediction of lift; Kutta-Joukowski law.

Reference books
McCormick *Aerodynamics, Aeronautics and Flight Mechanics* (Wiley, 1979)
Streeter and Wylie *Fluid Mechanics* (McGraw-Hill, 1981)
Houghton and Brock *Aerodynamics for Engineering Students* (Edward Arnold)
Dommasch *Airplane Aerodynamics* (Pitman)
Hale *Aircraft Performance Selection and Design* (Wiley, 1987)
Milne-Thomson *Theoretical Aerodynamics* (Macmillan, 1966)
Rutowski *Energy Approach to the General Aircraft Performance Problem* (Douglas A/C Co., 1990)

U3.725 Aerodynamics 2 — 4 units

Senior core course for the degree in Aeronautical Engineering.

Prereq U2.000 Mathematics 2 and U2.710 Fluid Mechanics
Coreq U3.720 Aerodynamics 1
Classes Sem 2:4 lec/wk plus associated tut
Assessment written exam at end of Sem 2

Syllabus summary: Introduction to three-dimensional flow; Biot-Savart law; horse-shoe vortex.

Basic gas dynamics; steady one-dimensional flow including friction and heat transfer; shock waves. Introduction to steady two-dimensional supersonic flow.

Viscous effects; introduction to boundary layer theory; heat transfer and skin friction. Prediction of aerodynamic drag.

Energy approach to general aircraft performance; climb rates; energy envelope; cruise performance. Excess power and specific energy calculation. Range calculations. Manoeuvring flight with increased load factor. Aircraft excess power comparisons.

The aerodynamics of control surfaces; introduction to aerodynamic derivatives; theory and applications.

Reference books
McCormick *Aerodynamics, Aeronautics and Flight Mechanics* (Wiley, 1979)
LiepmannandRoshko *Elements of Gasdynamics* (Wiley, 1957)
Houghton and Brock *Aerodynamics for Engineering Students* (Edward Arnold)
Schlichting *Boundary Layer Theory* (McGraw-Hill, 1960)
Hale *Aircraft Performance, Selection and Design* (Wiley, 1987)
Bertin and Smith *Aerodynamics for Engineers* (Prentice Hall, 1979)
Rutowski *Energy Approach to the General Aircraft Performance Problem* (Douglas A/C Co., 1990)

U3.730 Aircraft Structures 1 — 4 units

Senior core course for the degree in Aeronautical Engineering.

Mutually exclusive with U3.430 Mechanics and Properties of Solids 2 and U4.432 Mechanics and Properties of Solids 2A
Prereq U2.000 Mathematics 2 and U2.700 Mechanics and Properties of Solids 1
Classes Sem: 3 lec/wk with associated tut
Assessment course assignments and written exam at end of sem

Syllabus summary:
(a) Solid mechanics: stress and strain, linear elasticity, strain energy. Plane stress systems. Elastic vibration and buckling.
(b) Structural analysis: airframe structure. Loads and reactions in airfrarnes. Analysis of rnulti-cellboxbeams and tubes. Analysis of rings.

Reference books
Timoshenko *StrengthofMaterials,Partsland II* (VanNostrand)
Langtiaar *Energy Methods in Applied Mechanics* (Wiley)
Bruhn *Analysis and Design of Flight Vehicle Structures* (Tri-State Offset)
Megson *Aircraft Structures for Engineering Students* (Arnold, 1972)
Library classification: 620.11, 628.13, 629.13, 630.1

U3.735 Aircraft Structures 2 — 4 units

Senior core course for the degree in Aeronautical Engineering.

Coreq U3.730 Aircraft Structures 1
Classes Sem: 3 lec/wk and associated tut work
Assessment course assignments and written exam

Syllabus summary:
(a) SoHd mechanics: thermal stresses and plasticity; applications in plane stress systems.
(b) Structural analysis: elementary analysis of plates and stiffened panels and shells. Analysis of complex frameworks: introduction to displacement methods of analysis.

Reference books
Drucker *Introduction to the Mechanics of Deformable Bodies* (McGraw-Hill)
Bruhn *Analysis and Design of Flight Vehicle Structures* (In-state Offset)
Library classification: 620.11,629.13,630.1

U3.740 Aircraft Design 1 — 6 units

Senior core course for the degree in Aeronautical Engineering.

Prereq U2.441 Mechanical Design IA and U2.700 Mechanics and Properties of Solids 1
Coreq U3.431 Mechanical Properties of Materials, U3.720 Aerodynamics 1 and U3.730 Aircraft Structures 1
Classes Yr: (1 lec & 2 or 3hrs of tut and design activity)/wk
Assessment tut assignments plus minor and major design projects

Syllabus summary:
(a) Introduction todesign: the process of aircraft design; safety and its implications; component design; structural analysis.
(b) Optimisation; design for manufacture; joints and fasteners; vibration; fatigue; human factors, the art of design; social responsibilities.

Reference books
Svennson *Introduction to Engineering Design* (U.N.S.W.P., 1981)
Bruhn *Analysis and Design of Flight Vehicle Structures* (Tri-State Offset)

U3.750 Flight Mechanics 1 — 4 units

Senior core course for the degree in Aeronautical Engineering.

Mutually exclusive with U3.450 System Dynamics and Control
Prereq U2.000 Mathematics 2 and U2.412 Engineering Dynamics
Classes Sem 1: (3 lec & 2 tut)/wk
Assessment written exam at end of sem and course assignments

Syllabus summary:
(a) Dynamics component of course U3.450 System Dynamics and Control, delivered by Mech Eng Dept
(b) Static and manoeuvring longitudinal stability, equilibrium and control of rigid symmetric aircraft.

Origin of symmetric forces and moments. Aerodynamic load effects of wings, stabilisers, fuselages and powerplants. Trailing edge aerodynamic controls.

Trimmed equilibrium condition. Effects on performance and static stability of trimmed equilibrium.

The concept of static margin. Effects on static stability of free and reversible controls.

Manoeuvring longitudinal stability and the concept of manoeuvre margin. Effects on manoeuvring stability of free and reversible controls.

Reference books

Nelson *Flight Stability and Automatic Control* (McGraw-Hill, 1989)

Etkin *Dynamics of Atmospheric Flight* (Wiley, 1972)

Roskem *AirplaneFlightDynamicsandAutomaticFlightControls* (Roskam A&EC, 1979)

U3.755 Flight Mechanics 2 4 units

Senior core course for the degree in Aeronautical Engineering.

Coreq U3.750 Flight Mechanics 1
Classes Sem 2:4 lec/wk with associated tut
Assessment written exam at end of sem and course assignments

Syllabus summary: Axis systems for the description of aircraft motion.. Axis transformations. The general equations of flight vehicle motion.

State-space forms of the longitudinal and lateral-directional equations of aircraft motion. Nonlinear differential equations. Trim and perturbation equations. Linearisation about trim conditions. Linearised equations of longitudinal and lateral-directional motion.

Laplace transforms and their application to aeronautical dynamic system analysis/Eigenvalues and eigenvectors and their relation to the stability and behaviour of aeronautical systems.

Static lateral-directional equilibrium and stability. Introduction to lateral-directional control.

Linear approximation of aerodynamic derivatives and the influence of aircraft components oh stability derivatives.

Longitudinal and lateral-directional dynamic stability. Frequency domain dynamic stability analysis. Time domain analysis and solutions for the flight path of a rigid-body aircraft; response to control inputs.

Reference books

Nelson *Flight Stability and Automatic Control* (McGraw-Hill; 1989)

Etkin *Dynamics of Atmospheric Flight* (Wiley, 1972)

Roskem *Airplane Flight Dynamics and Automatic Flight Controls* (Roskam A&EG, 1979)

U3.760 Laboratory 4 units

Senior core course for the degree in Aeronautical Engineering.

Coreq U3.725 Aerodynamics 2 and U3.730 Aircraft Structures 1
Prereq U2.770 Engineering Computation
Classes approx. twenty-five 3hr lab sessions
Assessment lab assignments

Syllabus summary: A series of laboratory experiments are arranged in conjunction with the Senior courses. Students are evaluated orally during each experiment and are required to complete several detailed reports.

The course also involves a computer laboratory section where students are expected to develop a piece of useful engineering software.

Reference books

Bradshaw *Experimental Fluid Mechanics* (Pergamon, 1964)

Pankhurst and Holder *Wind Tunnel Techniques* (Pitman, 1965)

Library classification: 532; 532.54; 629.130725

U3.770 Flying Operations 2 units

Senior core course for the degree in Aeronautical Engineering.

Coreq 36 units of Senior courses
Classes part-week course held mid-semester vacation
Assessment written report

Syllabus summary:
Students are given flying instruction on powered aircraft and gliders, as well as experience of cross country flight and night flight. The flying experience is linked in with the Mechanics of Flight course.

U3.780 Aviation Technology 4 units

Senior core course for the degree in Aeronautical Engineering.

Prereq 96 units of Junior and Intermediate coursework
Classes Yr: 2 lec/wk & associated tut and lab work
Assessment based on assignments submitted during the year, plus one 2hr exam in Sem 1 and Sem 2

Syllabus summary: Survey of current practice in aviation measurement and instrumentation. Introduction to pressure, force, velocity and displacement transducers; accelerometers; electronic anemometers; temperature sensors; strain gauges. Use of electronic sensors as part of computer data logging system; signal generation; amplification; filtering; analogue to digital conversion. Digital data formats; storage requirements and accuracy limitations. Post-processing; calculation of mean and standard deviation for dynamic signals; analysis using fast Fourier transforms; random decrement. Calibration of sensors.

Manufacturing processes; automated machining processes; techniques for manufacture of non-metal components; composite materials; sealants and adhesives. Aeronautical fastening techniques. Introduction to CAD and NC machining.

Aeronautical material and hardware standards. Civil aviatioriregulations and airworthiness directives. Aircraft weight and balance control. In-service structural integrity checking. Systems standards.

Reference books

Students taking this course shouldbecomef amiliar with the Australian Civil Aviation Authority's Civil Aviation Orders, Parts 100 through 103, as well as the related British and United States Aviation authority documents

Cutler *Mnderslandmg Aircraft Structures* (PSP Professional, 1988)

U3.790 Industrial Organisation and Management 4 units

Senior core course for the degree in Aeronautical Engineering.

Classes to be announced
Assessment to be announced

Syllabus summary (Preliminary):
Microeconomics, the Australian business environment, the role of government, accounting systems and procedures, the accounting cycle, financial statements, internal performance, financial structures, intellectual property, contract law, legal obligations of business, capital budgeting and investment analysis, introduction to contract administration.

Reference books
Stanley *How toReadand Understanda Balance Sheet* (Schwartz & Wilkinson, Melbourne)
The Small Business Handbook (Small Business Development Corp., Victoria)
Eyre *Mastering Basic Management* (Macmillan)
Stoner, Collins and Vetton*Management in Australia* (Prentice-Hall)
Blank and Tarquin *Engineering Economy* (McGraw-Hill)

U3.801 Engineering Construction 2 4 units

Senior core course for the degree in Civil Engineering and in Project Engineering and Management (Civil).

Prereq U2.800 Engineering Construction 1
Classes Sem: 26hrs lec & 26hrs tut
Assessment one 3hr exam at end of course and assignments

Syllabus summary: Synthesis of systems for the construction of buildingand civil engineeringprojects. Advanced techniques for the evaluation of productivity and cost in production systems such as for concrete and asphalt Economic analysis in planning the execution of heavy construction projects such as tunnelling and marine projects.

Library classification: 624.068

U3.810 Network Planning 4 units

Senior core course for the degree in Project Engineering and Management (Civil). Elective course for other branches.

Assessment coursework, project submission and written exam

Syllabus summary: Fundamentals of project planning and control, simplified and manual methods for planning: bar charts, S-curves and other graphics, work breakdown structure, precedence and arrow networks; PERT/CPMmethods, resource allocation/ levelling, integrated cost/schedule techniques and network-based schedule and cost control.

U3.811 Contracts Formulation and Administration 6 units

Senior core course for the degree in Project Engineering and Management (Civil). Elective course for other branches.

Assessment essay, coursework, assignments and written exam

Syllabus summary: The making of a contract, precontract negotiation, nature and purpose of model conditions of contract, standard forms; contract administration and performance, enforcing liabilities and obligations, dispute resolution through effective negotiation, mediation, arbitration and litigation, claims preparation and investigation.

U3.900 Innovation and International Competitiveness 4 units

Senior elective course for the degree in all branches of Engineering.

Classes Sem: (1 lec/1 seminar)/wk
Assessment essay, group- project case study, assignments and written exam

Syllabus summary: The course is designed to provide students with an understanding of the forces of international competition that are setting the rules for the future of private and public sector organisations in which engineers are employed. Introduction to challengesof modern management; understanding of the new rules of international competitiveness; effects of globalisation onAustralia'seconomicperformance; the competitiveness of Australian firms; the generation of employmentand wealth; the changing requirements on the engineer; the engineer as manager and strategist; the role of innovation in business management; product innovation and commercialisation.

Text and reference books
See list supplied by lecturer

U4.005 Partial Differential Equations 2 units

Senior Advanced elective course for the degree in Mechanical Engineering.

Mutually exclusive with some options in the Senior Mathematics courses in the Faculty of Science
Prereq U2.000 Mathematics 2
Classes Sem 2:2hrs/wk
Assessment assignments and one 2hr exam at end of course

Syllabus summary: Occurrence of partial differential equations in engineering problems; types. Solution methods: separation of variables; series expansions; transform methods. Special functions. Applications of computer algebra.

Reference books
Consult lecturer

U4.070 Industrial Ergonomics 2 units

Senior Advanced elective course.

Mutually exclusive with U4.460 Industrial Engineering
Classes Sem 2:2 lec/wk plus associated lab work
Assessment course assignment

Syllabus summary:
(a) Lectures—History and scope of ergonomics; biomechanics; receiving and processing information; presentation of information; anthropometry and seating; ergonomic aspects of noise; human factors in safety; selection, skill and training; industrial lighting;' fatigue, shiftwork and the organisation of work; absenteeism; mental health and automation; design of equipment and workspace; biomechanics of handling materials; ergonomic job analysis; personal factors in work performance.
(b) Laboratory—Demonstration of protective clothing and equipment. Methods of measurement of work environment. Climatic chamber.

Reference books '
As advised during classes
Library classification: 150,331.1,611,612,620,658

U4.080 Computer-based Design 2 units

Senior Advanced elective course for the degree in all branches. The course is provided by the Key Centre of Design Quality.

Classes Sem: (1 lec & 1 tut)/wk
Assessment semester-long project completed by an interdisciplinary group of students using various computer-based design tools

Syllabus summary: This course addresses the various roles and types of computerrbased tools used during design. The aim of this course is to broaden the student's understanding of computer-based tools beyond the software available in the individual departments and to introduce the needs and tools for integrated computer-based design. Topics include: computer-based analysis, modelling, synthesis, data exchange standards, database management systems, integrated design environments in industry.

Reference books
As indicated during classes

U4.090 Asian Studies 3 8 units

Senior Advanced elective course.

Prereq U3.090 Asian Studies 2
Classes Yr: two 2hr classes/wk, one on language and general culture and the other on business culture. Attendance is required at all lectures and classes
Assessment oral tests, written assignments and one2hr written exam in June and November

Syllabus summary: language (40%), general culture (10%), business culture (50%) for the country chosen.

U4.202 Thesis 1 6 units

Senior Advanced core course for the degree in Civil Engineering and in Project Engineering and Management (Civil). The course U5.204 Thesis. Honours (10 units) may be substituted for this core course.

Coreq a senior core course in the field of the thesis
Classes literature survey and experimental work
Assessment submitted typed thesis and oral presentation

Syllabus summary: A study, in groups of 2 or 3 students, of a selected topic in Civil Engineering. Detailed information sheets are available from the School of Civil and Mining Engineering at the beginning of Semi.

U4.203 Thesis 2 4 units

Senior Advanced elective course for the degree in Civil Engineering and in Project Engineering and Management (Civil).

Coreq U4.202 Thesis 1
Classes Sem 2:52hrs of study
Assessment submitted typed thesis and oral presentation

Syllabus summary: Additional study of the topic selected for U4.202 Thesis 1.

U4.205 Practical Experience 4 units

Senior Advanced core course for the degree in Civil Engineering and in Project Engineering and Management (Civil).

Prereq 28 units of Senior courses
Classes 12wks practical work experience (375hrs minimum)
Assessment a written report

Syllabus summary: Each student is required to work as an employee of an approved engineering organisation and to submit a satisfactory written report of his or her work. Normally 12 weeks of practical work experience (375 hours minimum) is required and this is undertaken after the completion of some or all of the prescribed Senior core courses and before enrolment in the final year of study. The University Careers and Appointments Service is available to assist students to obtain suitable employment.

Reference book
Eagleson *Writing in Plain English* (Aust. Govt Publishing Service)

U4.214 Materials Aspects in Design 4 units

Senior Advanced core course for the degree in Civil Engineering.

Mutually exclusive with U4.212 Materials 3
Prereq U3.212 Properties and Materials
Classes 40hrs lec, 12hrs lab
Assessment one 3hr exam covering the whole syllabus

Course objectives: To relate the mechanical properties of metals and cement-based materials to the design of structures made from these materials.

Course outcomes: Ability to predict the influence of material properties upon the response of the structure under service conditions.

Syllabus summary: Fracture aspects in the design and use of concrete and reinforced concrete structures. Fracture, fatigue, fire and corrosion aspects in the design and use of metal structures. Durability and serviceability aspects in the design and use of concrete and reinforced concrete structures. Two laboratory sessions on failure modes of RC beams, one laboratory session on electron microscopy, one field trip.

Text and reference books
As for U3.212 Properties of Materials

U4.223 Finite Element Methods 4 units

Senior Advanced core course for the degree in Civil Engineering.

Prereq U3.222 Structural Analysis
Classes Sem: 26hrs lec & 26hrs tut
Assessment classwork, assignments and one 3hr exam

Syllabus summary: Introduction to finite elements, analysis of bars, beams and assemblages. Analysis of elastic continua, in plane stresses in plates, plane strain problems, plate bending. Elastic settlement analysis. Finite element analysis of vibrations and stability, use and testing of finite element packages.

Textbooks
As prescribed during the course

Reference books
Zienkiewicz *The Finite Element Method* 3rd edn (McGraw-Hill, 1977)
BatheandWHsonNumericalMethodsinFiniteElement Analysis (Prentice Hall, 1976)

Cook *Concepts and Applications of Finite Element Analysis* (John Wiley, 1974)
Library classification: 624.176, 624.02,624.171

U4.232 Bridge Engineering 4 units

Senior Advanced elective course for the degree in Civil Engineering.

Coreq U4.222 Structural Analysis 2 and U4.231 Structural Behaviour 2
Classes 26hrs lec & 26hrs tut
Assessmentbased on submitted work, seminar presentations and one 3hr exam

Syllabus summary: Highway and railway bridge loading; influence lines; analysis; traverse load distribution; computer modelling of bridges; effects of movements due to temperature. Elastic shortening and concrete creep and shrinkage; bridge bearings; selection of structural forms; standardised bridge systems,skew and curvedbridges, bridge foundations; construction methods; case studies of significant bridges.

Reference books
NAASRA *Bridge Design Specification*
Australian and New Zealand Railway Conferences *Railway Bridge Design Manual*
Library classification: 624.2-8

U4.236 Concrete Structures 2 4 units

Senior Advanced elective course for the degree in Civil Engineering.

Mutually exclusive with U5.233 Concrete Structures Honours
Prereq U3.232 Concrete Structures 1
Classes 28hrs lec, 28hrs tut
Assessment one 3hr exam plus assessment of selected assignments

Course objectives: To develop a depthinunderstanding of the fundamental behaviour and design of concrete and composite members and structures.

Expected outcomes: The development of design skills that will lead to reliable and economical designs of both practical and more complex structures.

Syllabus summary: Practical aspects of reinforced concrete, prestressed concrete and composite steel-concrete members and structures—non-linear behaviour, load-moment-curvature relationships, strength of beams, columns and beam columns, moment redistribution, ultimate strength of concrete slabs, yield line analysis of slabs, strip equilibrium analysis of slabs, the analysis of time-dependent effects in concrete structures, models of concrete creep and shrinkage, design of composite T-beams, design of composite slabs incorporating profiled steel sheeting, design of composite columns.

Textbooks
Warner *et al. Reinforced Concrete* (Pitman)
Warner and Faulkes *Prestressed Concrete* (Longman Cheshire)
Standards Australia Specifications—current editions
AS2327 Part 1 *Composite Structures Code*
AS1170 Parts 1 and 2 *Loading Code,* and
AS3600 *Concrete Structures Code,* or
AS HB2.2 *Structural Engineering Standards*
Reference books
Lin and Burns *Design ofPrestressed Concrete Structures* (Wiley)
Park and Gamble *Reinforced Concrete Slabs* (Wiley)
Other books as indicated in classes
Library classification: 624.17,624.183

U4.237 Structural Dynamics 4 units

Senior Advanced elective course for the degree in Civil Engineering.

Prereq U3.222 Structural Analysis
Mutually exclusive with U5.234 Structural Dynamics Honours
Classes 26hrs lec, 26 hrs tut
Assessment one 2hr exam and assignments

Course objectives: To provide an understanding of the dynamic behaviour of structural systems arid wind loads on structures.

Expected outcomes: To be able to determine the natural frequency of simple structural systems manually and complex systems using computer analyses; to be able to perform analyses for the effects of forced vibration and structural damping; to be able to perform wind analyses on low and high rise structures.

Syllabus summary: Introductory structural dynamics, natural frequency, free and forced vibration, structural damping, single and multi-degree of freedom systems, finite element dynamic analysis, consistent mass matrix, damping matrix, free vibration, forced vibration, wind loading on structures.

Reference book
Thomson *Theory of Vibrations with Applications* (Allen & Unwin, 1981)
Library Classification: 624.171,624.176 (Fisher Library)

U4.238 Steel Structures 2 4 units

Senior Advanced elective course for the degree in Civil Engineering.

Mutually exclusive with U5.224 Steel Structures Honours
Prereq U3.235 Steel Structures 1
Classes 28hrs lec, 28hrs tut
Assessment one 3hr exam at end of the semester plus assessment of assignment work

Course objectives: To develop a working knowledge of the behaviour and design of steel structures beyond a basic competency.

Expected outcomes: Proficiency in the design of steel structures.

Syllabus summary: Three of the 4 subjects will be available: (1) Bending and torsion in steel structures—behaviour, analysis and design; (2) Local buckling behaviour and design; (3) Flexural-torsional buckling—behaviour and design of beams; (4) Shell structures—behaviour and membrane analysis.

Textbooks
Trahair and Bradford *Behaviour and Design of Steel Structures* (Chapman & Hall, 1991)
Trahair *Flexural-Torsional Buckling of Structures* (Spon, 1993)
Standards Australia AS4100—*Steel Structures* (1990)
Gibson *Thin Shells* (Pergamon, 1980)
Vinson *The Behaviour of Plates and Shells* (Wiley, 1974)

Reference books
Bulson *Stability of Flat Plates* (Chatto & Windus, 1970)

Hancock *Design of Cold-Formed Structures* (AISC, 1994)
Kraus *Thin Elastic Shells* (Wiley, 1967)
Calladine *Theory of Shell Structures* (CUP, 1983)
Other, books as indicated during classes
Library classifications: 624.17, 624.182

U4.246 Environmental Geotechnics 4 units

Senior Advanced elective course for the degree in Civil Engineering.

Mutually exclusive with U4.242 Geotechnical Engineering
Prereq U3.244 Soil Mechanics A, U3.245 Soil Mechanics B
Classes 52hrs lec / tut
Assessment tut and assignment submissions, as indicated at the commencement of the course

Course objectives: To develop understanding of the goetechnical aspects of the design and management of industrial and domestic waste disposal systems.

Expected outcomes: Students should gain an understanding of: the role of geotechnics in the design of waste managementsystems;currentdesignmethods and technologies. In particular, they should be able to predict likely interactions between waste and soil, and pollutant movement in the ground, and should be able to evaluate strategies for the containment of industrial and domestic wastes and mine tailings.

Syllabus summary: Landfill design, including clay mineralogy, effects of chemicals on soil permeability, flow rates through membranes, effect of punctures, composite liners, mechanisms of mass transport, diffusion, dispersion, advective transport, sorption, predicting transport time, solutions to advection-dispersion equation, design of liners, stability of clay liners on slopes, design of covers, infiltration rates. Tailings disposal, including types of tailings dams, design of dams, water balances, rehabilitation.

Reference books
To be advised
Library classification: 624.15, 624.16

U4.247 Foundation Engineering 4 units

Senior Advanced elective course for the degree in Civil Engineering.

Mutually exclusive with U4.242 Geotechnical Engineering
Prereq U3.244 Soil Mechanics A, U3.245 Soil Mechanics B
Classes 52hrs lec/tut
Assessment one 3hr exam covering the whole syllabus at the end of semester. Credit will be given for tutorial and assignment submissions, as indicated at the commencement of the course

Course objectives: To develop understanding of: current methods used in the investigation and design of foundations on soils and rocks; the limitations of these methods.

Expected outcomes: Students should gain an understanding of: the design process in foundation engineering; the role of site investigation and field testing; the need to deal with uncertainty. In particular, they should develop the ability to: interpret the results of a site investigation; use soils data to design simple foundations; and develop an appreciation of the interaction between soils, the foundation system and the supported structure.

Syllabus summary: Site investigation and field measurements. Stress-strain behaviour of soils. Behaviour, selection and design of shallow foundations. Strip and raft foundations. Pile foundation analysis and design. Foundations on rock.

Reference books
Tomlinson *Foundation Design and Construction* (Pitman)
Peck *et al. Foundation Engineering* (Wiley)
Poulos and Davis *Pile Foundation Analysis and Design* (Wiley)
Fleming *et al. Piling Engineering* (Halstead Press)
Das *Principles of Foundation Engineering* (PWS—Kent)
Library classification: 624.15, 624.16

U4.251 Surveying 2 4 units

Senior Advanced elective course for the degree in Civil Engineering.

Mutually exclusive with U4.250 Surveying
Prereq U3.250 Surveying 1
Classes 32hrs lec, 20hrs fieldwork and tut
Assessment fieldwork, reports, tutorials, and one 3hr exam at the end of the course

Course objectives: To introduce students to precise measurement technologies, processes, computational procedures, and interpretive skills; to give students a high level of understanding of automated electronic measuring systems; to introduce students to data handling, manipulation, and presentation at a project level.

Expected outcomes: Students should gainthe ability to: undertake precise measurement procedures for determining position, extent and stability of points and structures; use advanced electronic measurement equipment; handle and manipulate data in electronic form; analyse data and determine the magnitude of errors.

Syllabus summary: CAD and database applications, horizontal and vertical curves, electronic distance measurements, precise angle measurement, high precision engineering surveys, geodetic surveying, global positioning systems, geographic information systems, photogrammetry.

Textbooks
Fryer and Elfick *Elementary Surveying* 7th edn (Harper & Row)
or
Uren and Price *Surveying for Engineers* 2nd edn (Macmillian)
Library classification: 526.9

U4.253 Civil Engineering Camp 4 units

Senior Advanced core course for the degree in Civil Engineering.

Prereq U3.250 Surveying 1
Classes the civil engineering camp is carried out over a 10-day period at a nominated location off-campus
Assess7nent no formal exam; assessment is based on field work activities, oral presentations and reports which are submitted during the camp period

Course objectives: To give students experience at gathering dimensional information and using that informationin design considerations; to give students experience in project design in a practical situation; to

give students the opportunity to experience project managementina practical situation; to develop student skills in working as a group member on an engineering project team; to develop oral and written presentation skills.

Expected outcomes: Students should develop an understanding of: dimensional control in a project situation; total project management considerations; real world designproblems; project presentation skills; group relationships; time management skills.

Syllabus summary: The activities involve work directed towards an integrated civil engineering project. A number of survey tasks are carried out to provide the necessary design information. At the camp, each group will be given responsibility for one component of an overall project. Oral presentation and design submissions form an integral part of the camp activities.

U4.260 Environmental Fluids 1 4 units

Senior Advanced elective course for the degree in Civil Engineering.

Mutually exclusive with U2.260 Engineering Hydrology
Classes 26hrs lec, 26hrs tut
Assessment one 3hr exam covering the whole syllabus at the end of the semester. Satisfactory performance in tutorials is also a requirement. Credit will be given for tutorial submissions, as indicated at the beginning of the course

Course objectives: To develop an understanding of: basic meteorological principles; the principles of hydrology; the importance of flood routing; the principles of flood mitigation; irrigation requirements; evaporation and reservoir design.

Expected outcomes: Students will be able to: list the key factors which affect the climate of Australia; describe intensity-frequency-duration curves and explain their use; calculate design rainfall intensities; calculate peak flows from catchments; determine runoff hydrographs for various storm durations and intensities; state the principles of flood routing and perform flood routing calculations; assess surface runoff and infiltration in catchments; list and utilise design procedures for storage and service reservoirs; calculate reservoir safe yield; determine evaporation from reservoirs and evapo-transpiration from catchments.

Syllabus summary: Elements of meteorology; precipitation measurement and analysis; design rainfall intensities; hydrographs; peak discharge calculations; evaporationand transpiration; infiltration and groundwater; surface runoff; flood routing.

Textbook
Australian Rainfall and Runoff (I.E. Aust, 1987)

Reference books
Raudkivi *Hydrology* (Pergamon)
Raudkivi and Callander *Analysis of Groundwater Flow* (Edward Arnold)
Library classification: 551.48

U4.265 Environmental Fluids 2 4 units

Senior Advanced elective course for the degree in Civil Engineering.

Mutually exclusive with U4.263 Fluids Engineering
Classes 26hrs lec, 26hrs tut
Assessment one 3hr exam covering the whole syllabus at the end of the semester. Satisfactory performance in class assignments is also a requirement. Sredit will be given for assignment submissions, as indicated at the beginning of the course

Course objectives: To develop an understanding of: ocean wave generation, transmission and coastal effects; the principles of sediment transport; breakwater design, fluid-structure interaction; flood detention basins and advanced flood routing techniques.

Expected outcomes: Students will be able to: list and describe the major parameters affecting ocean wave generation; describe the processes of ocean wave transmission; calculate energy transfer by waves; describe the behaviour of waves in shallow water; explain the fundamental principles of sediment transport; describe sediment transport processes in rivers; describe coastal sediment transport processes; explain basic performance requirements for breakwaters, and factors considered in their design; describe several fluid structures, together with associated fluid-structure interaction, including, but not limited to, spillways, stilling basins, bridge piers, water supply intakes; describe design considerations for flood detention basins; explain the principles of river routing and discuss the applications of flood modelling techniques and programs.

Syllabus summary: Coastal processes. Sediment transport. Breakwater design. Fluid structure interaction. Flood effects.

Reference books
To be advised during the course
Library classification: 627.58, 551.36

U4.266 Water Resources Engineering 4 units

Senior Advanced elective course for the degree in Civil Engineering.

Classes Sem: 26hrs lec, 26hrs tut
Assessment one 3hr exam covering the whole syllabus at the end of the semester. Satisfactory performance in class assignments is also a requirement. Credit will be given for assignment submissions, as indicated at the beginning of the course

Course objectives: To develop an understanding of: the assessment methods for water quality; physical, biological and chemical treatment methods; water storage and distribution systems; management principles for water resources, including water re-use; irrigation techniques and demands; hydro-power systems.

Expected outcomes: Students will be able to: state the requirements of water quality for various purposes; detail the physical methods of water treatment; detail the biological methods used in water treatment; detail the chemical methods used in water treatment; design multi-node water distribution networks; explain the design principles of water Supply for high-rise

buildings; describe water conservation methods and management principles for water use, including storm water detention and treatment; explain 'grey water' re-use techniques and their applications; describe various irrigation methods and associated hydraulic design; design small-scale hydro-power installations.

Syllabus summary:. Water quality; water purification methods; water reticulation, water resource management; irrigation and hydro-power.

Reference books
As indicated during classes
Library classification: 628.1

U4.273 Engineering Management 4 units

Senior Advanced core course for the degree in Civil Engineering.

Classes 26hrs lec, 26hrs tut
Assessment one 3hr written examination at the end of the semester, covering the whole syllabus; a major project assignment covering the project planning and documentation segment; class test during the semester and credit which may be given for any coursework as •advised at the commencement of the course

Course objectives: To develop an understanding of conceptualisation and management of engineering and construction projects including: economic modelling, appraisal and optimisation; economic analysis of public sector projects; project sensitivity and risk analysis and risk management techniques; value engineering; work study and related techniques; planning, scheduling and cost engineering of project; project documentation design and presentation.

Expected outcomes: Students should develop an understanding of the fundamentals of project conceptualisation, appraisal, planning and optimisation plus ability to: model and analyse basic economic problems in engineering and construction projects including formulation of objective criteria; analyse, interpret and present the results; quantitatively evaluate field productivity and method study, aspects of team management and design and presentation of professional documentation.

Syllabus summary: Introduction to project conceptualisation and development; stages in project life cycle; techniques of project appraisal including comparison of alternatives, valuation, depreciation and capitalisation method; sensitivity and risk analysis and management of risks; value engineering; work study and related concepts and techniques; pre- and post-tender planning, cost engineering, critical path method of scheduling; resource levelling and associated project management techniques.

Textbook
Organisation and Management ofConstruction (School of Civil and Mining Engineering, University of Sydney)

Reference books
Grant, Ireson and Leavenworth *Principles of Engineering Economy* (J. Wiley & Sons)
Thompson *Organisation and Economics of Construction* (McGraw-Hill) '
Turner *Handbook of Project-based Management* (McGraw-Hill)
Library classification: 624.068,658.01518,692.5-8

U4.274 Project Procedures 4 units

Senior Advanced elective course for the degree in Civil Engineering.

Classes 26hrs lec & 26hrs tut
Assessment based on submitted work and one 3hr exam

Syllabus summary:
(a) Cost engineering and estimating—Elemental estimating for cost planning and value engineering, work measurement and bills of quantities; computer aided estimating; cost monitoring of construction projects; tender preparation and documentation.
(b) Industrial legislation and awards.
(c) Contract law and documentation.

Library Classification: 692.5

U4.276 Professional Practice 4 units

Senior Advanced core course for the degree in Civil Engineering.

Classes 26hrs lec, 26hrs tut
Assessment project and assignment work including an oral presentation

Course objectives: To provide final year students with an appreciation of professional matters which will influence the way they will work as professional engineers.

Expected outcomes: Knowledge of occupational health and safety act; knowledge of procedures for quality assurance both in design and construction; understanding of industrial relations issues; understanding of basic civil engineering contracts; awareness of social responsibility of engineers; understanding of the importance and means of preparation of environmental impact statements; awareness of ethical issues related to the engineering profession.

Syllabus summary: The lectures will be delivered by practising engineers and other experts in the following subject areas: (a) Socialresponsibility in engineering, social and environmental issues and ethics of engineering practice; (b) Industrial relations, legal contracts and law; (c) Occupational health and safety, and quality assurance.

Reference material
As advised during course and
Tagg *et al. Civil Engineering Procedure* (Thomas Telford)
Wearne *Civil Engineering Contracts* (Thomas Telford)
Library classification: 331,343, 346,347

U4.292 Civil Engineering Design 4 units

Senior Advanced core course for the degree in Civil Engineering.

Prereq U3.291 Structural Design 2, U3.211 Materials 2, U3.221 Structural Analysis 1 and U3.230 Structural Behaviour
Classes 13hrs lec & 39hrs of drawing office work
Assessment no formal exam; assessment will be based on submissions

Syllabus summary: The design sequence including definition, value and criteria selection; generation of proposals; analysis of proposals; selection of design; development of details of a particular design selected.

Feasibility studies and examination of existingworks. Study of design projects by stages, including details of some aspects.

The course is under the direction of engineers in professional practice in cooperation with members of the academic staff. Lectures on specific aspects of design are supplemented by visits to construction, testing and manufacturing sites. Lectures and exercises on architectural design and practice and their relationship to civil engineering are included in the course.

Reference books

The course is of a wide-ranging nature, and all text and reference books previous and current courses have relevance. In addition, reference will be made to many codes and guides to practice, of which the following list covers only the-structural field:

Current SAA Codes, Manuals and Specifications, particularly
AS4100—*Steel Structures Code*
AS3600—*Concrete Structures Code*
AS1554—*Manual Welding, Part I*
AS1170—*Loading Code, Parts I and 11*
AS1511—*High Strength Structural Bolting Code*
MAI Steel Structures
NAA.S.RA. *Bridge Design Specification*
AS1720—*Timber Engineering Code*
(Purchase of separate codes is recommended)
Library classification: 624.15,624.177,624.18,624.25,625.72, 627.2, 627.3, 627.8

U4.293 Project Formulation 4 units

Senior Advanced elective course for the degree in Civil Engineering.

Coreq U4.292 Civil Engineering Design, U4.273 Engineering Management
Classes 13hrs lec & 39hrs drawing office work
Assessment no formal exam; assessment will be based on submitted work and oral presentation

Syllabus summary: This course will integrate the technical, commercial and managerial aspects of the civil engineering project.

Students will be cast in the role of entrepreneurs faced with the exploitation of a civil engineering business opportunity. They will assess the technical and financial feasibility of the project and appropriate legal and managerial arrangements and corporate structure for the enterprise.

Engineering design of the project will be carried to the point where it can be shown that the concept is technically sound.

The course will culminate with the presentation of a project to a board of review.

U4.419 Thermal Engineering 4 units

Senior Advanced elective course.

Prereq U3.420 Thermo-fluid Engineering
Classes Yr: 2hrs/wk
Assessment tut work, projects and three 2hr exams

Course objectives: To develop a good understanding of the principles of construction and air conditioning with special emphasis on a range of engineering applications.

Expected outcomes: Students should be able to (i) perform analyses of simple reacting systems and predict temperatures and species concentrations, and (ii) perform a complete design of air conditioning systems including thermal load calculations, ducting, control and equipment selection.

Syllabus summary: The course will comprise two or three of the following components dependent on the availability of lecturers from year to year:

Engineering Heat Transfer—Convective heat and mass transfer in laminar and turbulent flow. Analogies between heat, mass and momentum transfer. Phase change: boiling, condensation, melting. Radiation heat transfer. Computational methods.

Air conditioning technology—Heat load estimation, applied psychometrics, air handling equipment, refrigeration equipment, systems, control, energy conservation and management in buildings.

Power technology—Gas turbine cycles, performance, economic considerations. Steam power plant technology—cycles, turbo alternators, boilers, economic considerations.

Combustion engineering—Mass and energy balances, equilibrium, partial equilibrium and non-equilibrium products, simple reactor theory, chemical kinetics, premixed and diffusion flames, heterogeneous combustion, pollutant formation, combustion systems.

Reference books

S.R. Turns *An Introduction to Combustion* (McGraw-Hill, 1996)

U4.421 Fluids Engineering 4 units

Senior Advanced elective course.

Prereq U3.420 Thermo-fluid Engineering
Classes Yr: (2hrs lec & tut) / wk
Assessment tut work, projects and one 2hr exam at end of each sem

Syllabus summary: The course will comprise one or more of the following components dependent on the availability of lecturers from year to year.

Computational fluid dynamics—Conservation equations of fluid flow; boundary conditions, classification of flow problems. Numerical solution schemes based on pressure correction; the SIMPLE algorithm and its variants, convection schemes. Solution of the resulting algebraic equations. Turbulence modelling; implementation of boundary conditions in turbulent flow. Coupled heat transfer: convection, combustion, radiation heat transfer. Multiphase flow. Introductions to compressible flow, the physical significance of hyperbolic equations; characteristic based methods; FCT and TVD schemes. Pitfalls to avoid in CFD.

Fans and pumps—The design of incompressible fluid machines; specific speed; cavitation; mechanical construction.

Industrial aerodynamics—Practical flow categories; building aerodynamics; wind characteristics; wind loading; Australian wind code and design; vehicle aerodynamics; drag and stability; wind tunnel testing.

Reference books
Computational fluid dynamics and heat transfer
Fletcher *Computational Techniques for Fluid Dynamics, vols I and* 2 (Springer, 1988)
Patankar *NumericalHeat Transfer and Fluid Flow* (Hemisphere, 1983)

Fans and pumps—as advised during classes
Industrial aerodynamics
Aynsley, Melbourne and Vickery *Architectural Aerodynamics* (Applied Science Publishers, 1977)
Hucho (ed.) *Vehicle Aerodynamics* (Butterworths, 1987)

U4.422 Computational Methods for Partial Differential Equations 4 units

Senior Advanced elective course.

Prereq U2.000 Mathematics 2
Classes Sem: 2 lec/wk with associated tut and prac sessions
Assessment assignments

Course objectives: To give students practise in writing programs to solve linear PDEs. To provide sufficient theory so they understand why their programs (or commercial software) sometimes may not give the 'right' answerr

Expected Outcomes: Students will be able to set up and solve the common PDEs arising in Mechanical Engineering, using several of the following methods: finite differences, finite elements, boundary elements, finite volumes, weighted residuals. Students will appreciate the commonalities linking the equations in different fields, and linking the various solution methods'.

Syllabus summary: Finite difference techniques for elliptic, parabolic and hyperbolic partial differential equations. Method of weighted residuals (Galerkin, least-squares>, etc.). The use of the finite element, boundary element and finite difference methods in the effective computer solution of engineering problems in fluid dynamics, heat transfer and other areas.

Reference books
Press *et al. Numerical Recipes* (Cambridge, 1986)
Zienkiewicz and Morgan *Finite Elements and Approximations* (Wiley, 1983)
Library Classification: 515.35,532.05,620.0042

U4.430 Applied Numerical Stress Analysis 6 units

Senior Advanced elective course.

Mutually exclusive with U4.730 Aircraft Structures 3
Prereq U3.430 Mechanics and Properties of Solids 2
Classes Sem 1:2 lec/wk plus prac classes
Assessment one 2hr exam at end of course, class work is assessed

Syllabus summary: The finite element method. Philosophy. Matrix algebra. Matrix analysis of structures. Generalisation of the finite element method in elasticity for static, dynamic and thermal analysis. Rod elements. Beams. Triangular elements for plane stress. Natural coordinate systems. Introduction to plate and shell[5] theory. Theories and analysis in structural stability. Three dimensional elements. Modelling strategies. Isoparametric elements, accuracy arid convergence. Applications of finite element modelling in solid mechanics. Practical modelling of real structures will be done; a 'hands-on' approach will be taken.

Reference book
Cook *Concepts and Applications of Finite Element Analysis* (Wiley, 1989)

U4.433 Advanced Engineering Materials 6 units

Senior Advanced elective course.

Mutually exclusive with U4.434 Aerospace Materials Engineering
Prereq U3.430 Mechanics and Properties of Solids 2 or U3.431 Mechanical Properties of Materials
Classes Sem 2: (3 lec & 3 tut & lab)/wk
Assessment one 2hr exam at the end of Sem 2, one project report, assignments and lab reports as specified at the commencement of the semester

Course objectives: To understand (a) how to conduct failure diagnosis of engineering structures, (b) how to define the relationship between properties and microstructures of advanced engineering materials, and (b) how to improve mechanical design with the knowledge of mechanics and properties of materials.

Expected outcomes: Students should gain the capabilities: (a) to conduct failure diagnosis of simplified failure cases of engineering structures, (b) to define structure-property relationships of advanced engineering materials, and (c) to improve the performance of engineering structures through tailoring materials microstructure and manufacturing processes.

Syllabus summary: Postyield fracture mechanics, embrittlement, creep rupture, damage tolerance, structure integrity and reliability, thin film science and technology, advanced polymer matrix composites, toughening mechanisms, processing and manufacturing, superalloys, advanced joining methods.

Textbooks
Lecture notes

Reference books
Ashby *Materials Selection in Mechanical Design* (Pergamon, 1993)
Atkins and Mai *Elastic and Plastic Fracture* (Ellis Horwood, 1985)
Broek *Elementary Fracture Mechanics* 3rd edn (Martinus Nijhoff, 1982)
Chawala *Composite Materials* (Springer-Verlag, 1987)
Crawford *Plastic Engineering* 2nd edn (Maxwell-Macmillan, 1987)
Davidge *Mechanical Behaviour of Ceramics* (C.U.P., 1979)
Eckold *Design and Manufacture of Composite Structures* (McGraw-Hill, 1994)
Gibson *Principles of Composite Material Mechanics* (McGraw-Hill, 1994)
Harris *Engineering Composite Materials* (Institute of Metals, 1986)
Jones *Engineering Materials 3—Materials Failure Analysis* (Pergamon, 1993)
Richerson *Modem Ceramic Engineering* (M. Dekker, 1982)
Library classification: 620, 624, 666-679

U4.434 Aerospace Materials Engineering 4 units

Senior Advanced elective course for the degree in Aeronautical and Mechanical Engineering.

Mutually exclusive with U4.433 Aerospace Materials Engineering
Prereq U3.430 Mechanics and Properties of Solids 2 or U3.431 Mechanical Properties of Materials
Classes Sem 2: 3 lec & 3 tut & lab)/wk
Assessmen tone 2hr exam at the end of Sem 2 plus assignments and lab reports as specified at the commencement of the semester

Course objectives: To understand (a) how to conduct failure diagnosis of engineering structures, (b) how to define the relationship between properties and microstructures of advanced engineering materials, and (b) how to improve mechanical design with the knowledge of mechanics and properties of materials.

Expected outcomes: Student should gain the capabilities: (a) to conduct failure diagnosis of simplified failure cases of engineering structures, (b) to improve the performance of engineering structures through tailoring materials microstructure and manufacturing processes.

Syllabus summary: Postyield fracture mechanics, embrittlement, creep rupture, damage tolerance, structure integrity and reliability, thin film science and technology, advanced polymer matrix composites, toughening mechanisms, processing and manufacturing, superalloys, advanced joining methods.

Textbooks
Lecture notes

Reference books
Ashyby *Materials Selection in Mechanical Design* (Pergamon, 1993)
Atkins and Mai *Elastic and Plastic Fracture* (Ellis Horwood, 1985)
Broek *Elementary Fracture Mechanics* 3rd edn (Martinus Nijhoff, 1982)
Chawala *Composite Materials* (Springer-Verlag, 1987)
Crawford *Plastic Engineering 2nd* edn (Maxwell-Macmillan, 1987)
Davidge *Mechanical Behaviour of Ceramics* (C.U.P., 1979)
Eckold *Design and Manufacture of Composite Structures* (McGraw-Hill, 1994)
GibsonPrinciples of Composite Materials Mechanics (McGraw-Hill, 1994)
Harris *Engineering Composite Materials* (Institute of Metals, 1986)
Jones *Engineering Materials 3—Materials Failure Analysis* (Pergamon, 1993)
Richerson *Modern Ceramic Engineering* (M Dekker, 1982)
Library classification: 620, 624, 666-679

U4.438 Biomaterials and Biomechanics 4 units

Senior Advanced elective course for the degree in Mechanical Engineering.

Prereq any Intermediate Year Materials course or Physics. U3.450 System Dynamics and Control, or U3.750 Mechanics of Hight 1 or U3.530 Control 1 or U3.660 Process Control 1
Classes (4hrs lec/tut/lab)/wk
Assessment continual assessment and exam at end of Sem

Course Objectives: To gain a basic understanding of the major areas of interest in both the biomaterials and biomechanics fields, learn to apply basic engineering principles to biomedical systems, and understand the challenges and difficulties of bimedical systems.

Desired Outcomes: Students should be able to:
- Apply static and dynamic mechanical analyses to the human body to describe motion.
- Understand the mechanical behaviour of biological tissues and the types of models used to describe this behaviour.
- Understand all the factors involved in the selection of a biomaterial for tissue replacement, including mechanical, biocompatibility, material property and fixation factors.
- Improve their writtenand oral communication skills in a technical setting.

The students should gain a basic understanding of the major areas of current research in both the biomaterials and biomechanics fields, learn to apply basic engineering principles to biomedical systems, and understand the challenges and difficulties of biomedical systems.

Syllabus summary: Introduction to biomaterials, characteristics of materials, including mechanical testing and advanced analysis techniques, metallic, polymeric, ceramic, composite implant materials and their properties; structure/property relationships to biological materials and the study of 'biomimetics' (mimicry of biological materials), tissue response to implants, soft tissue replacement, hard tissue replacement and laboratory testing of biomaterials and biological materials.

Introduction to biomechanics, modelling the human body from the macroscopic level to the microscopic level, soft tissue mechanics—non-linear and viscoelastic descriptions, muscle mechanics, joint mechanics, kinematics and dynamics of human gait (gait analysis), biomechanics of cells, physiological fluid flow, biomechanics of injury, functional and mechanical response of tissues to mechanical loading.

Reference books
J.B. Park and R.S. Lakes *Biomaterials An Introduction* (Plenum Press, 1992)
J. Black *Orthopaedic biomaterials in research and practice* (Churchill Livingstone, 1988)
Y.-C. Fung *Biomechanics of Living Tissues* (Springer-Verlag)

U4.440 Advanced Design 6 units

Senior Advanced elective course for the degree in Mechanical and Mechatronic Engineering.

Prereq U3.440 Mechanical Design 2
Classes Yr: 3hrs/wk
Assessment assessment is based upon one major design project and several minor design tasks, complemented by one-on-one discussions during the year with each student in relation to these design activities

Course objectives: To develop a fuller understanding of and familiarity with the practical design processes expected in industry, including application of the knowledge obtained from other courses studied.

Expected outcomes: Students should be able to undertake with a measure of confidence basic design tasks likely to be encountered in early industrial employment, and should have an appreciation of and some familiarity with the many aspects associated with such an activity.

Syllabus summary: The course draws together the various subjects studied and introduces the student to the practical aspects of design in the commercial environment, with the encouragement of direct industry contacts. As well as design for function and mechanical and structural integrity, consideration is given to manufacturing possibilities, to economic, environmental and human aspects, and to professional responsibility and liability.

U4.441 Orthopaedic Engineering 4 units

Senior Advanced: elective course for the degree in Mechanical Engineering.

Prereq 36 units of Senior year subjects
Classes Sem 1: 4hrs tut/lab classes/wk
Assessment one 2hr;exam at the end of Sem 1

Course objectives: To introduce students to a number of applications of mechanics and system theory in machinery and instrumentation. To develop an understanding of dynamics analysis techniques and dynamics of common machinery.

*Expected outcomes:*Students will be able to measure machine vibration and diagnose its likely cause. They will understand the rationale of vibration condition monitoring and know how it is carried out. They will be able to analyse and design machinery involving planar and spatial mechanisms. They will understand and be able to use techniques of signal analysis in the frequency and time domains.

Syllabus summary: Musculoskeletal anatomy, physiology and function, including basic medical terminology, anatomy and physiology, normal and abnormal joints, bones, cartilage, ligaments and tendons. Introduction to orthopaedic injuries, including fractures, bone healing, fracture fixation, electrical stimulation of bone healing. Overview of the design, manufacture and use of artificial ligaments, hip, knee and shoulder joint prosthesis, bone cement, finite element modelling of prostheses, material considerations, testing of orthopaedic implants, failure of implants.

Library classification: 620.1, 620.101, 620.3, 620.7

U4.451 Dynamics and Systems Engineering 6 units

Senior Advanced elective course for the degree in Mechanical and Mechatronic Engineering.

Mutually exclusive with U4.452 Systems Engineering
Prereq U3.450 System Dynamics and Control and either U3.500 Industrial Electronics or U2.504 Electrical and Electronic Engineering
Classes Sem: 6hr/wk including associated prac sessions
Assessment one 3hr exam or two 2hr exams plus assignments

Syllabus summary: Review of dynamics, including modal analysis of lumped and continuous systems, aspects of applied problems, especially the dynamics of rotating machinery, the measurement of vibration and condition monitoring of machines. Some aspects of random vibrations, including measurement and prediction of failure.

Review of the analysis and dynamics of mechanisms. Dynamics of cams, gears and gear trains. Analytical mechanics. Spatial mechanisms and robotics. Rotor dynamics.

System modelling. Review of single-loop control system behaviour and root-locus design methods. State-variable approach to linear systems' behaviour; multiloop systems. Design methods for analogue systems. Simulation. Sample-data systems and discrete-time modelling. Z-transform. Digital implementation; direct digital control. Discussion of optimal control.

Reference books
Franklin, Powell and Emami-Naeini *Feedback Control of Dynamic Systems* (Addison-Wesley, 1986)
Friedland *Control Systems Design* (McGraw-Hill, 1987)

U4.455 Microprocessor Control of Machinery 6 units

Senior Advanced elective course for the degree in Mechanical Engineering.

Mutually exclusive with U3.476 Industrial Electronics A
Prereq U3.500 Industrial Electronics or U2.504 Electrical and Electronic Engineering
Classes Sem 1: (2 lec & 3hrs lab work)/wk
Assessment one 2hr exam at end of Sem 1; plus assignment and project work

Syllabus summary: An overview of some topics central to industrial automation, with emphasis on the use of single-board computers for embedded control of machinery and other products.

Sensors: inductive proximity sensors; optoelectronics and optical proximity sensors, optical encoders; synchro resolver; LVDT; tachogenerator; sensors for pressure and temperature measurement, including monolithic devices.

Actuators: overview of industrial pneumatics and hydraulics; review of some types of electric motors and their drives.

Basic interface electronics, and special-purpose interface ICs.

Design of a standard 8-bit microprocessor system will be discussed in detail: CPU; ROM and RAM, and address decoding; I/Ointerface chips;interrupts. The Zilog Z80 family will be used as an example system. Assembly language programming; problem definition, program design, project documentation; development systems; man-machine and machine-machine communication.

The course will involve considerable laboratory work, including a major project. The project will entail some assembly language programming, together with the design and bread boarding of simple interface circuitry to allow a single board computer to control external mechanical hardware.

Reference books
An extensive list of references will be distributed in class

U4.456 Sensors and Signals 6 units

Senior Advanced elective course.

Prereq U3.450 System Dynamics and Control and U3.476 Industrial Electronics
Classes Sem 1: (3hrs lec, 1hr tut & 2hrs lab)/wk
Assessment exam, assignments and laboratory work

Syllabus summary: This course comprises three equal parts: Devices, Signals and Systems. Devices deals with sensors and the interfacing of sensors to computers and machines. Signals deals with the modeling, conditioning and analysis of sensor signals. Systems deals with the use of sensor signals in control and systems design, withreference to key mechatronics applications:

(a) Devices
Process and machine instrumentation: sensor types (temperature, pressure, force, proximity) and properties; interfacing considerations, hardware and applications.

Automotive, aerospace and robotic sensors: sensor types (accelerometers, gyroscopes, lasers, ultrasonics, radar) and measurement principles; interfacing considerations, hardware and applications.

One 6-hour laboratory on sensor interfacing example.

(b) Signals
Introduction to signals and noise as stochastic processes; signal characterisation, signal conditioning. Signal analysis in the time domain; signal analysis in the frequency domain; modeling and processing of signals; introduction to estimation theory.

Two 2-hour computer laboratories; signal characterisation and signal modeling.

(c) Systems
Signal processing systems, hardware and software; special purpose and digital signal processing hardware; introduction to data fusion theory. Condition monitoring; reliability and fault detection. Example applications; process monitoring and automotive systems.

One 10-hour computer laboratory on system design.

U4.457 Computational Fluid Dynamics 4 units

Senior Advanced elective course.

Prereq U3.420 Thermo Fluid Engineering
Classes Yr: (1hr lec & 0.5 tut)/wk
Assessment tut work, projects and one 2hr exam at the end of each Sem

Syllabus summary: The course will provide the student with an understanding of the structure of a modern CFD package. At the end of the course the student will be able to write a simple code to solve the Navier-Stokes equations as well as use a state of the art CFD package. Specific topics covered will include:

- Conservation equations of fluid flow
- Finite difference solution methods for advection diffusion and Poisson's equations
- Solution of algebraic systems
- SIMPLE algorithm and its variants
- High order advection schemes
- Turbulence modelling
- Implementation of boundary conditions
- Coupled heat transfer: convection radiation heat transfer
- Pitfalls to avoid in CFD.

Reference books
Fletcher *Computational Techniques for Fluid Dynamics* Vols 1 and 2 (Springer, 1988)
FatankaiNumericalHeatTransferandFluidFlowQiemispheie, 1983)

U4.458 Advanced Topics in Mechanical Engineering A 2 units

Senior Advanced elective course.

Prereq 24 units of Senior courses
Classes Sem 1: (1hr lec & 0.5 tut)/wk

Syllabus summary: The course is designed to provide students with knowledge in a specialised topic that is of relevance to Mechanical or Mechatronic Engineering. The details of the course will vary depending on the topic being taught.

Textbook
To be advised

U4.459 Advanced Topics in Mechanical Engineering B 4 units

Senior Advanced elective course.

Prereq 24 units of Senior courses
Classes Sem 1: (1hr lec & 0.5 tut)/wk

Syllabus summary: The course is designed to provide students with knowledge in a specialised topic that is of relevance to Mechanical or Mechatronic Engineering. The details of the course will vary depending on the topic being taught.

Textbook
To be advised

U4.460 Industrial Engineering 6 units

Senior Advanced elective course.

Mutually exclusive with U4.070 Industrial Ergonomics, U4.461 Introduction to Operations Research, and U4.462 Industrial and Engineering Management
Prereq U2.000 Mathematics 2 and U3.460 Manufacturing Engineering and Management and completion of industrial experience period
Classes Sem 1:3 lec/wk plus associated tut and lab work and industrial visits
Assessment assignments plus one 3hr exam

Course objectives: To develop an understanding of:

- principles and practices of industrial and engineering management,
- effects of globalisation on Australia's economic performance, and the competitiveness of Australian firms,
- insight into the importance of innovation,
- roles appropriate to governments,
- ergonomics,
- information handling,
- safety,
- training,
- work performance,
- the role of operations research in modern industry,

- problem formulation and analysis techniques for operations research problems,
- the importance of reliability analysis in part and system designs, and
- the use of maintenance and repair to extend the useful life of systems.

Expected outcomes: Students should develop skills and abilities in:

- the application of problem solving solutions to management issues,
- an appreciation of the interrelationships and complexities associated with themanagement of a modern industrial organisation,
- the development of logical, thoughtful and creative presentations concerning industrial management,
- ergonomic analysis,
- information processing,
- consideration of the workspace,
- consideration of the workers and their skills, and
- the solution of a range of operations research and reliability problems.

Syllabus summary:
Industrial ergonomics—refer to syllabus summary for U4.070 Industrial Ergonomics.
Operations research—refer to syllabus summary for U4.461 Introduction to Operations Research.
Industrial and Engineering Management—total quality management, production planning and control, costing and pricing, inventory management and control, management reporting systems, value analysis, problem resolution strategies, dispute-management, project management, contract administration, marketing management, business planning, the managementof engineering enterprises, professional engineering skills.

Textbook
Samson *Management for Engineering* (Longmans)

Reference books
As for U4.070 and U4.461
Hicks *Introduction to Industrial Engineering and Management Science* (McGraw- Hill, 1977)
Harding *Production Management* 2nd edn (MacDonald & Evans, 1974)
Hussey *Introducing Corporate Planning* (Pergamon, 1972)
Currie *Work Study* 4th edn (Pitman, 1977)
Heyde *Concise MODAPTS* (AAPTS&R, 1975)
Koontz *et al. Management* 7th edn (McGraw-Hill, 1980)
Hunt *Managing People at Work* (McGraw-Hill, 1979)
Blakemore *The Quality Solution* (Australian Business Library, Vic.)
Kotler, Fitzroy and Shaw *Australian Marketing Management* (Prentice-Hall)
Macnamara *Australian Marketing and Promotion Handbook* (Australian Business Library)
Case Studies in Australian Strategic Management
Other books may be advised during the course

U4.461 Introduction to Operations Research 2 units

Senior Advanced elective course. A component of the course U4.460 Industrial Engineering.

Mutually exclusive with U4.460 Industrial Engineering
Prereq U2.000 Mathematics 2
Classes Sem 1: (1 lec & 1 tut)/wk
Assessment one 2hr paper at end of course plus assignments

Course objectives: To develop an understanding of:

- the role of operations research in modern industry problem formulation and analysis techniques for operations research problems,
- the importance of reliability analysis in part and system designs, and
- the use of maintenance and repair to extend the useful life of systems.

Expected outcomes: Students should develop skills in the solution of a range of operations research and reliability problems.

Syllabus summary: Method and history of operations research: broad aims; general problem approach.

Inventory control problems, with constant and random demand. Allocation problems; linear programming; transportation problem. Introduction to reliability analysis; component and system reliability; effect of maintenance and repair. Discrete event simulation with applications to inventory control and maintenance.

Reference books
Daellenbach, George and McNickle *Introduction to Operations Research Techniques* (Allyn and Bacon, 1984)
or
Taha *Operations Research—An Introduction* (Macmillan, 1976)
Lewis *Introduction to Engineering Reliability* (Wiley, 1987)
Library classification: 658

U4.462 Industrial and Engineering Management 2 units

Senior Advanced elective course for the degree in Mechanical and Mechatronic Engineering.

Mutually exclusive with U4.460 Industrial Engineering
Prereq U3.460 Manufacturing Engineering and Management or U3.571 Management for Engineers or U3.790 Industrial Organisation and Management; together with completion of the industrial experience period
Classes Sem 1: 2hrs of lec & tut/wk plus industrial visits
Assessment assignments and one 2hr exam

Course objectives: To develop an understanding of:

- principles and practices of industrial and engineering management,
- effects of globalisation on Australia's economic performance, and the competitiveness of Australian firms,
- insight into the importance of innovation, and
- roles appropriate to governments.

Expected outcomes: Students should develop skills and abilities in:

- the application of problem solving solutions to management issues,
- an appreciation of the interrelationships and complexities associated with the management of a modern industrial organisation, and
- the development of logical, thoughtful and creative presentations concerning industrial management.

Syllabus summary: Total quality management, production planning and control, costing and pricing, inventory management and control, management reporting systems, value analysis, problem resolution strategies, dispute management, project management,

contract administration, marketing management, business planning, the management of engineering enterprises, professional engineering skills.

Textbook
Samson *Management for Engineering* (Longmans)

Reference books
AsforU4.460

U4.470 Robotic Systems 4 units

Senior Advanced elective course for the degree in Mechanical Engineering (Mechatronics).

Prereq U3.450 System Dynamics and Control
Classes Sem 1: (2 lec & one 3hr lab/tut)/wk
Assessment one 3hr exam at end of Sem 1; plus assignment, project and lab work

Course objectives: To introduce aspects of design, control and use of industrial robots.

Expected outcomes: Students should gain an appreciation for the important factors that need to be considered in the selection and use of robots for industrial applications.

Syllabus summary: Overview of robotics: definitions, arm configurations. Kinematics and dynamics of robot manipulators. Control of robots. Programming languages. Robot vision; tactile sensing. Robot applications. System design, and integration of robots with other automated machinery.

U4.471 Machine Tool Technology 4 units

Senior Advanced elective course for the degree in Mechanical Engineering (Mechatronics).

Prereq U3.470 Mechatronics 2 or U3.450 System Dynamics and Control
Classes Sem 1: (3 lec & one 2hr lab/tut)/wk
Assessment one 2hr exam at end of Sem 1; plus assignment and project work

Syllabus summary: The first part of the course will concentrate on tools for metal cutting.

Static and dynamic characteristics of machine tools: rigidity, bearings, spindle mounting; accuracy; vibration. Control of machine tools. Numerical control: NC, CNC, DNC. Computer aided manufacturing.

Installation techniques; communication.

Non-conventional machining processes: EDM, ECM, ultrasonic machining, laser cutting and welding.

U4.472 Design of Automatic Machinery 4 units

Senior Advanced elective course for the degree in Mechanical Engineering (Mechatronics).

Prereq U3.440 Mechanical Design 2
Classes Sem 1: (3 lec & one 2hr lab/tut)/wk
Assessment one 2hr exam at end of Sem 1; plus assignment and project work

Syllabus summary: Automatic machinery: classification by function and configuration. The design process. Actuator and drive system principles; sensing. Work stations: design of machinery for parts feeding, clamping, machining, assembly, and inspection. Machine control systems; pneumatic logic; relay logic; programmable logic controllers. Practical aspects of design for automated manufacture: machining, assembly, materials handling. A number of case studies will be presented to illustrate common problems and their solutions.

U4.474 Computer Integrated Manufacturing 4 units

Senior Advanced elective course for the degree in Mechanical Engineering (Mechatronics).

Prereq U3.460 Manufacturing Engineering and Management
Classes Sem 1: (3 lec & one 2hr lab/tuf)/wk
Assessment one 2hr exam at end of Sem 1; plus assignment and project work

Syllabus summary: Overview of computers in design and manufacture. Data bases. Computers in process planning and factory management. Flexible manufacturing systems and automated factories.

U4.477 Computers in Real Time Control and Instrumentation 6 units

Senior Advanced elective course for the degree in Mechanical Engineering (Mechatronics).

Prereq U3.476 Industrial Electronics
Classes Sem 1: (3 lec & one 2hr lab/tut)/wk
Assessment project and assignment work, plus 2hr exam at the end of Sem. Satisfactory performance in project and assignment work is required

Course objectives: Microcomputer and microprocessor system, operating in real time have become very common components in today's engineering applications. The objective of this course is to teach the fundamentals of real time software and to build competence in the engineering use of such systems through lectures emphasising standard computer architectures, programming, and through intensive laboratory work with microcomputer systems interacting with experimental mechatronic processes.

Expected outcome: The student will have a basic knowledge of the hardware components available in a microcomputer system and a detailed knowledge of facilities and capabilities typically present in a professional real time operating system. The student will have the competence to design, implement and debug interrupt-driven multitasking systems with graphical user interfaces.

Syllabus summary: Review of sensing, analogue and digital electronics. Signal conditioning and data acquisition. Overview of the IBM PC architecture. Programming for interactive control using both assembly language and the high level language C. Timers, interrupts. Asynchronous tasks; data communication. Structured data; structures in C. Cooperative multi-tasking, real time operating systems. Designofinteractive graphical displays;man-machine communication.

Textbook
D.M. Auslander and C.H. Tham *Real Time Software for Control* (Prentice Hall, 1990)

Reference book
A reference list will be distributed
Library reference number: 629.8955133 1, Engineering Reserve

U4.478 Microprocessors in Engineered Products 6 units

Senior Advanced elective course for the degree in Mechanical Engineering (Mechatronics).

Prereq U3.476 Industrial Electronics
Classes Sem 1: (3 lec & one 2hr lab/tut)/wk
Assessment project and assignment work, plus one 2hr exam at the end of Sem. Satisfactory performance in project and assignment work is required

Course objectives: To provide experience, confidence and basic competence in the design and implementation of microprocessor-based products and instruments. To impart a detailed knowledge of the software and hardware architecture of a typical modern microcontroller, and an understanding of the use of these resources in product design. To give experience with modern cross-development tools. To provide experience of working in a project team to prototype a realistic product to meet a specification.

Expected outcomes: The student will have a detailed knowledge of the software and hardware architecture of a modern microcontroller. This knowledge will include anin-depth understanding of the relationship between assembly language, high-level language, and the hardware, of the utilisation and interfacing of microcontroller hardware resources, and of the design and development of software comprised of multiple interrupt-driven processes. The student will have the competence to develop prototype microprocessor-based products.

Syllabus summary: Specific requirements for microprocessor-based products. Problem definition and system design. CPU, memory and interface circuits. Tools for design, development and testing of prototype systems. The course will include a major project, where groups of students design, develop and commission a microprocessor-based product.

Textbook
Peatman Design *with microcontrollers* (McGraw-Hill)

Reference books
An extensive reference list will be distributed
Library classifications: 629.398,629.895,621.3815,621.38195, 001.6425,005.1

U4.480 Thesis 12 units

Senior Advanced core course for the degree in Mechanical and Mechatronic Engineering.

Prereq 36 units of Senior courses

Syllabus summary: In the Senior Advanced year of the course, each candidate works towards and writes an undergraduate thesis, at least one copy of which should be submitted in completed form (see below) before a date to be announced, which is normally not later than the last day in November.

Towards the end of each academic year a list of suggested topics and supervisors for thesis work is published for the information of current Senior year students. Each prospective Senior Advanced year student is then required to indicate his or her first, second, and third choices of topics after consultation with some or all of the prospective supervisors. Before the beginning of the next academic year, on the basis of Senior year results and other considerations, a topic and supervisor is advised to each new Senior Advanced year student, and work on the thesis may begin.

In the normal course of events some or all of the theoretical, developmental, and experimental aspects of research or design work are expected in a thesis. These aspects may be either directed by the supervisor or of a partly original nature, but in any event the student is directly responsible to his or her supervisor for the execution of his or her practical work and the general layout of the thesis itself.

Theses should be typewritten—with text, diagrams, graphs, photographs, etc., properly displayed—and not less than one copy should be submitted, permanently bound between hard covers for the departmental library, on or before the due date. Students are responsible for supplying their own paper, typewriting, diagrams, and binding, but in certain circumstances assistance may be given with the more difficult problems of photography, diagram duplication, etc. It is recommended that the size of the paper be A4.

It is customary in most investigational work for the worker to develop a set of index cards to keep track of his or her references.

Each thesis writer may be called upon at the year's end to show some evidence of his or her activities in this respect.

The Charles Kolling Prize may be awarded for the best graduation thesis.

U4.484 Professional Engineering 4 units

Senior Advanced core course for the degree in Mechanical and Mechatronic Engineering.

Prereq U3.460 Manufacturing Engineering and Management
GZflssesSem:(4hrslec/consultations/studentpresentations)/ wk
Assessment assessment of student assignments/ presentations and 2hr exam at end of Sem

Course objectives: To impart knowledge resulting in a more global approach to the practice of engineering and engineering management, as well as to provide a vehicle for improving communication skills.

Syllabus summary: Projectmanagement: specific aspects of project managementincludinginitial establishment of projects and design criteria, and capital cost estimating. Design management: topics will cover designintegration, codes and standards, specification preparation, and sources of information. Plant engineering management: the areas will include decision making, computerised maintenance, understanding unit operations, environment protection measures, engineering as an element in the cost of production, continuous improvement, provision of plant and ancillary services, and the engineer as a trainer.

U4.485 Professional Communication **4 units**

Senior Advanced core course for the degree in Mechanical and Mechatronic Engineering.

Prereq completion of industrial experience (see U4.486)
Classes some instructional sessions will be arranged to pro videbasic techniques for preparation and presents tion of technical material to an audience by audio-visual means and in report writing
Assessment satisfactory performance in the seminar as assessed by the participants and in a written report on industrial experience

Course objectives: To improve student competence and confidence in developing and presenting a formal technical presentation, and enhance student abilities and experience in technical report writing.

Expected outcomes: (i) the ability to structure and deliver a competent and informative technical presentation; (ii) the ability to present structured observations and reflections in the mode of a formal written report,

Syllabus summary: During the latter part of the year, one or two whole days aresetasidefor the presentation of student addresses at a public conference. Each final year student, usually in consultation with his or her thesis supervisor, prepares an abstract of the seminar for distribution one week in advance of the conference. Althoughit is not obligatory, the subject for the seminar is normally closely related to the student's thesis work; thus it tends to deal in depth withsome relatively narrow technical field. At the conference (where the audience comprises senior, senior advanced and postgraduate students, departmental staff and visitors), oral presentation of the thesisis followed by critical discussion under formal chairmanship.

The industrial experience report mustbe submitted early in Semester 1. The report is assessed on content and presentation in accordance with details that are distributed in the previous semester. The report should contain a section on management.

U4.486 Practical Experience 6 units

Senior Advanced core course for the degree inMechanical and Mechatronic Engineering.

Prereq 28 units of Senior courses
Classes 12wks prac work experience
Assessment will be on a Pass/Fail basis. Marks will not be given. (Course will not contribute to the weighted averages used to determine Honours)

Syllabus summary: Each student is required to work as an employee of an approved engineering organisation and to submit a satisfactory written report of his or her work. Normally 12 weeks of practical work experience (375 hours minimum) is required and this is undertaken after the completion of some or all of the prescribed Senior core courses and before enrolment in the final year of study. The University Careers and Appointments Service is available to assist students to obtain suitable employment. This course must be passed in order to graduate.

U4.490 Environmental Engineering 6 units

Senior Advanced elective course.

Mutually exclusive with U4.491 Environmental Acoustics and Noise Control if Acoustics forms part of U4.490; mutually exclusive with U4.694 Pollution Control Engineering if Environmental Impact Assessment forms part of U4.490
Prereq 36 units of Senior courses
Coreq U4.486 Practical Experience
Classes Sem 1:5hrs/wk plus 2 Saturday field-trips
Assessment one 2hr and one 1.5hr exam at end of Sem 1, plus assignments

Course objectives: To acquaint students with the methods engineers use to assess and deal with the environmental consequences of industry and other human activities, with particular emphasis on impact assessment and noise.

Expected outcomes: Students will appreciate the social, economic, and legislative aspects of environmental protection. They will understand the requirements of an environmental impact statement. They will be able to make the calculations and measurements necessary to estimate acoustic noise levels in machinery, buildings and the outside environment and to make recommendations as to how best to reduce them.

Syllabus summary: The course will consist of the following components depending on availability of lecturers.
Environmental acoustics and noise control—Basic acoustics theory, sound generation and propagation, impedance, absorbing materials, industrial noise sources, isolation methods of noise control, enclosures, instrumentation and measurement, frequency analysis, noise regulations. Computational methods in acoustics.
Environmental impact assessment—The nature of environment protection, fundamentals of air, water and noise pollution, solid waste disposal, limnology, marine and terrestrial ecology, aesthetics, urban and regional planning. Social and economic factors, legislation and its administration, preparation of environmental impact reports. Air pollution and its control—sources, dispersion, meteorology, photo-chemical smog formation, measurements, introduction to modelling, particles and aerosols, control equipment.

Textbooks
A. *GilpinEnvironmental Impact Assessment* (Cambridge U.P., 1995)
Environmental Planning and Assessment Act 1979, No. 203
Environmental Planning and Assessment Regulation, 1980

Reference books
Bies and Hansen *Engineering Noise Control* (Allen and Unwin, 1988)
Hassall and Zaveri *Acoustic Noise Measurement* (Bruel and Kjaer,1988)
G. Kiely *Environmental Impact Assessment*
Other books as advised during classes
Library classification: 534.8, 620.23,620.8,628.1

U4.491 Environmental Acoustics and Noise Control 2 units

Senior Advanced elective course.

Mutually exclusive with U4.490 Environmental Engineering if Acoustics forms part of U4.490
Prereq 24 units of Senior courses
Classes Sem 1: (2 lec & 1 tut)/wk
Assessment one 1.5hr exam at end of Sem 1

Course objectives: To acquaint students with the methods engineers use to assess and deal with the environmental noise due to industry and other human activities.

Expected outcomes: Students will appreciate the social, economic, and legislative aspects of environmental noise. They will be able to make the calculations and measurements necessary to estimate sound levels and noise in machinery, buildings and the outside environment and to make recommendations as to how best to reduce them.

Syllabus summary: Basic acoustics theory, sound generation and propagation, impedance, absorbing materials, industrial noise sources, isolation methods of noise control, enclosures, instrumentation and measurement, frequency analysis, noise regulations. , Computational methods in acoustics.

Reference books

Bies and Hansen *Engineering Noise Control* (Allen & Unwin, 1988)
Hassall and Zaveri *Acoustic Noise Measurement* (Bruel & Kjaer,1988)

Library classification: 534.8,620.23

U4.506 Biomedical Engineering Systems 4 units

Senior Advanced elective course for the degree in Electrical Engineering and the degree in Electrical Engineering (Information Systems Engineering.

Prereq U3.506 Fundamentals of Biomedical Engineering
Classes Sem 2: (2 lec & 1hr lab/tut)/wk
Assessment lab reports and one 2hr exam at end of Sem

Syllabus summary: Implantible devices—pacemakers, defibrillators, cardiomyostimulators, bionic ear. Functional electrical stimulation—bladder and bowel control, cerebellar, mid-brain stimulation, limb control, walking in paraplegics. Advanced imaging—pattern recognition, cervical smear analysis, chromosome analysis, cardiac image processing, automated chest X-ray analysis, mammography. Instruments—automated blood pressure, cardiac output, blood flow, EEC Advanced instruments—automated anaesthesia, blood pressure controllers, artificial insulin injectors. Laboratory work on respiratory measurements, blood pressure measurement, image processing, pattern recognition.

U4.512 Practical Experience 2 units

Senior Advanced core course for the degree in Electrical Engineering and the ISE stream.

Prereq 28 units of Senior courses
Assessment assessment in this course is by the submission, within the first two weeks of First Semester, of a written (hand or typed) report of about 2500w of the industrial experience undertaken in accordance with regulations. This report is to be general in nature, indicating the overall structure of the company, the areas that the student became familiar with and their relationship to the firm and finally, what the student did. Detailed material may be incorporated as appendices if desired, and the student should have the report vetted beforehand by a responsible officer of the company

Syllabus summary: It is necessary for the student to obtain industrial experience of 12 weeks' duration before entering 4th Year (Senior Advanced Year). The work which is acceptable to the Faculty may range from process-type work in a large industrial complex, where many different engineering processes and labour management relations may be observed, to semi professional or research work with small specialist companies.

The responsibility rests with the student to obtain work acceptable to the Faculty, although the University, through the Department of Electrical Engineering and the Careers and Appointments Service, will assist as much as possible. The student is required to inform the Department of Electrical Engineering of any work arrangements made and to obtain approval of these arrangements from the Department.

U4.521 Electrical Systems Control 4 units

Senior Advanced elective course for the degree in Electrical Engineering and the degree in Electrical Engineering (Information Systems Engineering).

Prereq U3.521 Energy Systems and U3.530 Control 1
Classes Sem 2: (2 lec & 1hr tut)/wk
Assessment assignments and one 2hr exam at the end of Sem 2'

Syllabus summary: Application of control theory to a selection of electrical systems such as power systems, drives, and robotic and vehicle systems. Control issues such as voltage, frequency and power regulation, protection, stability, reliability and security. Industrial controllers. Digital control and microcontrollers. Aspects of adaptive control, robust control. Supervisory control and data acquisition (SCADA) systems.

U4.522 Advanced Power Electronics and Drives 4 units

Senior Advanced elective course for the degree in Electrical Engineering and the ISE stream.

Prereq U3.522 Power Electronics and Drives.
Classes Sem 2: (2 lec & 1hr/lab/tut)/wk
Assessment one 2hr exam at end of Sem 2 and assignments

Syllabus summary: Modern power semiconductor devices 'smart power'; design analysis and simulation of power electronic circuits, digital firing control; recent machine developments; DC and AC drives, analysis, control; digital techniques for control, protection and data logging; applications.

U4.529 Electrical Systems Analysis 4 units

Senior Advanced elective course for thedegree in Electrical Engineering and the degree in Electrical Engineering (Information Systems Engineering).

Prereq U3.521 Electrical Systems
Classes Sem 1: (2 lec & 2hr tut)/wk
Assessment assignments, lab reports and one 2hr exam at end of Sem 1

Syllabus summary: A broad range of topics will be presented related to electrical systems analysis, with

a particular focus on electric power systems. Modelling of power system components. Analysis of power systems under normal operating conditions. Faults and protection. Transmission line transients. An introduction to various aspects of transient stability, voltage and long-term stability, dynamic stability. The electric power systems of the 21st century. Introduction to software packages such as EUROSTAG, EMPT.

Textbook
J.D. Glover and M. Sarma *Power Systems Analysis and Design* (P.W.S. Publ. Co., 1994)

U4.533 Non-linear and Adaptive Control 4 units

Senior Advanced elective course for the degrees in Electrical Engineering and Electrical Engineering (Information Systems Engineering).

Prereq U3.530 Control 1.
Classes 2 lec & one 1hr tut per week Sem 2
Assessment assignments and one 2hr exam at end of Sem

Syllabus summary: Modelling by physical equations and input-output structures; concepts of linear, nonlinear, optimal, adaptive and robust control. Nonlinear systems analysis review and extensions, stability theory, oscillations and geometric concepts. Feedback linearisation, sliding mode and passivity-based control. Model-reference adaptive control and self-tuning regulators. Other advanced control strategies, supervisory control, fuzzy control and neural networks. How to choose a strategy. Applications to electrical and mechanical systems including drives, power systems, robotic and vehicle systems.

Textbook
Slotineand Li *AppliedNonlinear Control* (Prentice-Hall, 1991)

Reference books
Astrom and Wittenmark *Adaptive Control* (Addison Wesley, 1989)
Kosko *Neural Networks and Fuzzy Systems* (Prentice-Hall, 1992)
Isidori *Nonlinear Control Systems* 2nd edn (Springer-Verlag, 1989)
Vidyasagar *Nonlinear Systems Analysis* 2nd edn (Prentice-Hall, 1993)

U4.539 Control 2 4 units

Senior Advanced elective course for the degree in Electrical Engineering and the ISE stream.

Prereq U3.530 Control 1
Classes Sem 1: (2 lec & 2 hr lab/tut)/wk
Assessment assignments, lab reports and one 2hr exam at end of Sem 1

Syllabus summary: State variable description of systems, canonical forms, relation to transfer functions, solution of the state equation, eigenvalues and eigenvectors. Regulator design using state feedback, controllability. State estimators, observability. Design of servo-mechanisms with non-zero command inputs. Introduction to optimal regulator design.

Analysis of non-linear systems. Describing functions, limit cycles. Phase plane analysis, trajectories, linearisation of non-linear differential equations, equilibrium points and their classification. Introduction to Lyapunov's direct method.

Sampled data systems. Discrete signals and sampling, discrete transfer functions. Discrete equivalents for continuous controller. Discrete models for sampled data systems, pulse transfer functions for feedback systems. Direct digital design by transform methods.

U4.544 Microwave Engineering 4 units

Senior Advanced elective course for the degree in Electrical Engineering and the ISE stream.

Coreq U4.549 Electronic Design
Classes Sem 2: (1 lec & one 2hr lab)/wk
Assessment lab work and one 2hr exam at the end of Sem 2

Syllabus summary: Review of travelling waves, planar transmission lines, passive microwave components, hybrids, connectors and transitions, directional couplers, matching, S parameters, network analyser measurements, active microwave components, microwave CAD.

U4.547 Optical Communication Systems 4 units

Senior advanced elective course for the degree in Electrical Engineering and the degree in Electrical Engineering (Information Systems Engineering).

Prereq U3.540 Electronics 1 and U3.552 Communications 1
Classes Sem 2: (2 lec & 1hr lab/tut)/wk
Assessment one 2hr exam at end of Sem 2 plus lab and assignments

Syllabus summary: Introduction to optical fibre communications, optical fibre transmission characteristics, semiconductor and fibre laser signal sources, optical transmitters, direct and external modulation, optical amplifiers, optical repeaters, fibre devices and multiplexers, fibre nonlinearity, optical detectors, optical receivers and regenerators, sensitivity and error rate performance, photonic switching and processing, lightwave local area networks, multi-channel multiplexing techniques, optical fibre communication systems.

U4.548 Integrated Circuit Design 4 units

Senior advanced elective course for the degree in Electrical Engineering and Electrical Engineering (Information Systems Engineering).

Prereq U3.540 Electronics 1 and U3.560 Digital Systems 1
Classes Sem 1: (2 lec & one 2hr tut/lab)/wk
Assessment a design project and one 2hr exam at the end of Sem 1

Syllabus summary: Technology (IC production process, design rules, layout). Design automation and verification (DRC, circuit extraction, simulation and hardware design languages). Basic digital building blocks (inverters, simple logic gates, transmission gates, propagation delays, power dissipation and noise margins). Digital circuits and systems (PLAs, dynamic circuits, RAM, ROM, microprocessors, systolic arrays).

Semicustom design (gate arrays and standard cells). Analog VLSI (switches, active resistors, current sources and mirrors, voltage, current references, amplifiers, DAC, ADC, continuous time filters, switch capacitor circuits, analog signal processing circuits).

Textbook
R.L. Geiger, P.E. Allen and N.R. Strader *VLSI design techniques for analog and digital circuits* (McGraw-Hill 1990)

U4.549 Electronic Design 4 units

Senior advanced elective course for the degree in Electrical Engineering and *core course* for the degree in Electrical Engineering (Information Systems Engineering).

Prereq U3.540 Electronics 1, U3.511 Circuit Theory and U3.512 Signals and Systems
Classes Sem 1: (2 lec & one 2hr lab/tut)/wk
Assessment assignments, lab reports, quizzes and one 2hr exam at end of Sem 1

Syllabus summary: Electronic design, passive and active components in practice, modelling of electronic circuits, linear and non-linear circuits for communication systems, integrated circuit techniques, electronic filter design and implementation, mixed-signal circuits, analog-digital conversion techniques, distortion and noise in electronic systems, special topics in electronic design.

U4.555 Advanced Communication Networks 4 units

Senior Advanced elective course for the degree in Electrical Engineering and the degree in Electrical Engineering (Information Systems Engineering).

Coreq U4.559 Data Communication Networks
Classes Sem 2: (2 lec & 1hr tut)/wk
Assessment 2 assignments, reports and one 2hr exam at end of Sem 2

Syllabus summary: ISDN architecture and organisation, common channel signalling system 7. Concepts of briadband, metropolitan and wide area networks. Network technologies, asynchronous mode transfer, fast packet switching, FDDI, DQDB. Multimedia communications networks. Telecommunications and computer network software design, network standards, and management. Principles, design and practice of terrestrial mobile networks, GSM, CPT and PCN. System and network reliability. Future trends in network demand and technologies.

U4.556 Error Control Coding 4 units

Senior advanced elective course for the degree in Electrical Engineering and Electrical Engineering (Information Systems Engineering).

Coreq U4.558 Digital Communication Systems
Classes Sem 1: (2 lec & 1hr tut)/wk
Assessment assignments and one 2hr exam at end of Sem 1

Syllabus summary: Error control coding principles, linear algebra, linear block codes, cyclic codes, BCH codes, Reed-Solomon codes, burst-error correcting codes, design of codecs for block codes, applications of block codes in communications and digital recording, convolutional codes, Viterbi algorithm, design of codecs for convolutional codes, applications of convolutional codes in communications, soft decision decoding of block and convolutional codes, trellis coded modulation, block coded modulation, design of codecs for trellis codes, applications of trellis codes in data transmission, multidimensional codes.

U4.557 Satellite Communication Systems 4 units

Senior Advanced elective course for the degree in Electrical Engineering and the degree in Electrical Engineering (Information Systems Engineering).

Coreq U4.558 Digital Communication Systems
Classes Sem 2: (2 lec & one 1hr tut/wk
Assessment assignments and one 2hr exam at end of Sem 1

Syllabus summary: Introduction to satellite communication, satellitelink design, propagationcharacteristics of fixed and mobile satellite links, channel modelling, access control schemes, system performance analysis, system design, mobile satellite services, global satellite systems, national satellite systems, mobile satellite network design, system reliability, channel signalling, digital modern design, speech code design, error control code design, low earth orbit communication satellites.

Textbook
Miller, Vucetic and Berry *Satellite Communication Techniques* (Kluwer, 1993) (in press)

Reference books
Evans *Satellite Communication Systems* (Pergrinus, 1987)
Bhargava *et al. Digital Communications by Satellite* (J. Wiley and Sons, 1981)
Spiker *Digital Communications Satellite* (Prentice-Hall, 1977)

U4.558 Digital Communication Systems 4 units

Senior advanced elective course for thedegree in Electrical Engineering and *core course* for the degree in Electrical Engineering (Information Systems Engineering).

Prereq U3.512 Signals and Systems and U3.552 Communications 1
Classes Sem 1: (2 lec & one 2hr lab/tut)/wk
Assessment assignments, lab work and one 2hr exam at end of Sem 1

Syllabus summary: Digital communications principles and performance criteria. Digitally modulated signals: non-linear modulation methods, continuous phase FSK, continuous phase modulation. Modulated carrier data transmission: QPSK, QAM, MFSK, MSK. Trellis coded modulation and modem technologies. Spread spectrum, including frequency hopping and CDMA principles. Optical communication systems—single and multi-channel systems, performance criteria and systems analysis. Satellite communications systems. Cellular mobile radio systems.

Textbook
Haykin *Communication Systems* (John Wiley, 1994)

U4.559 Data Communication Networks 4 units

Senior advanced elective course for the degree in Electrical Engineering and *core course* for the degree in Electrical Engineering (Information Systems Engineering).

Prereq U3.552 Communications 1
Classes Sem 1: (2 lec & one 2hr lab/tut)/wk
Assessment assignments, lab work and one 2hr exam at end of Sem 1

Syllabus summary: Networking principles. Multiplexing—FDM, TDM, STDM, CDM. Network topologies and circuit, packet and message switching concepts. Introductory queuing and traffic theory for circuit switched and packet switched networks. Local area network architectures. Network protocols—the 7 layer ISO/OSI model, physical, data link, and network layer implementations in LANs and public networks. Upper layer protocols. Optical fibre networks and architectures. Multi-channel optical communication systems. Introduction to FDDI, DQDB and interworkmg of LANs with wide area high speed networks. Comprehensive broadband networks for user access. Standards.

Textbooks
Stallings. *Data and Computer Communications* (Maxwell Macmillan Int., 1995)
Tannenbaum *Computer Networks* (Prentice Hall, 1996)

U4.568 Real Time Computing 4 units

Senior advanced elective course for the degree inElectrical Engineering and *core course* for the degree in Electrical Engineering (Information Systems Engineering).

Prereq U3.560 Digital Systems 1
Classes Sem 1: (2 lec & one 2hr lab/tut)/wk
Assessment one 2hr exam at the end of Sem 1, plus lab and assignments

Syllabus summary: Hard real time and embedded systems, as applied to engineering, manufacturing and automation. Timing and scheduling: periodic vs aperiodic processes, hard vs soft deadlines, predictability and determinacy, granularity, rate monotonic and-earliest deadline scheduling. Real-time systems and software, imlementation of real-time control. Real-time languages and their features. Real time Operating Systems. Real time Software Design. Embedded Systems: overview, signal flow, interfacing. Reliability and fault tolerance in hardware and software. SCAD A and DCCS. Some case studies.

U4.569 Digital Systems 2 4 units

Senior advanced elective course for the degree in Electrical Engineering and *core course* for the degree in Electrical Engineering (Information Systems Engineering).

Prereq U3.560 Digital Systems 1 and U3.450 Electronics 1
Classes Sem 1: (2 lec & one 2hr lab/tut)/wk in Sem 1
Assessment one 2hr exam at end of Sem 1, assignments, lab reports

Syllabus summary: Digital systems design process. Design cycle. Top down design. Specification. Functional design. Structural design. Testing. Hardware description languages. VHDL. Digital systems architectures. Processors, buses and I/O devices. Bus interconnections, synchronous, asynchronous and semi-synchronous buses. Bus interconnections—Case study 1. Memory and I/O interface design. Static and Dynamic memory design. Memory interfacing. Interrupts. Vectored interrupts. Interrupt controllers. Parallel interface design. Serial interface design. Bus arbitration. Processor interfacing. Case study 2.

U4.563 Advanced Digital Systems 4 units

Senior Advanced elective course for the degrees in Electrical Engineering (Information Systems Engineering) and Electrical Engineering.

Coreq U4.569 Digital Systems 2.
Classes Sem 2: (2 lec & 1hr tut/lab)/wk
Assessment assignments and one 2hr exam at end of Sem 2

Syllabus summary: High speed digital systems, nonidealities of digital logic. IBM PC interfacing. Building block circuits and their design. Circuit construction (prototyping, PCBs, connectors, etc.) Test equipment. Debugging. Case studies.

U4.564 Advanced Real Time Computing 4 units

Senior advanced elective course for the degree in Electrical Engineering and for the degree in Electrical Engineering (Information Systems Engineering).

Coreq U4.568 Real Time Computing
Classes Sem 2: (2 lec & one 1hr tut)/wk
Assessment one 2hr exam at the end of Sem 2, plus assignments

Syllabus summary: Modelling of real-time systems, design techniques, analysis and prediction of real-time behaviour, advanced scheduling techniques, simulation, verification and validation, communications, distributed real-time systems, reliability and fault tolerance, hardware architectures, CASE tools for real-time systems. Standards for real-time languages and operating systems.

U4.572 Project Management 4 units

Senior Advanced core course for the degree in Electrical Engineering and for the degree in Electrical Engineering (Information Systems Engineering.

Classes Sem 1: (1 lec & one 2hr tut)/wk
Assessment one 2hr exam plus assignments

Syllabus summary: The organisation of research and development; estimating costs and resources; financial appraisal techniques for selection and appraisal; project planning and control; the management of human resources; problem specification and decision making; innovation; patents.

U4.588 Thesis A 8 units

Senior advanced core course for the double degree Bachelor of Engineering (Electrical) and Bachelor of Commerce.

Mutually exclusive with U4.589 Thesis
Coreq 12 units of Senior Advanced Electrical Engineering courses
Assessment thesis, final presentation and interim progress submissions

Syllabus summary: Each student is required to select a topic, carry out background searches, experimental investigations, and to document such achievements and conclusions as are appropriate. The subject requires a consistent and significant effort eqivalent to one or two hours per week in Semester 1, and one to two days per week in Semester 2.

U4.589 Thesis 12 units

Senior advanced core course for the degree in Electrical Engineering and Electrical Engineering (Information Systems Engineering).

Mutually exclusive with U4.588 Thesis A
Coreq 24 units of Senior Advanced Electrical Engineering courses
Assessment thesis, final presentation and interim progress submissions

Syllabus summary: Each student is required to select a topic, carry out background searches, experimental investigations, and to document such achievements and conclusions as are appropriate. The subject requires a consistent and significant effort eqivalent to one or two hours per week in Semester 1, and two days per week in Semester 2.

U4.591 Image Processing and Computer Vision 4 units

Senior Advanced elective course for the degree in Electrical Engineering and the degree in Electrical Engineering (Information Systems Engineering).

Prereq U3.512 Signals and Systems and U3.553 Digital Signal Processing
Assessment assignments (25%) and one 2hr exam (75%) at end of Sem

Syllabus summary: Mathematical preliminaries: two-dimensional (2D) signals and systems, image models and image transformation, image digitalisation; visual perception, sampling, quantisation and colour representation. Image enhancement and restoration; histogram modelling, spatial and transform operations, filtering, deconvolution and extrapolation. Image compression: predictive methods, transform coding, vector quantisation and fracta based methods. Image reconstruction: Radon transform and projection theorem computer tomography, (CT) and magnetic resonance imaging (MRI) systems and three-dimensional (3D) imaging. Image analysis and computer vision; edge detection and boundary extraction, region and object representation, image segmentation and pixel classification, texture analysis and scene detection and matching.

U4.592 Fuzzy Systems 4 units

Senior Advanced elective course for the degree inElectrical Engineering and the degree in Electrical Engineering (Information Systems Engineering).

Classes Sem 2: (2 lec & one 1hr lab/tut)/wk
Assessment assignments and one 2hr exam at end of Sem 2

Syllabus summary: Mathematical backgrounds: ordinary set theory, uncertainty and linguistic variables, fuzzy sets, algebra of fuzzy sets, membership functions. Fuzzy control; approximate reasoning, fuzzy logic, fuzzification, defuzzification, fuzzy associative memory, fuzzy system design, a fuzzy controlled vehicle, adaptive fuzzy systems. Other applications: fuzzy pattern recognition, fuzzy image transform coding, fuzzy knowledge based systems.

Reference books
Kaufmann *Fuzzy Mathematical Models in Engineering and Management Science* (North Holand, 1988)
Bezdek *Pattern Recognition with Fuzzy Objection Function Algorithms* (Plenum Press, 1981)
Pedrycz *Fuzzy Control and Fuzzy Systems* (Research Studies Press, Wiley, 1989)
Koskok *Neural Networks and Fuzzy* Systems (Prentice Hall, 1992)

U4.593 Neural Computing 4 units

Senior Advanced elective course for the degree inElectrical Engineering and for the degree in Electrical Engineering (Information Systems Engineering).

Classes Sem 2: (2 lec & one 1hr tut)/wk
Assessment assignments and one 2hr exam at end of Sem

SyZZabus SMmman/.Tntroduction to artificial intelligence, review of knowledge representation techniques. Introduction to artificial neural networks. Artificial neural networks training algorithms, Neural networks training strategies. Hardware implementations of neural networks. Analog and digital very large-scale integration friendly learning algorithms. Applications: intracardiac electrogram classification, optical character recognition.

Textbook
Jabri, Coggins and Flower *Adaptive Analog Neural Systems* (Chapman and HaU, 1995)

U4.594 Adaptive Pattern Recognition 4 units

Senior Advanced elective course for thedegree in Electrical Engineering and for the degree in Electrical Engineering (Information Systems Engineering).

Classes Sem 2: (2 lec & one 1hr lab/tut)/wk
Assessment one 2hr exam at end of Sem 2

Syllabus summary: Mathematical preliminaries: probability theory, random vectors, decision theories.

Statistical approaches: feature extraction, nonlinear mapping, quadratic and linear classifiers, nonparametric estimation and classification. Fuzzy set approach: operations on fuzzy sets, the use of fuzzy sets in pattern recognition. Neural-net implementations: generalised perception, associative memories, self-organised neural nets, integrated neural-net computing environment, linking of symbolic and numeric processing.

U4.600 Practical Experience 8 units

Senior Advanced core course for the degree in Chemical Engineering.

Prereq 28 units of Senior courses
Classes there are no formal classes. Students are required to obtain 12 weeks' practical work experiencebefore entering their Senior Advanced Year

Assessment by submission of a report of approximately 2500w on the industrial experience undertaken. The report will cover the nature of the industry, the company's organisational relationships both internally and externally and a technical section devoted to the work performed by the student. The report is to be submitted before the end of the first week of the Senior Advanced academic year

Syllabus summary: Each student is required to work as an employee of an approved organisation and to submit a report on that work. The employment undertaken must be relevant to Chemical Engineering and should be discussed before acceptance with a member of the Department of Chemical Engineering. While the responsibility for obtaining satisfactory employment rests with the student, the Department, through the Chemical Engineering Foundation, and the Careers and Appointments Service will assist where possible.

U4.625 Reaction Engineering 4 units

Senior Advanced elective course for the degree in Chemical Engineering.

Prereq U3.625 Reaction Engineering 1
Classes Sem 1: (3hrs lec/tut)/wk
Assessment one 3hr exam at end of course plus assignments

Syllabus summary: Homogeneous reactors: non-isothermal design; unsteady state operation and multiple steady-states; reactor stability. Diffusion and reaction in porous catalysts: packed bed reactors and chemical vapour deposition. Multiple reactions: net reactionrate and stoichiometric multiple steady states. Multiphase reactors: slurry and bioreactors. Residence time distribution, non ideal reactors. Reactor optimisation.

Textbook
Fogler *Elements of Chemical Reaction Engineering* (Prentice-Hall, 1990)

Reference book
Levenspiel *Chemical Reaction Engineering* (Wiley, 1972)

U4.629 Advances in Polymer Engineering 4 units

Senior Advanced elective course for the degree in Chemical Engineering.

Prereq U3.610 Unit Operations 1
Classes Sem: 3hrs lec & tut/wk
Assessment assignments, etc., and one 3hr exam at end of course

Syllabus summary: Basic structure and properties of polymers. Application of chemical engineering fundamentals including reaction engineering and kinetics to produce polymer resins from monomers.* Engineering principles of polymer processing and shaping via extrusion, injection moulding, blow moulding, calendering and film blowing to obtain value-added products such as sheets, tubes, car parts, bottles, fibres for clothes, etc. A few case studies with nylon, polyester, polyethylene will be treated in detail.

Selection of polymers for engineering application based on chemical, mechanical, thermal and flow behaviour. Life cycle analysis, recycle and reuse of polymers.

Suggested texts
F.W. Billmeyer *Textbook of Polymer Science* 3rd edn (Wiley, N.Y.,1984)
R.C. Progelhof and J.L. Throne *Polymer Engineering Principles* (Hansen, N.Y., 1993)

U4.630 Mineral Processing (Mineral Dressing) 4 units

Senior Advanced elective course for the degree in Chemical Engineering.

Prereq U3.610 Unit Operations 1
Classes Sem: 4hrs lec, lab & tut classes/wk; and field trips as arranged
Assessment tut assignments, lab reports and one 2hr exam at end of course

Syllabus summary: Mineralogy and its relationship to mineral beneficiation, liberation. Metallurgical balances. Data reconciliation. Mineral processing unit operations, principles—comminution, concentration, heavy media separation, jigging, magnetic separation, electrodynamic and electrostatic separation, tabling and film concentrators. Flotation—surface chemistry. Collector, modifier action. Electrokinetic phenomena. Oxide and sulphide ore flotation. Depressants and selective flotation. Flotation kinetics. Ore sorting. Tailings dams.

Reference books
Gaudin *Principles of Mineral Dressing* (McGraw-Hill, 1939)
Taggart *Elements of Ore Dressing* (Wiley, 1964)
Wills *Mineral Processing Technology* (Pergamon, 1992)

U4.631 Mineral Processing (Extractive Metallurgy) 4 units

Senior Advanced elective course for the degree in Chemical Engineering.

Prereq U3.610 Unit Operations 1
Classes Sem: 2hrs lec, lab & tut classes/wk; and field trips as arranged
Assessment tut assignments, lab reports and one 2hr exam at end of course

Syllabus summary: Mineral beneficiation and its relationship to smelting practice. Principles of extraction and recovery in pyrometallurgy, hydrometallurgy and electrometallurgy. Alternatives in mining and minerals beneficiation—in situ leaching, dump and heap leaching. Mineral stability. Thermodynamics of reduction. Ellingham diagrams. Roasting ofsulphides. Matte smelting and converting. Refining. Hydrometallurgy and electrometallurgy.

Reference books
Gilchrist *Extraction Metallurgy* (Pergamon, 1989)
Moore *Chemical Metallurgy* (Butterworths, 1981)
Pehlke *Unit Process in Extractive Metallurgy* (Elsevier, 1972)
Newton Extractive *Metallurgy* (Wiley, 1967; Pergamon, 1967)
Rosehquist *Principles of Extractive Metallurgy* (McGraw-Hill, 1975)

U4.632 Separation Processes 4 units

Senior Advanced elective course for the degree in Chemical Engineering.

Prereq U3.610 Unit Operations 1
Classes Sem: 4hrs/wk
Assessment one 1.5hr exam plus assignments

Syllabus summary: Multicomponent distillation: history and introduction. Phase equilibria in multicomponent systems. K values for ideal and non-ideal systems, batch distillations. Computer methods of solution including Naphtali-Sandholm method. Flowsheeting packages for multicomponent distillation. Overall column efficiencies. Tray layout. Optimal column design. Membrane separation: introduction, types of membranes, separating ability and equipment. Packed distillation columns: capacity and HETP. Environmental applications; steam stripping of volatile organic componentfromaqueous waste liquids. Flowsheeting packages and phase equilibria in environmental systems. Practical distillation for tray and packed columns following the Kister methods.

Textbooks

Furzer *Distillation for University Students* (published by the author, Department of Chemical Engineering, University of Sydney, 1986)

Kister *Distillation Design* (McGraw-Hill, 1992)

Reference book

Perry and Green *Chemical Engineer's Handbook* 6th edn (McGraw-Hill, 1984)

U4.633 Advanced Particle Mechanics 4 units

Senior Advanced elective course for the degree in Chemical Engineering.

Prereq U3.610 Unit Operations 1 .
Classes Sem: 3hrs lec & tut/wk
Assessment assignments, etc., and one 3hr exam at end of course

Syllabus summary: Bulk solids flow: properties of bulk granular material; stress analysis of solids; testing of granular material; flow properties; design of bunkers; flow rate predictions; calculation of flow parameters of hoppers. Fluidisation: Applications; types of fluidisation; incipient fluidisation; theory of bubble rise; bubble formation; fluid-bed reactors. Pneumatic conveying of solids: regimes, models and equipment (including blowers). Hydraulic conveying: regimes, models and equipment (including pumps).

Reference books

Coulson and Richardson *Chemical Engineering* Vol. 2 (Pergamon, 1983)

Davidson and Harrison *Fluidised Particles* (C.U.P., 1963)

Shamlou *Handling of Bulk Solids* (Butterworths, 1988)

U4.634 Advanced Topics in Environmental Engineering A 4 units

U4.635 Advanced Topics in Environmental Engineering B 4 units

Senior Advanced elective courses for the degree in Chemical Engineering.

Prereq U3.610 Unit Operations 1
Classes Sem: 3hrs/wk (each course)
Assessment tut and assignments; one 3hr exam at the end of the semester (each course)

Syllabus summary: These two courses are focused on the application of chemical engineering fundamentals to developing quantitative descriptions of environmental fate and transport processes. These processes include chemical partitioning, reactions, and advective/dispersive transport in air, water and soil. Syllabuses for each subject will be defined annually.

Specific course topics will be drawn from: sources and type of air and water pollution; atmospheric chemistry and ozone pollution; control of sulphur and nitrogen oxides; transport, dispersion and reaction in the atmosphere; vapour emissions from landfills and surface impoundments; water pollution: physio-chemical and biological treatment processes; equilibrium in aqueous phase systems; groundwater movement and solute transport; oily phase migration in soils; in situ remediation of contaminated soils and sediments.

U4.640 Project Engineering 4 units

Senior Advanced core course for the degree in Chemical Engineering.

Classes Sem: approx. 4hrs lec, seminar & discussions/wk
Assessment tut assignments, seminar and one 3hr exam at end of sem

Syllabus summary: Principles of project management, management of large projects and a portfolio of small projects including planning techniques, organisation and control. Management of commissioning and start up of process plant, and of maintenance. Preparation and delivery of oral presenta tions on technical subjects. Introduction to occupational safety, safety management systems, management of environmental performance, safety during shutdowns, quality assurance and principles of Total Quality Management. The concept of 'completed staff work'. mtroducuontoprocessplantproducuonmanagement. Individual and in-team approaches to solving standard and open-ended problems.

Textbook

Burke *Project Management Planning and Control* 2nd edn (Wiley, 1992)

U4.655 Advanced Fluid Dynamics Modelling 4 units

Senior Advanced elective course for the degree in Chemical Engineering.

Classes Sem: 3hrs/wk
Assessment assignments, projects and one 2hr exam at end of course

Syllabus summary: This course will familiarise students with modern development in computational fluid dynamics (CFD) modelling. It will contain a review of the basic equations and introductions to mesh generation, solution methods, graphical analysis of results, turbulence modelling, multiphase flows, combustion, non-Newtonian flow and chemical reactions. The course will comprise a mixture of theory and practical use of a CFD package. Assessment will be via a 2 hour exam and project work. The projects will involve studying a chemical engineering application using the package.

U4.660 Process Control 2 4 units

Senior Advanced elective course for the degree in Chemical Engineering.

Prereq U3.660 Process Control 1
Classes Sem: 4hrs lec, tut & lab work/wk
Assessment tut assignments, lab reports and one 3hr exam

Syllabus summary: Frequency response analysis. Distributed parameter systems. Controller characteristics and tuning—stability analysis of feedback loops, measuring instruments and control hardware. Control valve characteristics and sizing. Multivariable control. Batch control. Programmable logic controllers. Instrumentation and control scheme implementation for industrial processes.

Textbook
Stephanopoulos *Chemical Process Control: An Introduction to Theory and Practice* (Prentice-Hall, 1984)

Reference books
As indicated during classes

U4.679 Major Industrial Project 24 units

Senior Advanced elective course for the degree in Chemical Engineering.

Syllabus summary: The course consists of the following components
1. Project
2. Case studies in project management
3. Case studies in hazard and environmental impact analysis
4. Case studies in process design and simulation

1. Project: This is the major component of the course. The project will be proposed by the sponsoring company in consultation withanacademicsupervisor. It will normally be carried out on the company's premises, using company resources; some projects may also involve work at the University. The project will encompass many of the features of the subject U4.680 Thesis, but its scope will be larger, and it will have additional objectives of an immediately practical nature for the sponsoring company.

The student will be required to submit a bound report to both the University and the sponsoring company by the deadline set from year to year for the subject U4.680 Thesis. In addition, the student will be required to present a full seminar (as distinct from the summary seminars presented in U4.680).

2. Case Studies in Project Management: The case studies will be proposed and managed by the sponsoring company in consultation with the lecturer in charge of the subject U4.640 Project Engineering 2. The case study will demonstrate principles of project management, management of large projects and a portfolio of small projects including planning techniques, organisation, control; also the management of commissioning and start up of process plant, and of maintenance.

3. Case Studies in Hazard and Environmental Impact Analysis: The case studies will be proposed and managed by the sponsoring company in consultation with the lecturers in charge of the subjects U4.696 Process Plant Risk Management, and U4.694 Environmental Impact Assessment.

The case studies will introduce the student to the principles of major hazard identification and management; to hazard and operability studies, and to the principles of reliability related to safety. They will also introduce students to occupational safety, industrial hygiene and the preparation of environmental impact reports.

4. Case Studies in Process Design and Simulation: The case studies will be proposed and managed by the sponsoring company in consultation with the lecturer in charge of the subject U4.684 Chemical Engineering Design 1. They are designed to introduce the student to commercially available physical properties and simulation packages; and to provide experience in the use of simulators in process design.

U4.681 Thesis 8 units

Senior Advanced core course for the degree in Chemical Engineering.

Prereq or Coreq Students should have completed or be enrolled in all other Senior Advanced core courses
Classes no formal classes. The thesis supervisor will be available for discussion at agreed times but the student is expected to work on his or her own initiative
Assessment written thesis and seminar

Syllabus summary: Students are asked to write a thesis, based on a modest, but significant research project, which is very often some aspect of a staff member's research interests. Most projects will be experimental in nature, but some may be largely theoretical or mathematical. Other topics may involve computer programming, feasibility studies, or the design, construction, and testing of equipment.

In undertaking the project, the student will learn how to examine published and experimental data, set objectives, organise a program of work, and analyse results and evaluate these in relation to existing knowledge. The thesis will be judged on the extent and quality of the student's original work and particularly how critical, perceptive, and constructive he or she has been, in assessing his or her own work and that of others.

Students are asked to nominate preferences from a list of available topics. Topics are allocated according to these preferences wherever possible. Deadlines are fixed each year for the submission of a thesis draft, and for the submission of the final thesis, typed and bound in an approved manner. Students are required to give a seminar, explaining the aims and achievements of their thesis.

U4.684 Chemical Engineering Design 1 4 units

Senior Advanced core course for the degree in Chemical Engineering.

Prereq U3.610 Unit Operations 1
Classes Sem 1: (3hrs lec & tut)/wk
Assessment one 2hr exam at end of Sem 1, plus assignments.

Syllabus summary: Introduction to process design. Design of pressure vessels and associated equipment. . Process flowsheeting. Sequential modular and equation-oriented approaches. Flowsheeting packages: structure, unit model libraries, thermo-

dynamics and physical properties models. Units and flowsheet degrees of freedom. Performance and design calculations. Process synthesis and analysis: conceptual design. Preliminary process optimisation. Short-cut design procedures.

Textbooks
Douglas *Conceptual Design of Chemical Processes* (McGraw-Hill, 1988)
Westerberg *et al. Process Flowslieeting* (C.U.P., 1979)

Reference book
Wells and Rose *The Art of Chemical Process Design* (Elsevier, 1986)

U4.685 Chemical Engineering Design 2 8 units

Senior Advanced core course for the degree in Chemical Engineering.

Prereq U3.610 Unit Operations 1, U3.621 Thermodynamics and U3.645 Project Economics
Coreq U4.684 Chemical Engineering Design 1
Classes Sem 2: approx. 8hrs informal classes, design and library work/wk
Assessment design report and contribution made to design group

Syllabus summary: The preparation of a detailed design project: flowsheet selection, heat and mass balances, detailed equipment design and costing, hazard assessment and hazard operability studies, environmental impact and project financial analysis.

U4.690 Reservoir Engineering 4 units

Senior Advanced elective course for the degree in Chemical Engineering.

Prereq U3.610 Unit Operations 1
Classes Sem: 4hrs/wk
Assessment one 3hr exam at end of course plus assignments

Syllabus summary: This course discusses the mathematical techniques that are commonly used to solve the partial differential equations describing the flow of oil and gas through reservoir rocks. The applications are drawn from reservoir engineering, but the solution methods apply more generally to multiphase flow through porous media. Equations for single phase flow in porous media. Steady state flow in 1 and 2 dimensions; aerial sweep efficiencies in regular well arrays. Miscible displacement processes: the convective-dispersion equation. Equations of flow for two-phase displacement processes in porous media. Linear one-dimensional flow: the Buckley Leverett solution to the two phase convection equation; shock front solutions; simulation methods. Application of the method of characteristics to partially miscible displacements involving two or three components.

Reference books
Dake *Fundamentals of Reservoir Engineering* (Elsevier, 1978)
Douglas *Conceptual Design of Chemical Processes* (McGraw-Hill, 1988)

U4.691 Process Systems Engineering 4 units

Senior Advanced elective course for the degree in Chemical Engineering.

Prereq U3.630 Computations and Statistics and U3.660 Process Control 1
Coreq U4.660 Process Control 2
Classes Sem 2: (3hrs lec/tut)/wk
Assessment 2.5hr exam at end of course plus assignments

Syllabus summary: Computer applications in process design, operation and control. Steady-state and dynamic process simulation. Process modelling. Process optimisation theory and applications including: on-line optimisation, linear and nonlinear programming. Available computer packages for process modelling and optimisation. Large scale flowsheet optimisation. Process control systems synthesis.

Reference books
Douglas *Conceptual Design of Chemical Processes* (McGraw-Hill, 1988)
Edgar and Himmelblau *Optimisation of Chemical Processes* (McGraw-Hill, 1988)
Reklaitis, Ravindran and Ragsdell *Engineering Optimisation: Methods and Theory* (John Wiley and Sons, 1983)
StephanopoulosC/iemfca/Process ControZ (Prentice-Hall, 1984)

U4.692 Optimisation Techniques 4 units

Senior Advanced elective course for the degree in Chemical Engineering.

Mutually exclusive with U4.691 Process Systems Engineering
Prereq U3.630 Computations and Statistics
Classes Sem: 4hrs lec & tut/wk
Assessment tut assignment on specific topics and one 2hr exam at end of course

Syllabus summary: Problem formulation, objective functions and constraints. Analytical and numerical search methods for single variable and multivariable systems. Linear systems, linear programming, network and distribution problems. Discrete sequential problems and dynamic programming. Flowsheeting programs and optimisation. Stochastic processes, queues, simulation, Monte Carlo methods.

Textbook
Edgar and Himmelblau *Optimisation of Chemical Processes* (McGraw-Hill, 1988)

Reference books
Fletcher *PracticalMethods of Optimisation,vol.I, Unconstrained Optimization* (John Wiley & Sons, 1980)
Fletcher *Practical Methods of Optimisation, vol. II, Constrained Optimization* (John Wiley & Sons, 1981)
Gill, Murray and Wright *Practical Optimization* (Academic Press, 1981)

U4.694 Environmental Impact Assessment 4 units

Senior Advanced elective course for the degree in Chemical Engineering.

Mutually exclusive with U4.490 Environmental Engineering if Environmental Impact Assessment forms part of U4.490
Prereq U3.610 Unit Operations 1 or U3.420 Thermo-fluid Engineering or U3.271 Transport Engineering and Planning
Classes Sem: one 3hr lec/wk; field trip and student seminar session; tut as arranged
Assessment tut assignments, report and one 2hr exam at end of course

Syllabus summary: The nature of environmental protection; air, water, noise pollution and waste disposal; hazard analysis; limnology, marine and terrestrial ecology; urban and regional planning; aesthetics; economic framework; social and political factors; environmental legislation and its implementation; environmental impact reports, case studies; field work.

Reference books

Berthoeux and Rudd *Strategy of Pollution Control* (Wiley, 1977)

A. Gilpin *Environmental Impact Assessment* (Cambridge U.P., 1995)

G. Kiely *Environmental Engineering* (McGraw-Hill, 1996)

Environmental Planning and Assessment Act, 1979, No. 203

Environmental Planning and Assessment Regulation, 1980

U4.695 Biochemical Engineering 8 units

Senior Advanced elective course for the degree in Chemical Engineering.

Prereq U2.610 Chemical Engineering 2

Coreq U2.066 Biochemistry 2 Auxiliary and U3.067 Microbiology 2

Classes Sem: 4 lec/wk, six 1hr tut sessions and four all-day lab sessions of 8-10hrs duration

Assessment assignments, lab reports and one 3hr exam at end of course

Syllabus summary: Evolution of biochemical engineering. A microorganism as a physio-chemical systern. Evolution of inicroorganisrnst Structure: and function of microbial growth. Biochemistry revision: structure of metabolism, major catabolic pathways, major anabolic pathways, metabolism of facultative aerobes. Integrated metabolism: rate-limiting sequences in microbial growth, transport into microbial cells and organelles, mass and energy balances, control of small metabolite concentrations (NADH and ATP), control of enzyme concentrations. Primary control of carbohydrate metabolism: catabolite repression, Pasteur effect, Crabtree effect. Environmental factors and microbial growth: growth requirements, concepts of limiting substrate, dissolved oxygen and carbon dioxide evolution, temperature and pH effects. Control of environmental factors; elementary instrumentation. Energetics of microbial growth; energetic requirements for the manufacture of cellular components, concepts of yield, maintenance energy, PO ratio, entropy and free-energy relationships, prediction of yield. Kinetics of microbial and animal and plant cell growth: single cell growth, cell cycle of bacteria, yeast and mammalian cells, typical batch growth curve. Continuous culture systems; chemostat, turbidostat, pH stat, continuous culture with recycle, multistage systems, plug flow reactors, enzyme reactors. Biological reactor design. The quantification of microbial growth; general principles for modelling complex systems, empirical and mechanistic models, Monod model, extensions to the Monod model including maintenance energy, viability, product inhibition, pH, etc. Unit operations in biochemical engineering: aeration and agitation, sterilisation and cleaning, fermenter design, product recovery scale-up. Industrial process: baker's yeast production, cheese manufacture, alternative fuels, food engineering, single cell protein, brewing, wine making, genetic engineering, amino acid production. Downstream processing. Economic analysis of the bioprocessing industry.

Textbook

Bailey and Ollis *Biochemical Engineering Fundamentals* IS edn (McGraw-Hill, 1986)

Reference books

Aiba *et al. Biochemical Engineering* (Academic Press, 1973)

Blakebrough *Biochemical and Biological Engineering Science* Vols 1-2 (Academic Press, 1968)

Mandelstam and McQuillan *Biochemistry and Bacterial Growth* (Blackwell, 1976)

Pirt *Principles of Microbe and Cell Cultivation* (Blackwell, 1975)

Solomons *Materials and Methods in Fermentation* (Academic Press, 1969)

Wang *et al. Fermentation and Enzyme Technology* (Wiley, 1979)

Whittaker and Stanbury *Principles of Fermentation Technology* (Pergamon, 1985)

Journal articles as indicated during classes

U4.696 Process Plant Risk Management 4 units

Senior Advanced core course for the degree in Chemical Engineering.

Classes Sem 2: 4hrs/wk involving 3hrs lec/tut and discussions

Assessment tut assignments and one 3hr exam

Syllabus summary: Inevitability of risk, types of hazard to people, the environment and property. Risk criteria or targets. Systematic hazard identification. Dimensions of risk. Quantification of consequences and frequency of hazardous incidents. Assessment of risks, risk contours. Role of the human factor. Inherent safety, and risk reduction by engineering and management approaches. Insurance, community and legal relationships. Case studies.

Reference book

Lees *Loss Prevention in the Process Industries* (Butterworths)

U4.697 Professional Option 2 units

Senior Advanced elective course for the degree in Chemical Engineering.

Prereq Credit for 145 units

Syllabus summary: Each student is required to carry out an assignmentrelated to the professionof Chemical Engineering; this will normally consistofa discussion of the design or operation of an industrial process. The discussion will be presented in the form of a written report, as a seminar, or both.

U4.689 Advances in Chemical Engineering A 4 units

Senior Advanced elective course for the degree in Chemical Engineering.

Classes Sem 1: 3hrs/wk

Assessment assignments, reports and one 3hr exam at end of course

Syllabus summary: This course will discuss the impact of current research and new technology on the

profession of chemical engineering; it will address the changes that are taking place in industrial processes as a result of new technologies.

The syllabus details will change from time to time as specialist lecturers become available.

U4.699 Advances in Chemical Engineering B 4 units

Senior Advanced elective course for the degree in Chemical Engineering.

Classes Sem 1:3hrs/wk
Assessment assignments, reports and one 3hr exam at end of course

Syllabus summary: This course will discuss the impact of current research and new technology on the profession of chemical engineering; it will address the changes that are taking place in industrial processes as a result of new technologies.

The syllabus details will change from time to time as specialist lecturers become available.

U4.720 Aerodynamics 3 4 units

Senior Advanced core course for the degree in Aeronautical Engineering.

Prereq U3.725 Aerodynamics 2
Classes Sem 1: 4 lec/wk with associated tut
Assessment written exam at end of Sem 1 plus course assignments

Syllabus summary: Lifting-line theory for three dimensional wings. Steady flow panel methods for aerofoil sections. Linearised compressibility corrections; wind tunnel corrections; the effects of aspect ratio and sweepback.

Aerofoil section boundary layer theory; pressure gradients; laminar to turbulent boundary layer transition; laminar separation bubbles; aerofoil stall. Calculation of aerofoil drag.

Steady two-dimensional supersonic flow; shock waves; method of characteristics. Two-dimensional supersonic aerofoils. Introduction to three-dimensional effects.

Reference books
Abbott and Von Doenhoff *Theory of Wing Sections* (Dover, 1959)
AndeisonFundamentals of Aerodynamics (McGraw-Hill, 1986)
Bertin and Smith *Aerodynamics for Engineers* (Prentice Hall, 1985)
John *Gas Dynamics* (Allyn & Bacon, 1984)
Jones and Cohen *High Speed Wing Sections* (Dover)
McCormick *Aerodynamics, Aeronautics and Flight Mechanics* (Wiley, 1979)
Milne-Thomson *Theoretical Aerodynamics* (Macmillan, 1966)
Pankhurst and Holder *Wind Tunnel Technique* (Wiley)
Schlichting *Boundary Layer Theory* (McGraw-Hill, 1960)

U4.725 Aerodynamics 4 4 units

Senior Advanced core course for the degree in Aeronautical Engineering.

Coreq U4.720 Aerodynamics 3
Classes Sem 2: 3 lec/wk with associated tut
Assessment written exam at end of Sem 2 plus course assignments

Syllabus summary: Three dimensional panel methods; lift distribution for arbitrary wing planforms; effects of fuselage and control surfaces. Unsteady subsonic aerodynamics; introduction to flutter and divergence Unsteady supersonic one-dimensional flow. Hypersonic flow; real gas effects. Rarefied gas flow. Introduction to transonic aerodynamics.

Reference books
AndeisonFundamentals of Aerodynamics (McGraw-Hill, 1986)
Bertin and Smith *Aerodynamics for Engineers* (Prentice Hall, 1985)
Bisplinghoff and Ashley *Principles of Aeroelasticity* (Dover, 1962)
Dowell *AModern Course in Aeroelasticity* (SijthoffNoordhoff, .1978)
Houghton and Brock *Aerodynamics for Engineering Students* (Edward Arnold)
John *Gas Dynamics* (Allyn & Bacon, 1984)
Liepmann and Roshko *Elements ofGasdynamics* (Wiley, 1957)
Thompson *Compressible Fluid Dynamics* (McGraw-Hill)

U4.730 Aircraft Structures 3 8 units

Senior Advanced core course for the degree in Aeronautical Engineering.

Mutually exclusive with U4.430 Applied Numerical Stress Analysis
Prereq U3.730 Aircraft Structures 1 and U3.735 Aircraft Structures 2
Classes Yr: 4 lec/wk
Assessment iat work assignments and rwo2hr exams

Syllabus summary: Plates and shells. Optimum structures. Buckling of bars, plates and shells; imperfection sensitivity. Structural dynamics. Structural fatigue; principles and practice. Finite element analysis; static and dynamic, for bars, plates and shells.

Reference books
Brush and Almroth *Buckling of Bars, Plates and Shells* (McGraw-Hill)
Cook *Concepts and Applications of Finite Element Analysis* (Wiley, 1981)
Cox *Design of Structures of Least Weight* (Pergamon, 1965)
Heubner *The Finite Element Method for Engineers* (Wiley Interscience)
Madag *Metal Fatigue: Theory and Design* (Wiley)
Roark *Formulas for Stress and Strain* (McGraw-Hill-Kogakusha)
Shanley *Strength Analysis of Aircraft Structures* (Dover)
Timoshenko and Woinowsky-Krieger *Theory of Plates and Shells* (McGraw-Hill-Kogakusha)
Washizu *Variational Methods in Elasticity and Plasticity* (Pergamon)
Zienkiewicz *The Finite Element Method in Engineering* (McGraw-Hill)
Library classification: 620, 620.11,624.17

U4.740 Aircraft Design 2 4 units

Senior Advanced core course for the degree in Aeronautical Engineering.

Prereq U3.740 Aircraft Design 1 and U3.725 Aerodynamics 2
Classes Yr: one 3hr class/wk
Assessment course assignments

Syllabus summary: Design requirements. Sources of information for aircraft design. Configuration design:

performance, weight and balance, propulsion. Aerodynamic design: lift, drag and control. Structural design: loads, philosophies, materials and analysis.

Systems design: requirements and specification system design procedures, systems integration.

Reference book
Torenbeek *Synthesis of Subsonic Airplane Design* (Delft U.P.)

U4.750 Flight Mechanics 3 4 units

Senior Advanced core course for the degree in Aeronautical Engineering.

Prereq U3.725 Aerodynamics 2 and U3.755 Flight Mechanics 2
Classes Sem 1:3 lec/wk with associated tut
Assessment written exam at end of sem and course assignments

Syllabus summary: Sources of flight dynamic modelling data.

Dynamic systems analysis techniques. Modelling and analysis of aircraft dynamic motions. Effects of inertial coupling between longitudinal and lateral-directional degrees of freedom. Gyroscopic motion.

Aircraft response to deterministic and stochastic inputs. Extended aircraft models. Sources of stochastic inputs and their characteristics.

Mechanics and models of aircraft control systems, sensors, components and devices. Motion measurement, signal analysis and conditioning.

Applications of closed loop control; modification of aircraft dynamic characteristics, stability and handling; guidance, manoeuvre control and navigation. Reference input signal characteristics and design. Transient response to control inputs.

Closed loop control systems; transfer functions for complete aircraft and control systems; stability and response characteristics of the closed loop system. Aircraft handling qualities description, specification and modification.

Reference books
D'Azzo and Houpis Linear*Control System Analysis and Design: Conventional and Modern* (McGraw-Hill, 1995)
Etkin *Dynamics of Atmospheric Flight* (Wiley, 1972)
Roskam *Airplane Flight Dynamics and Automatic Flight Controls* (RoskamA&EC, 19790

U4.770 Propulsion 4 units

Senior Advanced core course for the degree in Aeronautical Engineering.

Prereq U3.421 Thermodynamics and U3.725 Aerodynamics 2
Classes Sem 1:3 lec/wk with associated tut and project work
Assessment written exam at end of Sem 1

Syllabus summary: Propulsion unit requirements for subsonic and supersonic flight; thrust components, efficiencies, additive drag of intakes. Airscrew theory. Operation and thermodynamics of turbojet and turbofan engines; intakes and jet nozzles. Piston and other types of engines. Performance of propulsion units. Component design and performance. Noise and pollution.

Reference books
Glauert *The Elements of Aerofoil and Airscrew Tlieory* (C.U.P.)
Hill and Peterson *Meclianics and Thermodynamics ofPropulsion* (Addison-Wesley, 1965)
Kerrebrock *Aircraft Engines and Gas Turbines* (M.l.T. Press, 1977)

U4.775 Engineering Experience 4 units

Senior Advanced core course for the degree in Aeronautical Engineering.

Prereq 40 units of Senior courses
Classes 12wks prac work experience
Assessment a written report

Syllabus summary: Each student is required to work as an employee of an approved engineering organisation and to submit a satisfactory written report of his or her work. Normally 12 weeks of practical work experience (375 hours minimum) is required and this is undertaken after the completion of some or all of the prescribed Senior core courses and before enrolment in the final year of study. The University Careers and Appointments Service is available to assist students to obtain suitable employment.

U4.780 Seminar 2 units

Senior Advanced core course for the degree in Aeronautical Engineering.

Prereq Credit for 40 units of Senior courses

Syllabus suminary: Each student is required to give a seminar on a selected topic, and is expected to take part in the discussion sessions following the formal oral presentations of other students.

U4.785 Thesis or Design Project 12 units

Senior Advanced core course for the degree in Aeronautical Engineering. The honours course U5.785 Honours Thesis (16 units) may be taken instead of this core course by Honours candidates.

Prereq Credit for 40 units of Senior courses
Classes literature survey and experimental work
Assessment assessment by the supervisor of a submitted written thesis or design

Syllabus summary: Each student is required to conduct one piece of experimental, theoretical or design work in greater detail than is possible in ordinary classes and to write a thesis presenting the results of his or her investigations.

The student is expected to design and, if possible, construct any special apparatus or models that may be necessary.

Reference books
As advised

U4.790 Rotary Wing Aircraft 4 units

Senior Advanced elective course for the degree in Aeronautical Engineering.

Prereq U3.720 Aerodynamics 1 and U3.750 Mechanics of Flight 1
Coreq U4.720 Aerodynamics 3
Classes Sem 1: 3 lec/wk with associated tut
Assessment course assignments and a written exam

Syllabus summary: Introduction to rotary wing aircraft; vertical flight performance; forward flight performance; blade motion and control; dynamics of rotors; rotorcraft stabilities; rotor blade design.

Reference books
Bramwell *Helicopter Dynamics* (Arnold)
Gessow and Myres *Aerodynamics of the Helicopter* (Macmillan)

U4.791 Advanced Rotary Wing Aerodynamics 2 units

Senior Advanced elective course for the degree in Aeronautical Engineering.

Coreq U4.790 Rotary Wing Aircraft
Classes Sem: 2hrs/wk
Assessment course assignment

Syllabus summary: This course provides an extension of the course U4.790 Rotary Wing Aircraft in the specific area of blade aerodynamics.

Theory of rotating and translating blade elements. Vortex theory of rotor blades, including vortex formation, wake geometry and trailing vortices. Requirements for blade aerofoils and aerofoil design.

Reference book
NASA CR-3082

U4.792 Aviation Operation and Management 2 units

Senior Advanced elective course for the degree in Aeronautical Engineering.

Classes this course is given by visiting lecturers from airlines and by aviation officials. Times are arranged to suit lecturers and classes may be held in the evening. The course is not provided every year
Assessment to be advised during classes

Syllabus summary: Principles and practice of aviation and airline management. Discussion and analysis of airline operations. Discussion of flight safety and airworthiness standards.

Reference books
As advised during lectures

U4.793 Probabilistic Design 4 units

Senior Advanced elective course for the degree in Aeronautical Engineering.

Prereq U4.740 Aircraft Design 2
Classes Sem: 3hrs/wk
Assessment course assignments

Syllabus summary: Optimisation methods: linear and dynamic programming, simplex method.

Application of probability theory to loads, strength and structural degradation. Estimation of time to failure, survival rate and MTBF.

Optimisation of designs: replaceable, fail-safe, safe life and damage-tolerant systems. Minimum-weight and minimum cost optimisation.

Reference books
As advised during lectures

U4.795 Flight Mechanics 4 3 units

Senior Advanced elective course for the degree in Aeronautical Engineering.

Prereq U4.750 Flight Mechanics 3
Classes Sem 2: 3 lec & tut/wk
Assessment major assignment/project during Sem

Syllabus summary: Overview of aircraft dynamic system modelling.

Identification of dynamic systems. Model structure and parameter estimation. Introduction to parameter estimation techniques. Application to estimation of aircraft static, dynamic and control derivatives.

Aircraft state estimation. State estimation in the presence of noise and modelling errors. Introduction to Kalman filtering.

Overview of applications of digital flight control systems. Review of classical continuous system controller characteristics and control system design techniques. Discretised dynamic system characteristics. Controllability and observability. Modern control techniques and their application to guidance, control, navigation and structural-dynamic control problems. Common control system design software.

Reference books
LY Azzo and Houpis *Linear Control System Analysis and Design: Conventional and Modern* (McGraw-Hill, 1995)
Roskam AirplaneFlightDynamicsandAutomaticFlight Controls (Roskam A&EC, 1979)
Stevens and Lewis *Aircraft Control and Sjmulation* (Wiley, 1992)

U4.796 Advanced Computational Aerodynamics 2 units

Senior Advanced elective course for the degree in. Aeronautical Engineering.

Prereq U3.725 Aerodynamics 2
Coreq U4.720 Aerodynamics 3, U4.725 Aerodynamics 4
Classes Sem 2: one 1hr tut/wk
Assessment course assignments

Syllabus summary: Explicit methods; implicit finite difference and finite volume methods. Extensions to the basic method to capture shock wave effects. Computation of one- and two-dimensional flows. Benchmarkingofcomputationalresultsagainstknown flow solutions. ~

Reference book
C.A.J. Fletcher *Computational Techniques for Fluid Dynamics* Vols 1 and 2 (Springer-Verlag, 1992)

U4.797 Unsteady Aerodynamics 2 units

Senior Advanced elective core course for the degree in Aeronautical Engineering.

Prereq U3.720 Aerodynamics 1, U3.725 Aerodynamics 2
Coreq U4.720 Aerodynamics 3, U4.725 Aerodynamics 4
Classes Sem 2: (1hr lec/tut)/wk
Assessment course assignments

Syllabus summary: Advanced two- and three-dimensional panel method techniques; calculation of oscillatory flow results; prediction of aerodynamic derivatives. Pressure distributions for complete aircraft

configuration. Unsteady subsonic flow; rate derivatives; response to gusts; aeroelasticity; prediction of flutter and divergence.

Reference books

Abbott and Von Doenhoff *Theory of Wing Sections* (Dover, 1959)

Bertin and Smith *Aerodynamics for Engineers* (Prentice Hall, 1979)

Fung *An Introduction to the Theory of Aeroelasticity* (Dover, 1969)

Moran *Introduction to Theoretical and Computational Aerodynamics* (Wiley, 1984)

U4.802 Engineering Construction 3 4 units

Senior Advanced core course for the degree in Project Engineering and Management (Civil).

Prereq U3.801 Engineering Construction 2
Assessment coursework, project and written exam

Syllabus summary: Environmental impact assessment and mitigation, construction safety fundamentals, construction power/energy supply analysis and design, system and optimisation of temporary structures for both on- and off-shore facilities, construction techniques for large caisson, diversion and retaining structures.

U4.812 Operations Research 4 units

Senior Advanced core course for the degree in Project Engineering and Management (Civil). Elective course for other branches.

Prereq U2.000 Mathematics 2
Assessment coursework and written exam

Syllabus summary: Introduction to operations research in constructionmanagement,methods and procedures in operations research, problem formulation, optimisation functions and constraints, linear programming, transportation and network distribution systems, allocation of resources, inventory management, queues, simulation and Monte Carlo methods, discrete sequential problems and dynamic programming, reliability analysis.

U4.822 Value Engineering and Risk Analysis 4 units

Senior Advanced core course for the degree in Project Engineering and Management (Civil). Elective course for other branches.

Prereq U2.820 Engineering Economics
Coreq U4.823 Cost Engineering
Assessment project work and written exam

Syllabus summary: Value engineering techniques and methods, life cycle costing, cost/worthratio, creativity and brainstorming, overall and specific project risks using deterministic and probabilistic methods, computerised techniques for risk analysis.

U4.823 Cost Engineering 4 units

Senior Advanced core course for the degree in Project Engineering and Management (Civil). Elective course for other branches.

Assessment coursework, assignments and written exams

Syllabus summary: Estimating fundamentals, parametric estimating, preliminary and operational estimating, bidding strategy, quotations, tendering, cash flow projection and management, work analysis and design, productivity control, productivity database, computerised techniques for cost engineering.

U4.824 Project Formulation 4 units

Senior Advanced core course for the degree in Project Engineering.and Management (Civil). Elective course for other branches.

Prereq U2.820 Engineering Economics and U2.821 Engineering Accounting
Classes assessment and syllabus summary: see U4.293 Civil Engineering Project Design

U5.204 Thesis Honours 10 units

Senior Advanced elective course for the degree in Civil Engineering and in Project Engineering and Management (Civil).

Coreq a Senior core course in the field of the thesis
Classes Yr: 104hrs study
Assessment submitted typed thesis and oral presentation

Syllabus summary: A study, in groups of two students, of a selected topic in Civil Engineering. Detailed information sheets are available from the School of Civil and Mining Engineering at the beginning of the semester.

U5.213 Materials Honours 4 units

Senior Advanced elective course for the degree in Civil Engineering.

Coreq U4.214 Materials Aspects in Design
Classes 40hrs lec & 12hrs lab/tut
Assessment one 3hr exam plus assignments

Course objectives: To develop an understanding of advanced cement-based and metallic materials for new and challenging applications.

Course outcomes: Ability to select advanced cement-based and metallic materials for use under demanding service conditions for which their traditional counterparts may be less suitable.

Syllabus summary: Advanced cementitious materials, fibre-reinforced concrete. Modern ceramics and mechanisms for their toughening. High strength steels, stainless steels, multiaxial fatigue, impact strength of materials,stress corrosioncrackinginmetals. Thermal properties of mass concrete, dynamic effects on concrete properties, statistical analysis and interpretation of concrete data. Durability problems of prestressed and post-tensioned members. The laboratory sessions are held in the Microscope Unit and familiarise students with transmission and scanning microscopy, microanalysis and image analysis.

Reference books

Campbell-Allen and Roper *Concrete Structures: Materials Maintenance and Repairs* (Longman Scientific & Technical)

Others to be advised

Steel Structures Honours 4 units

Senior Advanced elective course for the degree in Civil Engineering.

Mutually exclusive with U4.238 Steel Structures 2
Prereq U3.235 Steel Structures 1
Classes 28hrs lec, 28hrs tut
Assessment one 3hr exam at end of the Sem plus assessment of assignment work

Course objectives: To develop a working knowledge of the analysis, behaviour and design of steel structures beyond a basic competency.

Expected outcomes: Proficiency in the analysis and design of steel structures

Syllabus summary: Three of the 4 subjects will be available: (1) Elastic and plastic analysis and design for bending and torsion in steel structures; (2) Elastic local buckling of plates, behaviour and design of plate web girders; (3) Flexural-torsional buckling—behaviour, analysis, and design; (4) Shell structures-behaviour, analysis, and design.

Textbooks
Gibson *Thin Shells* (Pergamon, 1980)
Standards Australia AS4100—*Steel Structures* (1990)
Trahair and Bradford *Behaviour and Design of Steel Structures* (Chapman & Hall, 1991)
Tiahaix Flexural-Torsional Buckling of Structures (Spon, 1993)
Vinson *The Behaviour of Plates and Shells* (Wiley, 1974)

Reference books
Bulson *Stability of Flat Plates* (Chatto & Windus, 1970)
Calladine *Theory of Shell Structures* (C.U.P., 1983)
Hugge *Stresses in Shells* (Springer Verlag, 1973)
Gould *Finite Element Analysis of Shells of Revolution* (Pitman, 1985)
Hancock *Design of Cold-Formed Structures* (AISC, 1994)
Kraus *Thin Elastic Shells* (Wiley, 1967,1983)
Timoshenko and Gere *Theory of Elastic Stability* (McGraw-Hill, 1961)
Other books as indicated during classes
Library classifications: 624.17,624.182

U5.225 Advanced Finite Elements Honours 4 units

Senior Advanced elective course for the degree in Civil Engineering.

Coreq U4.223 Finite Element Methods
Classes Sem: 26hrs lec & 26hrs tut
Assessment class work, assignments and one 3hr exam

Syllabus summary: Advanced elastic analysis, high order elements, isoparametric elements. Analysis of seepage and consolidation. Boundary element analysis, analysis of plates and shells. Advanced topics, computational techniques.

Textbooks
As prescribed during the course

Reference books
Crouch and Starfield *The Boundary Element in Solid Mechanics* (Allen & Unwin, 1983)
Zienkiewicz *The Finite Element Method* (McGraw-Hill, 1977)

U5.226 Finite Element Applications Honours 4 units

Senior Advanced elective course for the degree in Civil Engineering.

Assoc. Prof. Ansourian, Dr Clarke, Prof. Carter, Prof. Small
Coreq U4.223 Finite Element Methods
Classes Sem: 4hr/wk, including lec plus tut and computer lab sessions
Assessment assessment of computer assignments during Sem and one 2hr exam at end of course

Syllabus summary: Linear plate theory. Analysis of plate systems using finite strip and finite element methods. Finite element nonlinear analysis of frame structures, geometric and inelastic nonlinearities, solution techniques. Application of finite element packages to analysis of settlement, seepage, and consolidation. Use of microcomputers. Analysis of problems using finite layer methods.

Reference books
Bathe *Finite Element Procedures in Engineering Analysis* (Prentice-Hall, 1982)
Cheung *Finite Strip Method in Structural Analysis* (Pergamon, 1976)
Cook *Concepts and Applications of Finite Element Analysis* (Wiley, 1981)
Zienkiewicz *The Finite Element Method* (McGraw-Hill, 1989)
Relevant computer manuals
Library Classification: 624.171

U5.234 Structural Dynamics Honours 4 units

Senior Advanced elective course for the degree in Civil Engineering.

Assoc. Prof. Kwok, Prof. Hancock
Coreq U4.222 Structural Analysis 2 and U4.231 Structural Behaviour 2
Classes 26hrs lec & 26hrs tut
Assessment one 3hr exam

Syllabus summary: Structural dynamics, wind loading on structures. Finite element dynamic analysis, consistentmass matrix, dampingmatrix, free vibration, forced vibration, Eigenvalue routines.

Reference books
Clough and Penzien *Dynamics of Structure* (McGraw-Hill, 1982)
Thomson *Theory of Vibration with Applications* (Allen & Unwin, 1981)
Library Classification: 624.171,624.176

U5.239 Concrete Structures Honours 4 units

Senior Advanced elective course for the degree in Civil Engineering.

Assoc. Prof. Ansourian, Dr Reid
Coreq U4.222 Structural Analysis 2 and U4.231 Structural Behaviour 2
Classes 4hr/wk including lec and tut
Assessment one 3hr exam

Syllabus summary:
(a) Composite structures: shear connection, full and partial interaction. Simply supported and continuous beams, columns, bridge design, fatigue.
(b) Concrete structures: analysis of time-dependent effects in concrete structures: mathematical models of concrete creep and shrinkage, analysis of reinforced concrete beams, slabs and columns.

Non-linear behaviour of pres tressed and reinforced concrete sections and members; load-moment-curvature relationships; analysis of beams, columns and beam-columns; stability of members and frames.

Textbooks
Park and Paulay *Reinforced Concrete Structures* (Wiley, 1975)
Warner and FaulkesPresiressed *Concrete* (Longman Cheshire, 1988)
Australian Standard for Concrete Structures *AS3600-1988*
Library Classification: 624.183

U5.243 Soil Engineering Honours 4 units

Senior Advanced elective course for the degree in Civil Engineering.

Coreq U4.241 Soil Engineering
Classes 39hrs lec & 13hrs tut
Assessment one 3hr paper on the whole syllabus; assignment work may count towards the final assessment

Syllabus summary: Real soil behaviour. Models of soil behaviour. Advanced foundation analysis. Offshore geotechnology.

Reference books
Atkinson and Bransby *The Mechanics of Soils—An Introduction to Critical State Soil Mechanics* (McGraw-Hill, 1978)
Mitchell *Fundamentals of Soil Behaviour Qohn* Wiley & Sons, 1976)
Poulos *Marine Geotechnics* (Unwin Hyman, 1988)
Library Classification: 624.15, 624.16

U5.253 Surveying Honours 4 units

Senior Advanced elective course for the degree in Civil Engineering.

Coreq U4.251 Surveying 2
Classes Sem: 26hrs lec & 26hrs tut/lab
Assessment fieldwork and one 3hr exam at end of course

Syllabus summary: The earth—its motions, gravity field, size and shape, deformations. Geodesy and geophysics, classes of mathematical models. Leastsquares solution of over-determined problems. Positioning—point positioning, relative positioning, three-dimensional networks, horizontal networks, height networks. Precise surveys in industry and engineering. Satellite surveying. Remote sensing for engineers. Photogrammetry.

Textbook
Uren and Price *Surveying for Engineers* 2nd edn (Macmillan)

Reference books
Clark *Plane and Geodetic Surveying* Vol. II (Constable)
Vanicek and Krakiwsky *Geodesy: The Concepts* 2nd edn (North-Holland)
Library classification: 526.9

U5.267 Environmental Fluids Honours 4 units

Senior Advanced elective course for the degree in Civil Engineering.

Mutually exclusive with U4.265 Environmental Fluids 2
Prereq U3.262 Fluids 2
Classes 26hrs lec & 26hrs tut
Assessment one 3hr exam covering the whole syllabus at the end of the Sem. Satisfactory performance in class assignments is also a requirement. Credit will be given for assignment submissions, as indicated at the beginning of the course

Course objectives: To develop an understanding of: the methods of analysis of the turbulent flow of fluids; fluid flow in open channels under complex conditions; aspects of fluid-structure interaction; ocean waves and their effect on offshore structures; advanced flood analysis techniques.

Expected outcomes: Students will be able to: apply the Navier-Stokes equations to a range of different flow systems; describe the behaviour of flows in open channels near channel transitions; detail open channel surface profiles under sub- and super-critical flow conditions; describe several types of fluid structures, together with associated fluid-structure interaction, including, butnotlimited to, spillways, stilling basins, bridge piers, water supply intakes; list and evaluate the parameters affecting ocean wave generation and transmission; describe the behaviour of waves in shallow water and explain energy transfer by waves; calculate forces exerted on structures subjected to wave action; describe design considerations for flood detentionbasins; explain the principles of river routing and discuss the applications of flood modelling techniques and use of computer programs.

Syllabus summary: Advanced fluid mechanics. Waves. Flood analysis Advanced open channel flow. Aspects of fluid engineering.

Reference books
As advised during the course

U5.294 Civil Engineering Design Honours 4 units

Senior Advanced elective honours course for the degree in Civil Engineering.

Coreq U4.292 Civil Engineering Design
Classes 13hrs lec & 39hrs drawing office work
Assessment no formal exam; assessment will be based on submitted work

Syllabus summary: Aspects of the design cycle from concept to detailed design documentation are explored by way of selected project design assignments.

Design assignments will have a complexity requiring the selection and use of advanced analytical techniques and the interpretation of results, for incorporation in the design.

The course will be conducted by a practising professional engineer and will draw on the specialist expertise of academic staff.

Text and reference books
Advice will be given in class at the commencement of each assignment

U5.785 Honours Thesis 16 units

Honours course for the degree in Aeronautical Engineering. Alternative to the Senior Advanced core course U4.785 Thesis.

Prereq Credit for 36 units of Senior courses

Refer to course U4.785 for details.

Poor performance will lead to consideration for the award of a grade in the Pass course U4.785 only.

5 Other faculty information

General University information

This chapter of the handbook is concerned specifically wiLh the Faculty of Engineering. For further details about Hie LiiiversiU—its organisation, examinations, child care facilities, assistance for disabled students, housing, health, counselling, financial assistance, careers advice and a range of other matters—see the separate publication *Uiiivi'ivity of Sydney Diary,* available free from the Student Centre or from university of Syd ney U nion outlets.

The Faculty

Faculty adviser

You may discuss with the Secretary to the Faculty any questions about your studies, difficulties in maintaining your studies for financial or personal reasons, or any other questions or problems that may arise. *As difficulties can usually be handled more easily in the early stages, you should seek help without delay.* Discussions are held in strict confidence—simply come to the Faculty Office, in Room 226, Engineering Faculty Building and make an appointment.

Noticeboards

Faculty noticeboards, one for Junior courses and one for Intermediate courses, located outside the Student Enquiry Office, 2nd level, Faculty Building. Each of the Engineering departments has a noticeboard for Senior and Senior Advanced students.

Noticeboards are also in the various Science departments, and information concerning the courses given by those departments will be posted on these boards.

Details of class lists, timetable variations, examination times and other information relating to courses of study will be posted on the relevant noticeboards. Students are expected to inspect the noticeboards at frequent intervals.

Notices referring to cadetships, scholarships, vacation employment and career opportunities and other matters of this nature are also displayed on the noticeboards in and around the Student Enquiry Office, 2nd level, Engineering Faculty Building.

The Faculty library

The University of Sydney Library consists of a central library—called Fisher Library—and a number of branch libraries of which Engineering is one. The Engineering Library is on the ground floor of the PNR Building in the Engineering Precinct. Other branch and department libraries within the University contain relevant material, e.g. Architecture, Physics, Mathematics, Chemistry, Wolstenholme and Badham Libraries. Engineering students may use all the libraries of the University.

Multiple copies of reference books for Junior and Intermediate courses are held in the undergraduate section of Fisher Library. Students in the senior years in Engineeri ng will find most of their reference material in the Engineering Faculty Library. Books may be borrowed for two weeks with two loan renewals permitted. Journals may not be borrowed but photocopying facilities are available.

The Engineering Library opens from 8.45 am to 6.00 pm Monday-Friday during term. Vacationhours are 9.00 am to 5.00 pm Monday to Friday.

Dewey Decimal Classification numbers are given for some courses in chapter 4: *Courses of Study.* These are not meant to be exhaustive lists and reference should also be made to the subject catalogue in the library.

Engineering associations

SUCEA

The Sydney University Chemical Engineering Association (SUCEA) is a body representing the graduates of the Department of Chemical Engineering. Established in the 1950s, it is one of the oldest alumni associations at the University of Sydney. With 1326 members living in over 20 countries around the world, it is also one of the largest.

SUCEA holds a number of social events and a technical symposium each year with the aim of maintaining strong contact between the Department and its graduates (some of whom are well into their sixties). So, via SUCEA, you will still be part of the 'Chem Eng' family even after you graduate.

SUEUA

The objects of SUEUA, the Sydney University Engineering Undergraduates' Association, are:

(a) to perform such actions and to organise such functions as the committee may deem necessary and desirable in the interests of the Faculty of Engineering, University of Sydney, and the students thereof;

(b) to act as an intermediary body between the teaching staff on the one hand and the members of the Association on the other;

(c) to organise Engineering teams for inter-faculty sport.

The office of the SUEUA is on the ground floor of the PNR Building close to the Faculty library.

In this office the association conducts a bookshop where many items of stationery, and some textbooks and codes of practice, are available at competitive prices.

The SUEUA normally holds an election for the president and other office bearers in March each year and all financial members of the association are eligible to vote. The president becomes a member of the Faculty by virtue of this office. The by-laws of the University provide for the undergraduates in

Engineering to elect two others of their number to be members of Faculty and an election for this purpose is conducted in October each year. All Engineering undergraduates, including those enrolled in the Faculty of Science as candidates for the double degree, are eligible to vote.

Institution of Engineers, Australia

The professional body for Engineering in Australia is the Institution of Engineers, Australia, whose first objective is to 'promote the science and practice of engineering in all its branches'.

The institution functions through a series of divisions, the local one being the Sydney Division. Within each division are branches representing the main interests within the profession—e.g. civil, electrical, mechanical, chemical and transportation to name a few.

Any student of an approved School of Engineering can join the Institution as a student member (StudlE Aust).

As a student member you will receive the fortnightly magazine *Engineers Australia,* containing articles of general engineering interest and advising you of site tours, conferences, technical meetings of all branches, harbour cruises, film nights, and so on.

Student members may freely use the comprehensive library and reference facilities maintained by the Institution—a handy place to obtain a hard-to-get book or periodical.

Within most divisions is a Graduates and Students Section, known as GAS, and all graduates of, or students at, approved engineering schools are eligible for membership.

The Graduates and Students Sections organise film nights, site tours and o ther activities of general interest. The MalcolmStanley Speakers' Competitionf or public speaking is held each year, usually in September, and prizes are awarded for the best speeches.

Formembershipinformationandapplicationforms enquire at the Faculty Office or at the Sydney Division Office, 118 Alfred Street, Milsons Point 2061 (P.O. Box 138).

The Institution of Chemical Engineers

An alternative organisation for Chemical Engineering students is the Institution of Chemical Engineers. The Institution welcomes and values student members, offering special rates for technical meetings, together with Institution literature and guides to gaining employment. For further information contact the General Office in Chemical Engineering.

The Association of Professional Engineers, Scientists and Managers, Australia

APESMA is a professional organisation that represents the industrial interests of its members. Its major focus is onproviding advice and assistance on employment-related matters, including individual representation and improving salaries and conditions for professional engineers, scientists and managers. The Association also provides members with legal, financial and insurance services and runs an extensive management education program.

APESMA has some 19 000 members in all areas of public and private sectors in Australia. In addition, 6500 university students in engineering and science-related disciplines are student members.

The Association invites students to become affiliate members for no charge while they are studying. This membership gives students access to information and advice on industrial experience, salary rates for graduates and contracts of employment. Student members receive *The Student Update,* a publication designed specifically for students, three times a year. This gives students some practical insight into aspects of the workplace to which they may not have given much thought, in particular the employment issues that affect them as professional engineers.

For more information and student membership application forms, contact Felicity Ryan, Membership Liaison Officer, tel. 9264 9500.

Enrolment

Special enrolment instructions

These are the special requirements for Engineering students.

To complete your enrolment in Engineering you proceed to the PNR Enrolment Centre in the Drawing Office, where you

—collect your enrolment form,
—complete a registration form,
—consult an adviser about your plan of courses and
—record your courses on the computer and receive your timetable.

Examinations

Freedom of Information Act

Examination scripts, or copies of same, are available for viewing or collection from Departmental Offices for three months after final examinations each year, after which they will be shredded.

Enquiries

The Engineering Faculty Office is open for enquiries about Junior and Intermediate results during January. All enquiries should be made *in person* during this period. Enquiries about the Senior and Senior Advanced results should be made to the adviser in the appropriate department.

Supplementary examinations

A supplementary examination may be granted by the Faculty:

(a) to candidates whose performancein an examination has been significantly affected by duly certified illness or misadventure;

(b) to candidates who have failed an examination but whose overall level of performance in the year's work is deemed sufficient to warrant the concession of a further test.

Supplementary examinations under category (b) are normally granted *only* to those candidates who are in their first year of attendance.

The award of supplementary examinations is a privilege and not a right.

Illness or misadventure

The Faculty of Engineering recognises that the performance of students may be adversely affected by illness or other misadventure, and makes provision for special consideration of such disabilities when examination results are considered.

Any student who believes thathis/her performance has been or may be adversely affected by an occurrence of illness or misadventure may request the Faculty to make special consideration of same. All such requests must include a special consideration application on the form provided by the Faculty, supplied within one week of the occurrence and accompanied by an appropriate medical certificate or other relevant documentary evidence apart from the student's own submission. Such certificates or documentary evidence ***should state not only the nature of the illness or misadventure but also (where relevant) the opinion of the issuer as to the extent of the disability involved.***

If the student has completed the assessment for which special consideration is requested, then further documentary evidence of the extent of the disability from a specialist medical practitioner/counsellor etc. must also be supplied. For example, if a student completes an examination but still wishes to request special consideration for it, this additional specialist evidence is required.

Finally, the Faculty intends only to compensate for sub-standard performance in assessments which do not reflect a student's true competence in a subject, and such provisions must not act to the disadvantage of other students. The Faculty will only compensate students when there is clear evidence that results have been adversely affected by the disability for which special consideration is requested.

Financial assistance

Special assistance

In certain circumstances assistance is available to students who encounter some unforeseen financial difficulty during their studies. The assistance is usually in the form of bursaries or interest free loans.

Students wishing to apply for financial assistance should make enquiries from either of the following:

Financial Assistance Office, Student Services, tel. 93512416.

President of the Students' Representative Council, tel. 9660 5222.

J.N. Ellis Memorial Fund

The J.N. Ellis Memorial Fund was established in 1969 following an appeal made to all graduates in engineering to honour the memory of Neil Eilis, who as Sub-Dean and later as Administrative Assistant to the Dean over a considerable period of years was able, by sympathetic counselling, to help many students who were having difficulties in completing their studies.

The object of the fund is to provide financial assistance to students in the Faculty of Engineering who are in such a position that without assistance they would not be able to continue their studies. Students seeking such assistance should apply to Financial Assistance, Student Services, tel. 9351 2416. Awards are made on the recommendation of the Dean. Value: $500. Applications may be made at any time.

Those who receive assistance from the fund are asked to make a contribution to it when they are financially able to do so. In this way the fund will be able to continue and grow in the extent to which it can help deserving students in future years.

Learning assistance

The University's Learning Assistance Centre offers a wide range of workshops and other activities to assist students develop the learning and language skills needed for academic study. The workshops are available free to all enrolled students of the University. Workshop topics include essay and assignment writing, oral communication skills, studying at university, conducting research.

The Learning Assistance Centre is located on Level 7 of the new Education Building next to Manning House (tel. 9351 3853).

Cadetships, scholarships and prizes

Many students enrolling in the Faculty of Engineering obtain financial assistance by way of a cadetship or scholarship, either at the time of enrolment, or at a later stage in their studies.

Information about the Australian government *Austudy Scheme* is available from the State Director, Department of Employment, Education and Training, 477 Pitt Street, Sydney 2000.

Scholarships are also awarded by a number of industrial organisations. Many of these do not require the student to enter into a financial bond.

Some government departments and public authorities provide cadetships or traineeships which require the student to enter into an agreement to work for the employer for a specified number of years after graduation.

Before accepting a bonded cadetship or traineeship students should give careful consideration to the conditions of the award and in particular the obligations which they will incur should they decide to relinquish the award for any reason.

A list of currently available prizes and scholarships is available from the University's Scholarships Office in the Main Quadrangle, tel. 9351 3250.

6 Postgraduate study

The Faculty of Engineering offers a wide range of postgraduate research and coursework programs within the Departments of Aeronautical, Chemical, Electrical and Mechanical and Mechatronic Engineering and the specialisation, Environmental Engineering.

Full details of the postgraduate degrees and diplomas are contained in a leaflet which is available from the Faculty Office.

Doctor of Engineering

The senior of the higher degrees in the field of engineering is the DEng degree. Originally called Doctor of Science in Engineering, DScEng, the name was changed to Doctor of Engineering in 1981. The degree is awarded for distinguished published work. The first doctorate in engineering was conferred in 1924.

DScEng
John Job Crew Bradfield, 1924
William George Baker, 1932
David Milton Myers, 1938
David Lipscombe Hollway, 1954
Bernard Yarnton Mills, 1959
Robert Thomas Fowler, 1960
James Brydon Rudd, 1962
John Ernest Benson, 1975
Harry George Poulos, 1976
George Kossoff, 1981
Robert Henry Frater, 1982

DEng
John Robert Booker
Bhushan Lai Karihaloo
Kerry Rowe
Nicholas Snowden Trahair

Doctor of Philosophy

The degree of Doctor of Philosophy is a research degree awarded for a thesis considered to be a substantially original contribution to the subject concerned. This degree is becoming a prerequisite for research appointments in government and industrial research and development laboratories.

Applicants should normally hold a master's degree or a bachelor's degree with first or second class honours of the University of Sydney, or an equivalent qualification from another university or institution.

The degree may be taken on either a full-time or part-time basis.

In the case of full-time candidates, the minimum period of candidature is six semesters (3 years). The maximum period of candidature is normally ten semesters.

Part-time candidature may be approved for applicants who can demonstrate that they are engaged in an occupation or other activity which leaves them substantially free to pursue their candidature for the degree. Normally the minimum period of candidature will be determined on the recommendation of the Faculty but in any case will not be less than six semesters; the maximum period of candidature is normally 14 semesters.

The Faculty may admit some applicants on a probationary basis for a period not exceeding twelve months.

Master of Engineering

Graduates in engineering of the University of Sydney who have had at least three years' experience after graduation may be admitted as candidates for the ME degree. The award is made for a thesis or a design of special merit, and maybe looked upon as an external degree reserved by the Faculty for its own graduates.

Master of Engineering (Research)

The Masterof Engineering (Research) degree provides candidates with opportunities to develop specialist interests through a program of supervised research (theoretical or applied), shorter than the three years usually required for the PhD degree. Candidature is normally on a full-time basis but may also be undertaken part-time. The ME(Res) degree may be undertaken in the Departments of Aeronautical, Chemical, Electrical or Mechanical Engineering in the School of Civil and Mining Engineering

The minimum academic entry requirement is normally the 4-year Bachelor of Engineering degree from the University of Sydney with first or second class honours in the same branch of engineering as that in which the ME(Res) degree is to be undertaken, or an equivalent qualification from ano ther university or tertiary institution. In exceptional circumstances a graduate in engineering with a pass degree or a graduate with an honours degree in a different branch of engineering or from another Faculty may be admitted to candidature but such an applicant may be required to undergo a preliminary examination.

The Faculty may admit some applicants on a probationary basis for a period not exceeding twelve months.

The minimum period of candidature is one year full-time and two years part-time and the maximum period of candidature is two years full-time and three years part-time. If a candidate is required to undertake a preliminary examination then the candidature commences after the completion of the preliminary examination.

Special attentionis drawn to the need for applicants to provide concise details of their proposed research program including aims and methodology and evidence of their ability to carry out intensive research and advanced study. Candidates who enrol for this degree with the object of later transferring to candidature for the PhD degree should select a research project that is suitable for this purpose.

Applicants admitted to candidature for the ME(Res) degree are expected to workindividually on advanced study and research under the direction of a supervisor, with whom regular consultation about their work and the general planning of their thesis is required. On completion of their candidature a thesis must be submitted embodying the results of their work.

Master of Engineering Studies

The MES degree provides candidates with programs of formal coursework alone or coursework and applied research aimed at meeting the professional development needs of engineers and scientists in the private and public sectors of industry and in private practice.

The minimum academic entry requirement is the 4-year Bachelor of Engineering degree from the University of Sydney, or an equivalent qualification from.another university or tertiary institution.

The minimum period of candidature is one year full-time and two years part-time and the maximum period of candidature for all candidates is two years full-time and three years part-time.

Candidates for the MES have two alternative methods of candidature, by coursework alone or by coursework and project. They are required to complete either 30 units of coursework or at least 20 units of coursework and a design or research project valued at 10 units.

Candidates may choose to complete the units of coursework from the same subject area or fromrelated subject areas, in the same department or school, or they may choose to complete all subjects from departments other than the one in which they are primarily studying. Candidates may also be given permission to take subjects from another Faculty at this University or from another tertiary institution such as the University of New South Wales or the University of Technology, Sydney. If you wish to apply to count subjects from another tertiary institution, you would of course need approval from that institution to enrol there and the permission of the University of Sydney.

The regulations in regard to coursework taken external to the Faculty are:

- Up to 12 units and a maximum of 4 approved subjects can be taken in other Faculties or external to the institution
- Up to 12 units of approved business related subjects.
- A maximum of 5 units of approved undergraduate engineering subjects can be taken within the Faculty at this university.
- A minimum of 50% of all coursework must be undertaken within the Faculty of Engineering at the postgraduate level.
- Approval to take courses at another institution is given on the understanding that you may not count these courses towards a degree, diploma or any other qualification at the other institution where you are taking them.
- A candidate who fails to demonstrate satisfactory progress may be asked to show good cause why his or her candidature should not be terminated. A candidate who fails (or discontinues without permission) in more than 2 courses or 6 units (whichever is the higher) will be deemed not to have made satisfactory progress and may be asked to show good cause why he or she should be allowed to re-enrol.

Most postgraduate subjects are run in the afternoon or evening.

A 1-hour lecture each week for one semester (i.e. 14 weeks) together with the associated tutorial, laboratory and assignment work, is rated normally as one unit.

For their projects, candidates are encouraged to select problems based on their professional experience or their researchinterests. Many projects will be closely related to the research activity within the Faculty, and in some cases it may be possible for original work to be reported in the project report. A design study or a critical examination of a professional problem may also be acceptable as a project. The work on the project is expected to occupy about one-third of a candidate's total program, i.e. a maximum of 10 units credit.

Aeronautical Engineering

There is no coursework program currently available.

Chemical Engineering

There is no coursework program currently available.

Civil Engineering

The School of Civil and Mining Engineering offers the MES coursework program in the areas of Geotechnical Engineering, Structural Engineering and Structural and Foundation Engineering.

You should note, however, that the School of Civil and Mining Engineering may not be able to offer all its courses each year, so that even a full-time candidate may take 18 months or two years to complete the degree requirements in that School.

Electrical Engineering

The Department of Electrical Engineering is not able to offer its full coursework program each year. It therefore may take candidates two years to complete the degree requirements.

Mechanical and Mechatronic Engineering

The coursework program is available on both a full- and part-time basis in Mechanical Engineering There is no Masters program in Mechatronic Engineering available at present.

In order to complete the degree requirements in one year, however, a candidate would need to take subjects from those offered by other departments or by another tertiary institution.

Environmental Engineering

The Faculty of Engineering offers a coursework program in Environmental Engineering for the MES degree and DipEnvironEng. While the program is managed by the Department of Chemical Engineering, teaching is by Chemical, Civil and Mechanical Engineering, as well as by other departments in the University.

Both MES and Diploma candidates will be required to complete certain core requirements:

- MES candidates will need to choose at least 15 units from the list of postgraduate environmental subjects taught by the Faculty of Engineering and Diploma candidates 10. The course P4.300 Environmental

Impact Assessment will be a core requirement for all candidates within these 15/10 compulsory units. This will mean that 50% of the coursework will have to be taken from postgraduate Environmental Engineering subjects.

- All candidates will also be required to complete at least one subject from each of the approved Economics subjects and Planning and Law subjects.
- The remaining units to be completed may be chosen from any of the postgraduate subjects offered by the Faculty of Engineering.

Diplomas

Courses leading to the award of a diploma are currently available in the following specialist areas:

Geotechnical Engineering	DipGeotEng
Structural Engineering	DipStructEng
Structural and Foundation Engineering	DipStructFoundEng
Power Engineering	DipPowEng
Computer Systems Engineering	DipCompSystEng
Telecommunications	DipTelecomm
Environmental Engineering	DipEnvironEng

The minimum academic entry requirement is the 4-year Bachelor of Engineering degree from the University of Sydney, or an equivalent qualification from another university or tertiary institution.

The minimum period of candidature is one year full-time and two years part-time and the maximum period of candidature for all candidates is two years full-time and three years part-time.

Candidates are required to complete 20 units of coursework, chosen from the subjects available for the MES degree. The Diploma requirements differ from the MES requirements only in that no project is required.

The School of Civil and Mining Engineering offers Diplomas in Geotechnical Engineering, in Structural Engineering and in Structural and Foundation Engineering. As for the MES, even full-time candidates could take 18 months to two years to complete the diploma requirements.

The Department of Electrical Engineering offers Diplomas in Computer Systems Engineering, in Power Engineering and in Telecommunications. As for the MES degree, it may take candidates longer than the minimum period of candidature to complete the Diploma requirements.

The Diploma in Environmental Engineering is managed by the Department of Chemical Engineering. The teaching is provided by Chemical, Civil and Mechanical Engineering and by other teaching departments in the University. As for the MES in Environmental Engineering, the DipEnvironEng has certain requirements:

- Diploma candidates will need to choose at least 10 units from the list of postgraduate environmental subjects taught by the Faculty of Engineering.
- The course P4.300 Environmental Impact Assessment will be a core requirement, as will the completion of at least one subject from each of the approved Economics and Planning and Law subjects.

The Committee for Postgraduate Studies of the Faculty of Engineering has prescribed subjects which may be taken by candidates for the degree of Master of Engineering Studies and by candidates for postgraduate diplomas within the Faculty.

Note: For information about these subjects, please contact the Faculty or GSE Office, or the coursework adviser in your school or department.

Appendix: Explanation of symbols for courses of study

Symbols may have been used in the courses of study chapter in the handbook as a succinct way of presenting teaching and assessment information. Because of the varied nature of the work described and occasional difficulties in interpretation and typesetting, such details are not construed as a firm undertaking. Students are advised to check details with the departments concerned. The significance of symbols used is as follows:

Hypothetical examples of symbols used

Title of course	**Double Dutch** 1
Actual lecturers	Assoc. Prof. Holland Dr Nederlands
Allied studies	*AKn* HSC German
Class contact & course duration	Classes Yr: (3 lec & 1 tut)/wk
Exams, essays, etc.	*Assessment* one 3hr exam, two 2000w essays/sem, 4 tut papers/sem

Title of course	**8766 Star Wars 5**
Actual lecturers	Dr Lazer Ms Gunn
Allied studies	*Prereq* 7653 *Coreq* Intro. Media Manipulation
Class contact & course duration	*Classes* Sem 1: (2 lec & 3 tut/prac)/wk; Sem 2: (2 lec & 2 tut/prac)/wk
Exams, essays, etc.	*Assessment* one 3hrexam/sem, classwork

Allied studies

AKn	assumed knowledge
Prereq	prerequisite (you must have passed the indicated prerequisite before you start the course)
Coreq	corequisite (you must enrol in this course at the same time unless you have already passed it)

Type of class contact/assessment

class	class contact of any form
lab	laboratory
lec	lecture
prac	practical
tut	tutorial
exam	examination
tut paper	tutorial paper

Duration

hr	hour
Sem 1	Semester 1
Sem 2	Semester 2
Yr	throughout the year

Frequency

/wk	per week
/fn	per fortnight
/sem	per semester
/yr	per year

Examples

Classes

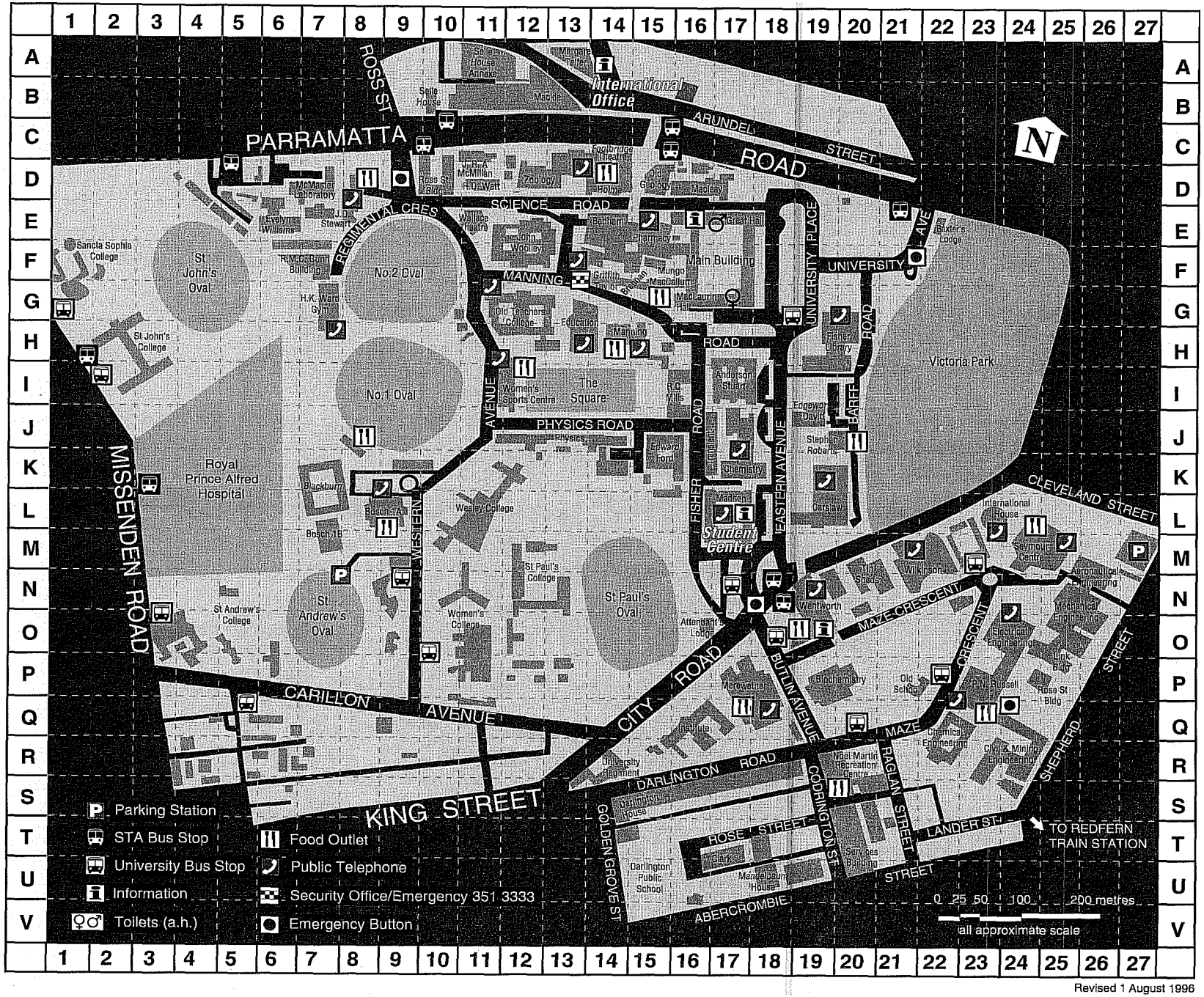
Sem 1:1 class/wk	one class work session each week during Semester 1
Yr: (2 lec & 3 tut/prac)/wk	two lectures and three tutorials or practicals weekly, throughout the year
Sem 2: 3 lec/wk & 1tut/fn	three lectures per week and one tutorial per fortnight, during Semester 2

Assessment

one 3hr exam	one 3-hour exam
two 3hr exams/sem	two 3-hour exams per semester
one 2000w essay	one 2000-word essay
one 3000w essay, two 2000w essays/sem, 4 tut papers	one 3000-word essay for the course, two 2000-word essays per semester and four tutorial papers for the course
(one 3000w & two 2000w essays)/sem	one 3000- and two 2000-word essays per semester

Departments, schools and buildings – main campus

Academic & Executive Services 16E
Accounting 17P
Administrative Policy & Strategic Planning Division 16E
Administrative Support Services Division 16E
Aeronautical Engineering 26M
Agricultural Chemistry & Soil Science 10D
Agricultural Economics 11D
Agriculture Faculty Office 11C
Alma Street Glasshouse 23N
Anaesthesia 7K
Anderson Stuart Bldg 17I
Anatomy & Histology 17I
Animal Science 7F
Anthropology 16F
Archaeology, Classics & Ancient History 16F
Architectural & Design Science 22M
Architecture, Dept & Faculty Office 22M
Archives 19H
Art Workshop 20M
Arts Faculty Office 16F
Asset Management 13A
Asian Studies 14F
Attendant's Lodge 16O
Badham Bldg & Library 14E
Banks (see Financial institutions)
Baxter's Lodge 22E
Behavioural Sciences in Medicine 7K
Biochemistry 20P
Biological Sciences 16D
Blackburn Bldg 7K
Bookshops:
Medical 7K
SRC Secondhand 19N
University Co-operative 16J
Bosch 1A (lecture theatres) 8L
Bosch 1B Bldg 7M
Botany 16D
Brennan, C., Bldg 15F
Business Liaison Office 13D
Business Services 19U
Campus Services 20T
Careers Centre 13B
Carslaw Bldg 19L
Cashiers 13A
Celtic Studies 12E
Central Services 22E
Centre for English Teaching 17L
Centre for Teaching & Learning 19L
Chancellor's Committee Shop 17F
Chaplains' Centre 10G
Chemical Engineering 22Q
Chemistry 17K
Child Care:
Boundary Lane 16U
Carillon Avenue 9Q
Laurel Tree House (Glebe) 16B
Union (Darlington) 21S
Civil & Mining Engineering 24R
Clark Bldg 17T
Clock Tower 17F
Community & Alumni Relations 19H
Computer Science, Basser Dept 17L
Continuing Education, Centre for 13B
Coppleson Postgraduate Medical Institute 9K
Counselling Service 13G
Crop Sciences 13F
Darlington House H66 14S
Development Office 16O
Disability & Welfare Services 13G
Econometrics 17P
Economic History 17P
Economics, Dept & Faculty Office 17P
Edgeworth David Bldg 19J
Education Bldg & Faculty Office 13G
Educational Development & Evaluation 15K
Educational Psych., Measurement & Technology 13G
Edward Ford Bldg 15K
Electrical Engineering 24O
Employment Service, Casual 13C
Engineering Faculty Office 25O
English 12E
Equal Employment Opportunity Unit 16S
Evelyn Williams Bldg 6E
Experimental Medicine 7K
External Relations Division 16E
Facilities Planning, Office of 20T
Financial institutions:
Commonwealth 14C
Credit Union 14D
National Australia 15E
National Australia 19N
Financial Assistance 13G
Finance, Dept of 16Q
Financial Management & Reporting 13A
Financial Services Division 16E
Fine Arts 15I
Fisher Library 19G
Footbridge Theatre 14C
French Studies 15F
Garage, University 21T
Geography 16Q
Geology & Geophysics 19J
Germanic Studies 15F
Government & Public Administration 17P
Great Hall 18E
Greek, Modern 14F
Griffith Taylor Bldg 14F
Gunn, R.M.C., Bldg 7F
Health Service
Holme Bldg 14C
Wentworth Bldg 19N
History 15G
History & Philosophy of Science 19L
Holme Bldg 14C
Industrial Relations, Dept of 16Q
Infectious Diseases 7K
Information Technology Services 19U
Institute Bldg 16Q
International Office & International Student Services 13A
International House 23L
Italian 15I
Koori Centre 12G
Language Centre 14F
Learning Assistance Centre 13G
Linguistics 16J
Link Bldg 25O
Lost Property 14F
Mackie Bldg 13B
MacLaurin Hall 16G
Macleay Bldg &Museum 16D
Madsen Bldg 17L
Mail Room (Internal) 20T
Main Bldg 17F
Mandelbaum House 18U
Manning House 14H
Margaret Telfer Bldg 13A
Marketing, Dept of 16Q
Marketing & Publications 11E
Mathematics & Statistics 19L
McMaster Laboratory CSIRO 7D
McMillan, J.R.A., Bldg 11C
Mechanical & Aeronautical Engineering Bdg 25N
Mechanical Engineering 25N
Media Office 16E
Medicine 7K
Medicine, Dept of 7K
Medicine Faculty Office 15K
Merewether Bldg. 17P
Microbiology 20P
Mills, R.C., Bldg 15I
Mungo MacCallum Bldg 15G
Music 24M
Nicholson Museum 16G
Obstetrics & Gynaecology 9K
Occupational Health 15K
Old Geology Bldg 15D
Old School Bldg 21P
Old Teachers' College Bldg 12G
Operations Accounting 13A
Pathology 7K
Performance Studies (entrance Manning Rd) 12F
Personnel Services 13A
Pharmacology 7M
Pharmacy 15E
Philosophy 17G
Photowise Imaging 20T
Physics 13J
Physiology 17I
Planning Support Office 16E
Post Office 15E
Printing Services, University 20T
Properties & Investments 13A
Psychological Medicine 4K
Psychology 14F
Purchasing 20T
Publications Unit 16E
Public Health & Community Medicine 15K
Quadrangle 17F
Queen Elizabeth II Research Institute 9K
Regiment, University 14R
Religion, School of Studies in 12E
Research & Scholarships 16E
Revenue Services 13A
Risk Management 13A
Rose Street Bldg 24P
Ross Street Bldg 10D
Russell, Peter Nicol, Bldg 23P
St Andrew's College 2 5O
St John's College 3 3H
St Paul's College 4 12N
Sancta Sophia College 5 1F
Scholarships 16F
Schools Liaison 11E
Science Faculty Office 19L
Security & Bldg Services 14F
Selle House 10B
Semitic Studies 17F
Senate Room 16G
Services Bldg 20T
Seymour Theatre Centre 24M
Shepherd St Parking Station 27M
Sir Hermann Black Gallery 19N
Social & Policy Studies in Education 13G
Social Work & Social Policy 15I
Solicitor, University 16E
Sports:
Noel Martin Recreation Centre 20R
Sports Union 7G
Swimming Pool 20R
Tennis courts 20D
Ward, H.K., Gymnasium 7G
Women's Sports Association 12I
Stephen Roberts Theatre 20J
Stewart, J.D., Bldg 8E
Stores 20T
Student Centre* 17L
Student Services* 13G
SRC 19N
SUPRA 4R
Surgery 7K
SydU•tech 19U
Systems Development 13A
Teaching & Curriculum Studies 13G
Tin Sheds Gallery 20M
Trades & Grounds Serrvices 20T
Traffic Office 14F
Transient Bldg 16J
Union, University of Sydney
Wentworth Building 19N
Holme Building 14D
Manning House 14H
Unistaff 19U
University Collection 19H
University of Sydney Club 15G
Urban & Regional Planning 22M
Veterinary Anatomy 8E
Veterinary Clinic 6E
Veterinary Clinical Sciences 6E
Veterinary Pathology 7E
Veterinary Science Faculty Office 8D
Vice-Chancellor's Office 16E
Wallace Theatre 11E
War Memorial Gallery 17E
Watt, R.D., Bldg 11D
Wentworth Bldg 19N
Wesley College 6 11L
Western Avenue Underground Parking Station 8N
Wilkinson Bldg 22M
Women's College 7 11O
Women's Studies 15S
Woolley Bldg, John 12E
Yeoman Bedell's Office 17E
Zoology 12D



- **Student Centre (17L):**
- academic transcripts
- admissions
- enrolments
- examinations
- graduations
- handbook sales
- HECS enquiries
- travel concessions

- **Student Services (13G):**
- accommodation
- counselling
- financial assistance
- special services (disabilities, etc.)

Revised 1 August 1996

Notes