

SECTION 1: ACADEMIC BOARD COURSE PROPOSAL

PART 1: OVERVIEW OF PROPOSAL

Faculty: Engineering & Information Technologies

School presenting the proposal: Aerospace, Mechanical, & Mechatronic Engineering (AMME)

Faculty Contact person and/or: A/Professor Andrew Ruys **Ext. No:** 18610
Academic Proponent **E-mail:** a.ruys@aeromech.usyd.edu.au

Date course approved by Faculty:

1.1.1. Type of proposal: New

1.1.2. Type of course: Postgraduate Coursework

1.1.3. Name of Award course(s)

Name of **New** Award course: Master of Engineering (Biomedical)

1.1.4. Abbreviated name

ME (Biomedical Engineering)

1.1.5. Date of introduction or deletion

Introduced: Year 2009 Semester 1

1.1.6 Availability to students

Commonwealth supported students	Full-time	<input type="checkbox"/>
	Part-time	<input type="checkbox"/>
Fee-paying local students	Full-time	<input checked="" type="checkbox"/>
	Part-time	<input checked="" type="checkbox"/>
Fee-paying international students	Full-time	<input checked="" type="checkbox"/>
	Part-time	<input type="checkbox"/>
Research Training Scheme (Postgrad. Research students only)		<input type="checkbox"/>

SECTION 1: ACADEMIC BOARD COURSE PROPOSAL

PART 2: DETAILS FOR ASSESSMENT OF PROPOSAL

1.2.1 Purpose of the proposal

The purpose of this proposal is to introduce a new award course, the Master of Engineering (Biomedical). The course is designed to meet the needs of the Australian and overseas biomedical industry by producing graduates with the strongest possible technical skills in areas of relevance to the rapidly growing local and global biomedical industry.

1.2.2 Justification for proposal

The Need

The global trend towards an aging population has resulted a dramatic increase in demand for qualified Biomedical Engineering students in the industry. There were 655 medical devices companies in Australia in 2007, 30 more than in 2006. These companies contributed about A\$372 million to Australia's gross domestic product in 2004-2005 and earned export revenue of \$958 million in 2004-2005 with an additional \$2.48 billion spent on imports. The Australian Biomedical technology industry currently manufactures over 250,000 products with a turnover in Australia of \$4.5 billion in 2005. The industry is expected to advance rapidly into new fields of science and engineering, with nanotechnology and other research developments expected to facilitate new innovations in the biomedical sphere and an increasing convergence of physical and biological technology platforms. Australia's medical device industry can list among its distinct competitive advantages its reduced time to market compared with overseas competitors, its comparatively highly skilled workforce, and its geographic position within the Asia Pacific region. Moreover, around 80 per cent of the Australian biomedical industry is concentrated on the east coast of Australia, putting Sydney University at a strategic advantage in the Australian industry.

The global medical technology market is valued at over AU\$214 billion a year and is one of the fastest growing markets in the world, with projected growth above 10 per cent a year. Currently the major markets for medical devices are in the developed economies of the northern hemisphere (North America, Europe, UK and Japan). However, the future promises to be quite different, with Asian markets for medical devices growing rapidly. It is predicted that Asian markets will overtake those of Europe and North America within 15 years, presenting Australia with a significant geographic advantage.

The growth of the developing countries such as India and China and countries from the Middle East requires large numbers of engineers with skills in biomedical engineering. These countries have barely started to establish their medical technology industries, and in the next few decades, we anticipate a huge rise in demand for training in overseas institutions from students in these countries.

The proposed ME course in Biomedical Engineering will also complement our strong research group in Biomedical Engineering and related topics and will assist the sourcing of PhD students following their graduation with the proposed Master of Engineering (Biomedical). The proposed course will provide the opportunity to a number of graduates with the Masters qualification to take a research path in the same field.

In conclusion, Biomedical Engineering is currently one of the fastest growing degree programs in the world today, and demand from industry and for student training from the Asia Pacific region is going to increase exponentially in the next decade. This proposal aims to complete the picture by addressing the skills shortage situation at the postgraduate level as a response to this rapidly growing local and global industry need for postgraduate training.

Background

When our school began its Biomedical Engineering undergraduate degree program in 1998, there was only one academic staff member in the discipline. Now there are four, each with a complementary specialty:

- **A/Prof Andrew Ruys** – Biomaterials synthesis and testing, with two decades of research experience in the field and 135 publications.
- **A/Prof Colin Dunstan** – Formerly of Amgen (one of the world's top biotechnology companies), a biologist and specialist in biomedical commercialization.
- **Dr Hala Zreiqat** – Senior Lecturer in Tissue Engineering, and the founder and Director of SuTEN (Sydney University Tissue Engineering Network).
- **Dr Qing Li** - Senior Lecturer in Computational Biomedical Engineering.

Our school therefore already has a strong academic team in place, all of whom will be involved in this new ME (Biomedical) initiative.

Industry Participation in the ME (Biomedical) Initiative

A number of key people from the Biomedical Industry are actively involved in the Biomedical Engineering undergraduate degree program in our school of AMME undergraduate program through the SUABE (Sydney University Association of Biomedical Engineers) organisation. SUABE is becoming a major force for growth in University-biomedical industry links, and is almost totally funded by industry sponsorship. Our most recent SUABE event (the 2008 annual dinner) had 160 people in attendance, including more than 20 representatives from Industry.

The Biomedical Engineering undergraduate degree program in our school of AMME is also benefiting from active industry participation in undergraduate and postgraduate thesis projects. For example, some of the key participants in recent years include:

- Cochlear: Innovation Manager
- ResMed: Innovation Manager
- ASDM: CEO
- Portland Orthopaedics: CEO
- NHMRC: Senior Board Member
- Ventracor: Innovation Manager
- Columna: CEO
- Sirtex Medical: Chief Scientist
- Sunshine Heart: CEO
- Brandwood Biomed: MD
- Madry Technologies: MD
- Filament Ltd: Principal
- Worley Parsons Biomedical Division: Division Manager
- Stryker: Senior Engineer

These links will form a foundation for the industry-focused basis of our new ME (Biomedical) initiative.

Academic Rationale

The technology advancements in the field of biomedical engineering over the last two decades have been significant. Australia has the 6th largest biomedical industry in the world, and is arguably the most innovative nation in the world in the field per head of population. The Australian biomedical technology industry employs tens of thousands of people in a broad spectrum of companies ranging in size from less than 10 employees (e.g., Applimex and Biomech) up to several thousand employees (e.g., ResMed, Cochlear, and CSL).

There have been a number of completely new industries created from Australian Innovations in the last two decades:

The Bionic Ear (Cochlear Implant). Pioneered in Australia 30 years ago, Cochlear Ltd (Sydney) is now a company of several thousand employees which leads the world in this field, well ahead of its numerous overseas competitors.

Sleep Apnea Devices (prevent snoring/choking). Pioneered in Australia by Prof Colin Sullivan about 20 years ago, and now the basis of the huge Global Company headquartered in Australia (ResMed) which leads the world in this field, well ahead of its numerous overseas competitors.

Mechanical Heart. A completely novel approach to the mechanical heart (floating impeller in a diamond-like-carbon-coated titanium pump) was Pioneered in Australia by Dr John Woodard a decade ago and now the basis of Australian Company Ventracor which leads the world in this field, well ahead of its overseas competitors with their older and much more primitive mechanical heart devices.

Antivenom Serum. Australia's largest medical company CSL is a global pioneer in anti-venom serum for spiders, snakes, and other venomous creatures. CSL has developed an extensive range of these products and leads the world in this field.

Spinal Disk Replacement. Chronic back and neck pain is one of the largest drains on the health budget and current surgical treatments involving fusion are rather primitive and unstable, partly also because of the surgical inaccessibility of the spinal disks. A completely novel approach to the problem of spinal disk failure has been developed in Australia by Columna Ltd involving a soft disk replacement implantable by simple keyhole surgery.

There are many other examples of brilliant Australian home-grown innovations leading to commercial success in the biomedical sphere. In spite of this spectacular level of commercial innovation, only 5 Australian Universities currently offer any teaching programs in Biomedical Engineering. Contrast this to the USA where more than 50 universities teach Biomedical Engineering, and the number grows every year.

Our school, Aerospace, Mechanical, & Mechatronic Engineering (AMME) began its Biomedical Engineering undergraduate degree program 10 years ago in 1998 and we have seen dramatic developments in the last 4 years which persuade us that the introduction of an ME (Biomedical) postgraduate coursework degree is timely: many of

our Biomedical Engineering undergraduate students have received multiple job offers on graduation in recent years, and the ***student numbers in our Biomedical Engineering undergraduate course have quadrupled in the last 4 years from about 70 to about 260.***

Learning and Teaching Objectives

The learning and teaching objectives of the proposed course are directly linked to the skills, attributes and knowledge a graduate can be expected to achieve. These skills and attributes are listed as follows:

Engineering and Information Technologies Faculty:

<http://www.itl.usyd.edu.au/GraduateAttributes/facultyGA.cfm?faculty=Engineering>

University generic graduate attributes:

<http://www.itl.usyd.edu.au/GraduateAttributes/statement.htm> .

University Strategic Plan, Goals and Priorities and Proposed Master Program

The proposed Master of Engineering (Biomedical) is a challenging and professionally relevant postgraduate degree program, assisting University's endeavours in meeting the priorities and confirming the University's continuing adaptation as an institution to employer and community needs. The proposal therefore meets key University strategic objectives associated with teaching and learning as included in the Strategic Directions 2006-2010 document.

Faculty Plan and Proposed Master Program

The proposed program contributes to the following strategies of the Faculty:

- *Grow Revenue (and Margin) through increased offers to students (at undergraduate and postgraduate level)*

There is an extensive market for the proposed Masters program locally and overseas mainly due to the fact that the field of biomedical engineering has long been under-represented in Australian Universities and the situation for the industry is one where demand for graduates outstrips supply. Skills and expertise are need for the biomedical engineering industry. This proposal will assist the AMME School to source a higher number of fee paying students and therefore is a strategic initiative as outlined by the Faculty goal above.

- *Improve Graduate Quality, through Learning by Innovative Pedagogy and Curriculum*

The approach to be used in the proposed Master program will also make extensive use of project based learning and laboratory work contributing directly to the above mentioned strategic goal.

Proposal's relevance to students, employers and professional organisations

The proposal is considered very relevant towards addressing the needs of employers and professional organisations, namely Engineers Australia. The link to the employer's needs is clear through the input of a large number of companies operating in the biomedical industry as expressed through the SUABE organisation. The proposal is also relevant to students who as graduate engineers aim at obtaining necessary corporate

status within the Engineers Australia Institution and require professional development and further education to qualify.

Proposal's implications on the University's existing offerings

There are no implications on the University's existing offerings other than completing the picture at postgraduate level of the undergraduate area where the School of AMME makes its offerings.

1.2.3 Benchmarking, market research and analysis

Extensive market research has been conducted and selected results are as follows:

(i) Benchmarking:

As has been explained in previous sections of this proposal, the lack of undergraduate and post graduate programs in biomedical engineering in Australia has presented a serious issue to the industry. In Australia, this has been addressed through the introduction of the Biomedical Engineering undergraduate program in our school of AMME at the University of Sydney. We will be using our 10 year existing Bachelor of Engineering Mechanical (Biomedical) course as the benchmark for this new proposed Master of Engineering (Biomedical).

Bachelor of Engineering Mechanical (Biomedical). AMME Sydney University				
First Year				
Sem	C/S/E	CP		
1	C	3	MATH1001	Differential Calculus
1	C	3	MATH1002	Linear Algebra
1	C	6	ENGG1801	Intro Computing
1	C	6	BIOL1003	Human Biology
1	C	6	CHEM1101	Chemistry 1 Life Sciences
2	C	3	MATH1003	Integral Calc & Modelling
2	C	3	MATH1005	Statistics
2	C	6	ENGG1802	Engg Mechanics
2	C	6	AMME1550	Dynamics 1
2	S	6	ENGG1803	Professional Engineering
Second Year				
1	C	6	MATH2067	DE's & Vector Calculus for Engineers
1	C	6	ELEC2004	Introductory Electronics
1	C	6	AMME2301	Mechanics of Solids 1
1	C	6	AMME2500	Engg Dynamics
2	C	6	AMME2200	Thermo / fluids
2	C	6	AMME2302	Materials 1
2	C	6	MECH2400	Mechanical Design 1

2	C	6	MECH2901	Anatomy and Physiology for Eng
Third Year				
1	C	6	MECH3361	Mechanics of Solids 2
1	C	6	MECH3261	Fluid Mechanics
1	S	6	AMME3500	System Dynamics and Control
1	S	6	MECH3660	Manufacturing engineering
Fourth Year				
1	C	3	MECH4060	Professional Engineering 2
1,2	C	6	AMME4101	Thesis A
1,2	C	6	AMME4102	Thesis B
1,2	C	0	AMME4100	Practical Experience
1	E	6	AMME4981	Applied Biomedical Engineering
1	E	6	AMME4990	Clinical and Regulatory Principles
1	E	6	ELEC3802	Fundamentals of biomedical eng
2	E	6	MECH4961	Biomechanics and Biomaterials
2	E	6	AMME4790	Biomechatronics
2	E	6	MECH4902	Orthopaedic and Clinical Engineering
2	E	6	AMME4970	Applied Tissue Engineering
Single degree students take sufficient 4th year electives to attain 192cp.				
Combined degree students take sufficient 4th year electives to attain 240cp.				

The proposed ME course will involve a set of electives that cover similar topics to the senior electives of our current BE.

It is pertinent also to include a brief analysis of the other 4 universities in Australia that offer training in this area:

University of NSW (UNSW)

UNSW offers only an *M Biomedical Engineering* and has done so for about 20 years. It does not offer an undergraduate degree in Biomedical Engineering. Their current student enrolments are larger in number than that of our Sydney University Biomedical Engineering undergraduate program (the most recent estimate is 400, about 50% higher than Sydney University). UNSW actively recruits international students, but also has local students in its *M Biomedical Engineering*. There is no doubt that Sydney University has been disadvantaged in recent years by not offering an ME (Biomedical). We have numerous enquiries from potential students who wish to do an ME (Biomedical) at Sydney University and in the last 10 years we have had no choice but to direct them to UNSW.

It is pertinent to outline the UNSW *M Biomedical Engineering* program here as they are our nearest competitor, both geographically, and in terms of the fact that they are number 1 in Biomedical Engineering student numbers in Australia (~400), while Sydney University is ranked Number 2 (~260). The UNSW *M Biomedical Engineering* is a 72 credit point program, positioned midway between the Sydney University MPE (96 credit points) and the Sydney University MES (48 credit points). The *M Biomedical Engineering* is generally done as a 5-year combined degree program with a BE from one of the traditional fields of engineering. Students complete 72 credit points of Biomedical Engineering core/electives during their 5 year combined degree, with the option of either doing their thesis in Biomedical Engineering or in their primary degree area. If the latter, they take 12cp of Biomedical Engineering electives instead of the Biomedical Engineering thesis. The following combined-degree programs are offered:

Programs with Flexible First Year

- BE (Chem)/M_{Biomed}E
- BE (Comp)/M_{Biomed}E
- BE (Elec)/M_{Biomed}E
- BE (Mech)/M_{Biomed}E
- BE (Mtrn)/M_{Biomed}E
- BE (Tele)/M_{Biomed}E

Programs without flexible first year

- BE (Binf)/M_{Biomed}E
- BE (Mat)/M_{Biomed}E
- BE (Soft)/M_{Biomed}E

In each of these programs, there are certain Biomedical Engineering units which are classed as core, and this varies from one combined degree to another to a certain extent, however, BIOM1010 (Engineering in Medicine and Biology), BIOM9420 (Clinical Laboratory Science), PHPH (Principles of Physiology A) and ANAT2511 (Fundamentals of Anatomy) are standard core units. Various electives are offered in similar areas to those offered in our current University of Sydney Biomedical Engineering undergraduate program in our school of AMME. Areas include Tissue Engineering, Regulatory Requirements, Biomedical Technology, Biomechanics, Biomaterials, Biomedical Instrumentation and Biomedical Signal Analysis. As can be seen from the outline of the University of Sydney Biomedical Engineering undergraduate program (school of AMME) listed above, our Biomedical Engineering electives cover similar topic areas, as this is the key skill set required of a Biomedical Engineering graduate. UNSW also offers an MEngSci in Biomedical Engineering which is also a 3 semester course, although in some circumstances, credits from previous study can be granted.

Comment: This is the most serious competitor to the current proposal. However, the UNSW *M Biomedical Engineering* and *MEngSci* degrees are 3-semester degrees. They are therefore more of a competitor to the MPE than to the one-year ME (Biomedical) we are proposing here. Thus, a niche market exists for the one-year coursework masters in Biomedical Engineering in Australia, which this current proposal aims to fill.

Queensland University of Technology (QUT)

QUT offers a Bachelor of Engineering (Medical) undergraduate program that is very similar to the one offered in our school of AMME at the University of Sydney. QUT does

not offer a postgraduate degree in Biomedical Engineering. Like ours, the QUT program has been running about 10 years. However, their enrolment numbers are very small, less than 100 in total. We have very strong links with QUT and have been asked to assist them with growing their program. A basic outline of their program is as follows:

Queensland University of Technology (QUT)	
Bachelor of Engineering (Medical) undergraduate program	
Year 1 - Semester 1	
ENB101	Engineering Mechanics 1
LSB131	Anatomy
MAB131 OR MAB180	Engineering Mathematics 1A OR 1B
PCB136	Engineering Physics 1C
Year 1 - Semester 2	
ENB102	Engineering Mechanics 2
ENB103	Electrical Engineering
ENB104	Engineering Materials
MAB132 OR MAB182	Engineering Mathematics 2A OR 2B
Year 2 - Semester 1	
ENB211	Dynamics
BEB100	Introducing Professional Learning
ENB231	Materials and Manufacturing 1
LSB451	Human Physiology
Year 2 - Semester 2	
BEB200	Introducing Sustainability
ENB201	Fluid Mechanics
ENB215	Fundamentals of Mechanical Design
ENB222	Thermodynamics 1
Year 3 - Semester 1	
ENB105	Electrical and Computer Engineering
ENB311	Stress Analysis
ENB319	Biomechanical Engineering Design
MAB233	Engineering Mathematics 3
Year 3 - Semester 2	
ENB318	Biomechanical Engineering Systems
ENB322	Biofluids
ENB338	Biomaterials
ENB437	Health Legislation in the Medical Environment
Year 4 - Semester 1	
BEB801	Project 1
ENB301	Instrumentation and Control
ENB432	Engineering Asset Management and Maintenance
Applications Minor Selective	
Year 4 - Semester 2	
BEB701	Work Integrated Learning 1
BEB802	Project 2
ENB335	Modelling and Simulation For Medical Engineers
PCB605	Biomedical Instrumentation
Applications Minor Selectives	

Comment: QUT has no competitor masters program.

Melbourne University

In 2005, Melbourne University introduced a Biomedical Engineering undergraduate

program, which they then scrapped in 2007 with the switch to their new MPE Postgraduate Engineering approach. It remains to be seen how their new program develops.

Comment: A degree of uncertainty exists at Melbourne University, and it is not currently considered a serious player in the field.

Latrobe University

Latrobe University in Melbourne is a small player in the Biomedical Engineering field. It offers a 5-year combined degree program called the Electronic Engineering/Biomedical Engineering degree, which is similar to the concept offered by UNSW in that the biomedical strand is the masters, however in the case of Latrobe, the combined degree is offered only with the Electrical Engineering stream, whereas UNSW offers it with all Engineering streams.

Comment: Latrobe University makes a very small impact in Australia terms of student numbers and research profile in the Biomedical Engineering field and is not a serious competitor.

Flinders University

Flinders University used to offer a 4-year Bachelor of Engineering (Biomedical & Electronics) program, but this was a small program and it was suspended in 2006. Flinders University is one of the lowest tier Australian Universities and has a very small engineering program, competing as it does in the very small marketplace of Adelaide, a city of only 1 million people with, Adelaide University a G8 university ranked 62 in the world taking the position of strong market leadership, while Flinders and the University of South Australia struggle to compete.

Comment: This program is now defunct.

Biomedical Engineering Teaching - The Global Picture

Overseas, the number of Universities offering Biomedical Engineering is very large. The leader in the UK and in the world is Leeds University, strategically located near the hospital where the world's first successful hip replacement was developed by Charnley in the 1960s. This is not a coincidence, Leeds is regarded as the birthplace of Biomedical Engineering. The coordinator of the Biomedical Engineering undergraduate program in our school of AMME at the University of Sydney (A/Prof Andrew Ruys) has spent time at Leeds University and has ongoing strong links to Leeds University which offers a 3 year BEng (Medical Engineering) and students can opt to take a 4th year in which case they graduate with an MEng (Medical Engineering). This is quite different to the Australian system where the BE is the major 4-year degree while the ME is the minor 1 or 2 year degree.

University of Leeds: Medical Engineering. 3 Year BEng or 4 Year MEng

Year 1		
Module	Title	Credits
MECH1200	Design and Manufacture 1	20
MECH1210	Mechanical Engineering Thermodynamics	20
MECH1220	Computers in Engineering Analysis	20
MECH1230	Solid Mechanics	20

MECH1280	Engineering Materials	20
MECH1520	Engineering Mathematics 1	20
Year 2		
Module	Title	Credits
LUBS2190	Company Organisation	10
MECH2140	Actuator Systems	10
MECH2160	Mechatronics	10
MECH2270	Fluid Mechanics 2	10
MECH2410	Engineering Materials 2	10
MECH2550	Computers in Engineering Analysis 2	10
MECH2610	Engineering Mechanics	20
MECH2620	Vibration and Control	20
MECH2630	Design and Manufacture 2	20
Year 3 - BEng Completion Year		
Module	Title	Credits
MECH3480	Aerodynamics	20
MECH3600	Professional Studies	10
MECH3800	Professional Skills	10
MECH3810	Individual Project	30
MECH3825	Computational Mechanics	20
MECH3835	Biomedical Engineering	20
MECH3845	Design and Manufacture Systems	20
Year 4 MEng Year		
Module	Title	Credits
MECH5480M	Biotribology (Distance Learning)	15
MECH5490M	Biomaterials (Short Course)	15
MECH5500M	Functional Joint Replacement Technology	15
MECH5840M	Team Project	40
MICR5100M	Tissue Engineering	15
SPSC2304	Mechanics of Sport and Exercise 2	20
SPSC3315	Movement Analysis: a Multidisciplinary Approach	10
SPSC3316	Mechanics of Sport and Performance	10

Comment: This degree program has more relevance to our Biomedical Engineering undergraduate degree program than it does to this proposed Master of Engineering (Biomedical), and it can be seen to be relatively similar both to our Biomedical Engineering undergraduate degree program and that of QUT. However, Leeds University will be used as a benchmark to the proposed Master of Engineering (Biomedical) program to ensure international competitiveness for the offering at the University of Sydney.

In the USA, the number of universities offering Biomedical Engineering is approaching 100. A list of the top 25 for 2008 appears below. One of our staff, A/Prof Dunstan, worked for Amgen (California) the number 1 Biotech startup company in the USA, which arose 30 years ago and is now valued at \$50 billion with over 20,000 employees. Our Tissue Engineering Senior Lecturer (Dr Hala Zreiqat) has many research collaborations with the US and Europe, including The Johns Hopkins University. Thus we have strong links to the US system via A/Prof Dunstan and Dr Zreiqat.

2008 Ranking: The Top 25 Biomedical Engineering Universities in the USA

- 1 Johns Hopkins University (MD)
- 2 Duke University (NC)
- 3 Georgia Institute of Technology
- 4 University of California–San Diego
- 5 University of Pennsylvania
- 6 Massachusetts Institute of Technology
- 7 Case Western Reserve University (OH)
- 8 Boston University
- 9 Rice University (TX)
- 9 University of Michigan–Ann Arbor
- 11 Northwestern University (IL)
- 12 University of Washington
- 13 Stanford University (CA)
- 14 University of California–Berkeley
- 15 Vanderbilt University (TN)
- 16 University of Wisconsin - Madison *
- 16 University of Virginia
- 16 Washington University in St. Louis
- 19 Tulane University (LA)
- 19 University of Texas–Austin

The Johns Hopkins University Biomedical Engineering

The Johns Hopkins University is ranked the top US university for Biomedical Engineering, and its program has been going about 25 years. They have about 440 undergraduate students and 200 postgraduates, so they are only about 60% bigger in undergraduate numbers than the Biomedical Engineering undergraduate program in our school of AMME at the University of Sydney, however they have 6.5 times the staffing level, with 26 primary faculty staff (we have 4). As they are the US leader, it is pertinent to outline their programs here. They have a very flexible undergraduate program indeed:

Undergraduate Program (BA or BS) Total 4 Years and 128 credits.

(4 JHU Credits are Equivalent to 6 USYD credit points)

46 Credits: Physics/Chemistry Maths

34 Credits: Biomedical Engineering Core:

- 580.221: BME Molecular and Cellular Biology
- 580.223: Biological Models and Simulations
- 580.224: Thermodynamics and Statistical Physics for BME
- 580.421: Systems Bioengineering I with lab – Cells and Cardiovascular Systems
- 580.422: Systems Bioengineering II with lab – Neural Systems
- 580.425: Systems Bioengineering III – Genes to Cells
- 580.222: Biological Systems and Control

21 Credits: Biomedical Engineering Focus Area. Choose From one of 4 areas:

1. Biological Systems
2. Cell Engineering — Tissue Engineering — Biomaterials
3. Computational Biology — Bioinformatics — Imaging Science

4. Sensors — Microsystems — Instrumentation

3 Credits: Computer Programming

18 Credits: Humanities and Social Sciences

6 Credits: Electives

The focus areas each contain a large amount of options, some of which are offered by The Johns Hopkins University Department of Biomedical Engineering, and some of which are external to the department.

The Johns Hopkins University Master of Science in Engineering

This is a two year program comprising 24 credits of coursework plus a thesis project. As such, it is like a fusion of our MER and MES degrees into a two-year degree. The coursework comprises only one core unit which is a large two-semester course (Physiological Foundations in Biomedical Engineering). The remaining coursework requirements are completely flexible, chosen from a wide range of electives, from the same areas as the four Biomedical Engineering Focus Areas listed under the undergraduate program above.

(iii) Summary table of competitive offerings to proposed award course:

Institute	Competitive Offering	Additional information
The University of Sydney	Bachelor of Engineering Mechanical (Biomedical) 192cp	To be used as a benchmark for the proposed course. Has been in existence 10 years and is well established with 260 students and 4 dedicated full-time academic staff.
University of New South Wales	M Biomedical Engineering (72cp) generally done as a 5-year 240cp combined degree with a BE from another discipline	A serious threat that is addressed with this proposal.
Queensland University of Technology	Bachelor of Engineering (Medical) 192cp 4 years	Not presenting a serious threat to the proposed course.
Latrobe University	Electronic Engineering/Biomedical Engineering combined degree (Electronic is a Bachelors, Biomedical is a Masters).	Not presenting any threat to the proposed course.

The University of Melbourne	Master of Biomedical Engineering (equivalent to an MPE)	Just introduced in 2008. Not presenting any threat to the proposed course.
The University of Leeds	3 Year BEng or 4 Year MEng in Medical Engineering	Top UK program and arguably the top in the world.
The Johns Hopkins University	2 Year Master of Science in Engineering in Biomedical Engineering	Top US program and arguably the top in the world. 1 Year of Coursework, 1 year of thesis.

(iv) Estimated Student Demand

Estimated Student Demand	2009	2010	2011
Local fee-paying	10	15	15
International fee-paying	10	15	20
Estimated Total EFTSU	20	30	35
Lowest EFTSU for which course would be run	10	10	10

Estimated Full-time and Part-time Students	2009	2010	2011
Estimated number of Full-time students	15	25	30
Estimated number of Part-time students	5	5	5

Impact on students currently enrolled: The proposed course will have no impact on any other postgraduate offerings in the School of AMME, the Faculty and the University of Sydney.

Enrolment Quotas:

Will quotas be set for the proposed award course or for any units of study within the award course?

For local fee-paying students

No

For international fee-paying students

No

1.2.4 Consultation and External References

Consultees	Date of consultation	Method of consultation	Type of supporting evidence provided
Advanced Surgical Design and Manufacture Limited	Early 2008	Discussions with senior personnel with graduate hiring authority	Letter of support forthcoming
Columna Limited	Early 2008	Discussions with senior personnel with graduate hiring authority	Letter of support received
Engineering Faculty	Early 2008	Discussions	Letter of support forthcoming
SUABE Organisation	Early 2008	Telephone discussion, emails, face-to-face discussions	Letter of support forthcoming
Engineers Australia	Early 2008	Via the GSE	Letter of support forthcoming

1.2.5 Course structure

Award Course	Length of candidature (years)	Type of Enrolment	
		Full-time	Part-time
Master of Engineering (Biomedical)	Minimum	1 year	1 1/2 year
	Maximum	1 1/2 year	3 year

(b) Minimum credit points required for completion of qualification: 48 credit points.

(c) Mode of delivery: Face-to-face teaching

Justification

As mentioned earlier, the proposed Master program aims to provide graduates with the strongest possible technical skills. To achieve this, a face-to-face method of instruction is

deemed necessary. Moreover, a significant part of the degree studies includes laboratory and project based work that cannot be offered by any other method of delivery other than the face-to-face proposed.

(d) Does the course involve clinical or industrial placement/experience?

No

(e) Please indicate what processes are in place to guarantee the quality of academic staffing, available resources for teaching and provision of adequate curriculum delivery, assessment and authentication of student work.

The processes which are in place to guarantee the quality of academic staffing, are based on the Engineering Faculty strategy in this area, namely, *recruit, develop and retain (through reward, recognition and support) our people*. Three recent academic appointments in the AMME School, an A/Prof and two Senior Lecturers together with the incumbent A/Prof support the biomedical engineering field as a strong team of 4. Moreover 3 significant adjunct professors from industry support this team, both in research and teaching. These appointments make available adequate resources for the teaching and delivery of the proposed curriculum.

The policies and procedures associated with assessment, as outlined by the University of Sydney will be followed to assess student work. This is a Masters program and a professional approach to student work through project work, report writing, team work and presentations will also be heavily employed to ensure the skills of graduates are as strong as possible meeting the required standards as outlined in another section of this proposal. These skills also include technical skills.

1.2.6 Assessment procedures

Proposed Assessment Regime	Proportion of assessment regime (%)	Use of external assessors/examiners (Yes/No) (if yes, please provide details)
Final Examination	30	No
Practical Laboratory Work	35	No
Projects	35	No

Justification

The field of biomedical engineering requires strong technical skills and the proposed Master aims to address such need. The level of study as a Master program and the specialisation requires a more professional approach to student work and learning experiences and hence the proposed part of project works at 35%. The final examination will be used as a classic tool to ensure student learning has reached acceptable level,

although the 30% weight is relatively low to allow for more practical work and assessment to occur in the proposed program.

1.2.7 Student workload

(a)

Expected Workload	Total Time Expected (per credit point)
Lectures	18 minutes
Tutorials	10 minutes
Independent study	12 minutes
Reading and work for assessment	8 minutes
Project Work	30 minutes

(b) Provide an indication of how the academic course load including the weight given to any dissertation component compare with other similar course loads in the faculty/college/university.

This is similar to other Master of Engineering degrees offered by the Faculty.

(c) What load for HECS and student load purposes should be given to each of the constituent parts or units making up the award course?

N/A

1.2.8 Attributes of graduates

<p>Research and Inquiry: Graduates of the University will be able to create new knowledge and understanding through the process of research and inquiry. This might be understood in terms of the following:</p> <ul style="list-style-type: none"> • be able to identify, define and analyse problems and identify or create processes to solve them • be able to exercise critical judgement and critical thinking in creating new understanding • be creative and imaginative thinkers • have an informed respect for the principles, methods, standards, values and boundaries of their discipline and the capacity to question these 	<p>Project based learning approaches will be used to teach most of the Masters program, therefore directly contributing to the development of the student's research and inquiry attributes listed in the left section</p>
---	--

<ul style="list-style-type: none"> • be able to critically evaluate existing understandings and recognise the limitations of their own knowledge 	
<p>Information Literacy: Graduates of the University will be able to use information effectively in a range of contexts. This might be understood as:</p> <ul style="list-style-type: none"> • recognise the extent of information needed • locate needed information efficiently and effectively • evaluate information and its sources • use information in critical thinking and problem solving contexts to construct knowledge • understand economic, legal, social and cultural issues in the use of information • use contemporary media and technology to access and manage information 	<p>Industry standards and recent technical papers will be used as part of the teaching and activities in each unit, and this will assist the graduates to improve their information literacy skills as outlined in the left section</p>
<p>Personal and Intellectual Autonomy: Graduates of the University will be able to work independently and sustainably, in a way that is informed by openness, curiosity and a desire to meet new challenges. This might be understood in terms of the following:</p> <ul style="list-style-type: none"> • be intellectually curious and able to sustain intellectual interest • be capable of rigorous and independent thinking 	<p>A questioning approach and the way projects and laboratory work will be run will assist the graduates to improve the personal and intellectual autonomy attributes as listed in the left section</p>

<ul style="list-style-type: none"> • be open to new ideas, methods and ways of thinking • be able to respond effectively to unfamiliar problems in unfamiliar contexts • be able to identify processes and strategies to learn and meet new challenges • be independent learners who take responsibility for their own learning, and are committed to continuous reflection, self-evaluation and self-improvement • have a personal vision and goals and be able to work towards these in a sustainable way 	
<p>Ethical, Social and Professional Understanding: Graduates of the University will hold personal values and beliefs consistent with their role as responsible members of local, national, international and professional communities. For example:</p> <ul style="list-style-type: none"> • strive for truth, honesty, integrity, open-mindedness, fairness and generosity • acknowledge their personal responsibility for their own value judgements and behaviour • understand and accept social, cultural, global and environmental responsibilities • be committed to social justice and principles of sustainability • have an appreciation of and respect for diversity • hold a perspective that acknowledges local, national and international concerns • work with, manage, and lead others in ways that value their diversity and equality and that facilitate their contribution to the organisation and the wider community 	<p>The biomedical industry requires ethical, social and professional approaches and these will be instilled in the student work through the “real” industrial projects to be used for teaching and learning</p>

<p>Communication: Graduates of the University will use and value communication as a tool for negotiating and creating new understanding, interacting with others, and furthering their own learning. This might be understood in terms of the following:</p> <ul style="list-style-type: none"> • use oral, written, and visual communication to further their own learning • make effective use of oral, written and visual means to critique, negotiate, create and communicate understanding • use communication as a tool for interacting and relating to others 	<p>The project based approach will assist graduates to get communication skills at the highest possible level through their work on project definition, project documentation, project planning, presentations, team work that requires negotiation, critique and ways to relate to other team members</p>
---	--

1.2.9 Transitional arrangements (for continuing students)

Last year of student intake under existing Resolutions: Local students N/A
International students N/A

Provisions in place for students enrolled under existing Resolutions: N/A

1.2.10 Course administration

Course to be administered by the following Faculty: Engineering & Information Technologies and supported by teaching staff from the School of Aerospace, Mechanical, & Mechatronic Engineering (AMME)

(a) Is there **shared teaching** with other Faculties?
No. Please see below on provision of additional information.

(b) Basis for the above allocation between faculties: N/A

(c) Combined degree – inter-faculty arrangements: N/A

(d) Is the proposed award course part of a **con-joint venture** with another institution?

No

1.2.11 Resolutions

(a) Are there changes to the list of Degrees, Diplomas and Certificates conferred by your Faculty, as listed in the **Resolutions of the Senate** available in the **University**

Calendar ?

Yes *If yes, please complete Appendix 2.*

(b) Will there be new Resolutions or changes to the existing **Resolutions of the Senate** for the proposed Coursework award course?

Yes *If yes, please complete Appendix 3.*

(c) Will there be new Resolutions or changes to the existing **Faculty Resolutions** for the proposed award course?

Yes *If yes, please complete Appendix 4.*

(d) Will there be changes to the academic dress due to the introduction of the proposed new award course?

No

1.2.12 Quality assurance arrangements and plans

(a) Monitoring, measuring and achieving quality learning and teaching

Learning and teaching processes associated with the proposed Master of Engineering (Biomedical) will follow excellent existing structures already in place within the Faculty of Engineering and the School of AMME, in the same way as other Master of Engineering Studies delivered by the School of AMME.

Biomedical Engineering is already a distinct teaching and research area within the School. The School has Teaching Area Meetings organized by the Discipline/Program Directors held at least twice a year. Teaching issues relevant to the area can arise from the Head of School's Advisory Committee or Staff-Student Liaison Committee meetings. Action taken is referred back to the Head of School's Advisory Committee, which is chaired by the Head of School, for reporting at the Staff-Student Liaison Meetings.

Moreover, student feedback is widely used and takes the following forms:

- (1) Students can approach a unit coordinator/lecturer with criticisms or suggestions. The Unit coordinator/lecturer is responsible to take the matter to the Head of School, where usually a delegated academic takes action and reports back to Head of School's Advisory Committee.
- (2) At the School level, unit of study evaluation surveys are assessed by the Dean of Engineering, the Head of School and the academic concerned with the Head following up on action taken.
- (3) Staff-student liaison meetings are held each semester, and are attended by most academic staff teaching within the Master program as well as student representatives. Reports are produced prior to this Staff-student liaison meeting. The reports cover units of study that semester, and are detailed. The Head of School refers the comments to the relevant unit coordinator and responses are tabled at the following meeting.

The School also has a Teaching & Learning Director and regular meetings are held, with interface to the Faculty of Engineering's teaching and learning management, assessment and development structures.

Following the policy requirements, the mapping of our activities is as follows:

Monitoring of students' experiences of the teaching and learning of graduate attributes in their units of study through the Unit of Study Evaluation (USE) process.	This method will be used for the proposed Master program.
Monitoring of students' experiences of the teaching and learning of graduate attributes in their degrees and courses using the Student Course Experience Questionnaire (SCEQ)	This method will be used for the proposed Master program.
Monitoring of the (Management and Evaluation of Coursework Teaching) policy requirement for the integration of the revised generic attributes in the learning outcomes communicated to students in unit of study outlines.	This method will be used for the proposed Master program.
Monitoring of the (Assessment and Examination of Coursework) policy requirements relating to integration of generic attributes in assessment standards and tasks.	This method will be used for the proposed Master program.

(b) Reviewing content, delivery and Resolutions of the award course

The School of AMME regularly reviews its undergraduate and postgraduate programs, and the same process will be applied to the new Master of Engineering (Biomedical), to ensure a suitable academic standard with appropriate industry relevance. The specialisations are reviewed in rotation, and the proposed Masters will be first reviewed in 2009.

Within the School, content, delivery and syllabus integration is reviewed at the Teaching Area coordination meetings and by The Head of School's Advisory Committee which meets at least once per month and more frequently at times of program revision. The Head of School's Advisory Committee is the key forum for discussion and development of the School's teaching program improvements.

Engineers Australia, the professional body representing engineers, reviews all specialisations for Accreditation approximately every four years.

(c) Review and rationalise units of study for the award course

The Teaching Area Committee for Biomedical engineering, chaired A/Prof Ruys will deal with the Biomedical stream at the unit of study level.

SECTION 1: ACADEMIC BOARD COURSE PROPOSAL

PART 3: RESOURCE IMPLICATIONS

1.3.1 Estimated Student Numbers for next three years of the award course

Estimated Student Demand	2009	2010	2011
Estimated Student Numbers	20	25	30
Estimated EFTSU	18	22	25

1.3.2 Availability of teaching and support staff

(a) Availability of academic and support staff to deliver the proposed award course:

There is sufficient number of academic staff within the School of AMME to deliver the units associated with the proposed Master of Engineering (Biomedical). The IT and technical staff required to deliver the proposed course are also available in the School.

(b) Strengths of the department/school/faculty:

The strength of the School in the biomedical engineering field is on a strong and continuous climb, with three recent academic appointments in the AMME School, an A/Prof and two Senior Lecturers together, who, together with the incumbent A/Prof support the biomedical engineering field as a strong team of 4. Moreover 3 significant adjunct professors from industry support this team, both in research and teaching. These appointments make available adequate resources for the teaching and delivery of the proposed curriculum. The field of biomedical engineering is a strategic area within the School for the near and long term future.

1.3.3 Availability of teaching space, and other required facilities

(a) Teaching rooms:

There are teaching rooms within the AMME School to facilitate the offering of the proposed degree.

(b) Lecture theatres:

There are lecture theatres within the AMME School to facilitate the offering of the proposed degree.

(c) Laboratories (including computer access labs):

There are existing laboratories within the AMME School that can support the proposed degree.

(d) Staff offices:

There is no issue with staff offices that need to be dealt with under the proposed degree.

(e) Storage or other space required including any which needs to be rented externally:

There is no need for extra space within the AMME School to support the proposed degree as the space available for the biomedical engineering program is satisfactory.

1.3.4 Availability of Library Resources

There is nothing specific to the proposed degree that needs to be addressed and added to the holdings of the library. The existing library resources are deemed more than sufficient for the students to study for this program. The online journals are also adequate for the postgraduate students taking this course.

1.3.5 Availability of IT and other Equipment

(a) Computer Technology:

The computer hardware/software equipment is available within the School of AMME.

(b) Other Equipment: N/A

1.3.6 Timetabling arrangements

The proposed award course will be offered in the following teaching period:
standard

APPROVALS



Nominated Faculty Officer



Dean of Faculty (or Delegate)

SECTION 1 – APPENDIX 2: RESOLUTIONS OF THE SENATE (DEGREES, DIPLOMAS AND CERTIFICATES)

Resolutions of the Senate (Degrees, Diplomas and Certificates)

SECTION 1 – APPENDIX 3: RESOLUTIONS OF THE SENATE (COURSEWORK AWARD COURSES)

Resolutions of the Senate (Coursework award courses)

Course Title: Master of Engineering (Biomedical)

1. These Resolutions must be read in conjunction with the *University of Sydney (Coursework) Rule 2000*, which sets out the requirements for all coursework courses, and the relevant Faculty Resolutions.

DEGREES, DIPLOMAS AND CERTIFICATES IN THE FACULTY OF ENGINEERING AND INFORMATION TECHNOLOGIES

1. The postgraduate degrees in the Faculty of Engineering and Information Technologies shall be:

1.1 Master of Professional Engineering (MPE)

1.2 Master of Engineering (ME)

1.3 Master of Information Technology (MIT)

1.4 Master of Applied Information Technology (MAppIT) (Not available to new students in 2009)

1.5 Master of Information Technology Management (MITM)

1.6 Master of Philosophy (MPhil)

1.7 Master of Project Management (MPM)

1.8 Doctor of Philosophy (PhD)

1.9 Doctor of Engineering (DEng)

1.10 Doctor of Engineering Practice (DEngPrac)

2. The diplomas in the Faculty of Engineering and Information Technologies shall be:

2.1 Graduate Diploma in Engineering (GradDipEng)

2.2 Graduate Diploma in Telecommunications (GradDipTelecomm)

2.3 Graduate Diploma in Power Engineering (GradDipPowEng)

2.4 Graduate Diploma in Computer Systems Engineering (GradDipCompSystEng)

2.5 Graduate Diploma in Environmental Engineering (GradDipEnvironEng)

2.6 Graduate Diploma in Project Management (GradDipPM)

2.7 Graduate Diploma in Structural Engineering (GradDipStructEng)

2.8 Graduate Diploma in Sustainable Processing (GradDipSustProc)

2.9 Graduate Diploma in Information Technologies (GradDipIT)

2.10 Graduate Diploma in Applied Information Technology (GradDipAppIT) (Not available to new students in 2009)

2.11 Graduate Diploma in Information Technology Management (GradDipITM)

2.12 Graduate Diploma in Computing (GradDipComp)

3. The certificates in the Faculty of Engineering and Information Technologies shall be:

3.1 Graduate Certificate in Engineering (GradCertEng)

3.2 Graduate Certificate in Project Management (GradCertPM)

3.3 Graduate Certificate in Greenhouse Gas Mitigation (GradCertGHGMit)

3.4 Graduate Certificate in Information Technologies (GradCertIT)

3.5 Graduate Certificate in Applied Information Technology (GradCertAppIT) (Not available to new students in 2009)

3.6 Graduate Certificate in Information Technology Management (GradCertITM)

2. Requirements for the [Award Course]

2.1 To qualify for the award of the Master of Engineering (Biomedical) a student must:

2.1.1 complete successfully units of study giving credit for a total of 48 credit points; and

2.1.2 satisfy the requirements of all other relevant By-Laws, Rules and Resolutions of the University.

SECTION 1 – APPENDIX 4: RESOLUTIONS OF THE FACULTY

Resolutions of the Faculty

1. The degree of Master of Engineering may be awarded in the following subject areas and the named testamurs for the degree shall specify the subject area: To qualify for one of these streams, students will have completed a minimum of 24 cp of the specific subject area.

1.1 Aerospace Engineering

1.2 Automation and Manufacturing Systems

1.3 Environmental Engineering

1.4 Sustainable Processing

1.5 Biophysical Processes

1.6 Structural Engineering

1.7 Geotechnical Engineering

1.8 Fluid and Wind Engineering

1.9 Environmental Fluids

1.10 Wireless Engineering

1.11 Network Engineering

1.12 Power Engineering

1.13 Biomedical Engineering

2 Admission Requirements

2.1 Pre-requisites:

2.1.1 12cp junior mathematics (equivalent to MATH1001, 1002, 1003, 1005);

2.1.2 6cp junior biology (students who do not meet this pre-requisite can do a biology bridging course);

2.1.3 6cp of either junior chemistry, mathematics or physics; and

2.1.4 6cp of computing.

3. ME (Biomedical) Units of Study

3.1. Students wishing to study towards the award of ME(Biomedical) must take units of study to the value of 48 credit points from the below table.

	UoS	UoS Name	c.p. value	core/elect
*Mandatory Professional unit 12cp	AERO5900	Research Thesis	12	core
Professional Practice Elective 6 cp:	ENGG5201	Data quality in engineering computing	6	elective
choose from:	ENGG5202	Sustainable design, engineering and management	6	elective
	ENGG5203	Quality engineering and management	6	elective
	ENGG5204	Engineering Professional Practice	6	elective
	ENGG5205	Professional Practice in Project management	6	elective
	ENGG5215	International engineering strategies and operations	6	elective
	ENGG5216	Management of technology	6	elective
Mandatory Specialist units 30 cp:	AMME5981	Computational Biomedical Engineering	6	core
	AMME5990	Biomedical Engineering Technology 1	6	core
	AMME5921	Biomedical Engineering Technology 2	6	core
	AMME5971	Applied Tissue Engineering	6	core
	AMME5961	Biomaterials Engineering	6	core
**Engineering Electives 12cp	AMME5301	Mechanics of Solids 1	6	elective
	AMME5500	Engg Dynamics	6	elective
	AMME5200	Thermo / fluids	6	elective
	AMME5302	Materials 1	6	elective
	MECH5400	Mechanical Design 1	6	elective
	AMME5271	Computational nanotechnology	6	elective
		To total credit points	48	

*Students who have met this requirement in their primary degree, in a relevant field, will be granted an exemption.

**Only available to students who are exempt from the thesis requirement.



University of Sydney

LIBRARY IMPACT STATEMENT

Proposed Unit of Study: Master of Professional Engineering (Biomedical)

I have examined the library needs related to the proposal and certify that existing library holdings, staffing, services and accommodation are, or will be, adequate to conjure the demands that are inherent in it.

Students will use resources and services of several of the University Libraries including the SciTech Library. To ensure that sufficient resources are available and current it will be necessary for the Faculty to work closely with the library to develop the collection.

We look forward to working with the students and staff to support this course and develop training and services appropriate to their needs and support the development of the graduate attributes discussed in the proposal.

If, in the future, new Units of Study are developed within this program, or the Faculty intends delivering the program or Units within the program in a different mode, it is understood that the library will be advised and will be asked to provide additional Library Impact Statements specific to the new Units.

A handwritten signature in black ink that reads 'Susan Hanfling'.

Susan Hanfling
Director, Library Services
for the University Librarian

Wednesday, 27 February, 2008.

SECTION 2: FEE REVIEW AND FEE SETTING

Faculty: Engineering & Information Technologies

Department/School presenting the proposal: Aerospace,
Mechanical, & Mechatronic Engineering (AMME)

Faculty Contact person and/or: A/Professor Andrew J. Ruys **Ext. No:** 18610

Academic Proponent E-mail: a.ruys@aeromech.usyd.edu.au

2.1.1 Type of proposal: New

2.1.2 Type of course: Postgraduate Coursework

2.1.3 Name of Award course(s)

Name of **New** Award course: **Master of Engineering (Biomedical)**

2.1.4 Abbreviated name

ME (Biomedical)

2.1.5 Date of introduction or deletion

Introduced: Year 2009 Semester 1

2.1.6 Fee review and Fee-setting

Fees for Postgraduate award course:

Postgraduate award course	Current Fees (per 1 EFTSU per annum)		Proposed Increase (%)		Proposed Fees (per 1 EFTSU per annum)	
		Local students	International students	Local	Local students	International students
ME Biomedical	18240	23049	5.6	5.6	19440	24480

PROPOSED BY:



Nominated Faculty Officer

Dean of Faculty (or Delegate) PVC (College)

APPROVAL:

Deputy Vice-Chancellor (Academic & International) / Vice-Chancellor

SECTION 3: COURSE INFORMATION FORM AND MARKETING PLAN

PART 1: COURSE INFORMATION FOR FLEXSIS

Faculty: Engineering & Information Technologies

Department/School presenting the proposal: Aerospace,
Mechanical, & Mechatronic Engineering (AMME)

Faculty Contact person and/or: A/Professor Andrew J. Ruys **Ext. No:** 18610

Academic Proponent E-mail: a.ruys@aeromech.usyd.edu.au

3.1.1 Type of proposal: New

3.1.2 Type of course: Postgraduate Coursework

3.1.3 Name of Award course(s)

Name of **New** Award course: **Master of Engineering (Biomedical)**

3.1.4 Abbreviated name

ME (Biomedical)

3.1.5 Date of introduction or deletion

Introduced: Year 2009 Semester 1

3.1.6 Course Code

Course Code of Existing Award Course for amendment or deletion:
HC048

3.1.7 CRICOS Code

CRICOS Code of Existing Award Course for amendment or deletion:
061789G

3.1.8 Short degree description (e.g. for the UAC Guide):

3.1.9 Full degree description (e.g. for Faculty handbook):

Master of Engineering (Biomedical)

3.1.10 Level of Award:

Masters degree by coursework

3.1.11 Is this an Honours course? No

3.1.12 If the proposal is for a new award course, please indicate if the new

course is the result of new resolutions for an existing course? Yes

3.1.13 Name of award that will be conferred upon completion of course:

Master of Engineering (Biomedical)

3.1.14 If the proposal is for a new award course, please indicate which category the proposed course should be allocated to according to the DEST Field of Education and Discipline Area (available from the [Courses and Fees Toolkit](#) on the Academic and International website):

DEST Field of Education 039903

DEST Discipline Area 039903

3.1.15 Credit points required for the Award: 48

3.1.16 Location/ Campus for Student Attendance:

Camperdown & Darlington

3.1.17 Are students enrolling in the proposed award course subject to:

Criminal Record Check No

Prohibited Employment Declaration No

Health Records & Privacy No

Information Declaration

3.1.18 Prohibitions:

The maximum credit points per semester are set to 24.

3.1.19 Articulation Pathway (if applicable):

Course(s) to which this course articulates		Credit given in articulating course
Code	Name	
N/A	N/A	N/A

3.1.20 Units of Study offered in proposed award course:

(a). Existing units of study

Code	Description	Semester	Cp	Core/Elective
AMME5900	Research Thesis	1/2	12	*Core

*Students who already have a B.E. are exempt from this requirement.

(b). New units of study

Code	Description	Semester	Cp	Core/Elective
AMME5921	Biomedical Engineering Technology 1	2	6	Core
AMME5961	Biomaterials Engineering	2	6	Core
AMME5971	Applied Tissue Engineering	2	6	Core
AMME5981	Computational Biomedical Engineering	1	6	Core
AMME5990	Biomedical Engineering Technology 2	1	6	Core
MECH5901	Anatomy & Physiology for Engineers	2	6	Core
AMME5301	Mechanics of Solids 1	2	6	Elective
AMME5500	Engg Dynamics	2	6	Elective
AMME5200	Thermo / fluids	2	6	Elective
AMME5302	Materials 1	1	6	Elective
MECH5400	Mechanical Design 1	1	6	Elective
AMME5271	Computational nanotechnology	1	6	Elective
ENGG5201	Data quality in engineering computing	1,2	6	Elective
ENGG5202	Sustainable design, engineering and management	1	6	Elective
ENGG5203	Quality engineering and management	1,2	6	Elective
ENGG5204	Engineering Professional Practice	1,2	6	Elective
ENGG5205	Professional Practice in Project management	1,2	6	Elective
ENGG5215	International engineering strategies and operations	1,2	6	Elective
ENGG5214	Management of technology	1,2	6	Elective

SECTION 3: COURSE INFORMATION FORM AND MARKETING PLAN

PART 2: COURSE INFORMATION FOR UNIVERSITY'S UNDERGRADUATE AND POSTGRADUATE COURSE DATABASE (FOR MARKETING PURPOSES)

3.2.1 UAC Code: (Undergraduate courses only)

3.2.2 CRICOS Code: 061789G

3.2.3 Career Opportunities: The graduates with the proposed Master of Engineering (Biomedical) will be able to work as Biomedical engineers in the local and global medical technology and biomedical industries, and in the biomedical engineering technical support departments which are found in most hospitals.

3.2.4 Areas of study: Biomedical Engineering, Tissue Engineering, computing.

3.2.5 Assumed Knowledge: A Bachelors degree in engineering or related field or Graduate Diploma in Engineering

3.2.6 Minimum education requirements:

Bachelor degree (pass)

Additional information:

3.2.7 If the proposal is for a Postgraduate award course, please indicate the course method:

Coursework

3.2.8 UAI (for UG only): N/A

3.2.9 Additional admission selection criteria:

3.2.10 If the course is offered to international students please complete the following:

UAI International (for international students only): (Undergraduate courses only)

Other international student entry requirements: IELTS test (or equivalent) results with overall score of 6.5 and no band under 6.

3.2.11 If the proposal is for a Postgraduate award course, please indicate the

application closing date:

For local students, closing date for applications is as per University Calendar dates.

For international students, closing date for applications is as per University Calendar dates.

3.2.12 Will mid-semester intake be available for:

Commonwealth Supported students No

Local fee-paying students No

International fee-paying students No

SECTION 3: COURSE INFORMATION FORM AND MARKETING PLAN

PART 3: MARKETING PLAN

3.3.1 Marketing plan and strategy

The course will be marketed following its approval using a number of approaches as follows:

- A profile article will be sought for the Engineers Australia magazine to target potential engineers looking to upgrade their qualifications.
- Marketing via Ausbiotech conferences and trade fairs.
- A single page brochure will be designed for mailing to potentially new students.
- The website of AMME will be updated to reflect the availability of the new degree.
- An internal mail out to a number of companies that have engineers who could benefit from the degree will be done. These companies will include all the ones connected with SUABE and AMME research collaborations, as well as many of the other 650 Australian medical device companies known to A/Prof Andrew Ruys. This is considered as the most direct way to attract potential students for the proposed degree.
- Mail course brochures to overseas institutions.
- Place course brochures in international conferences and events such as Engineers Australia meetings and other relevant events.
- The Faculty will market this degree during their on-shore marketing activities in China and India twice a year.

APPROVALS



Nominated Faculty Officer



Dean of Faculty (or Delegate)

SECTION 4: INTERNATIONAL STUDENT ADMINISTRATION REQUIREMENTS

Faculty: Engineering & Information Technologies

Department/School presenting the proposal: Aerospace, Mechanical, & Mechatronic Engineering (AMME)

Faculty Contact person and/or: A/Professor Andrew Ruys **Ext. No:** 18610

Academic Proponent E-mail: a.ruys@aeromech.usyd.edu.au

4.1.1 Type of proposal: New

4.1.2 Type of course: Postgraduate Coursework

4.1.3 Name of Award course(s)

Name of **New** Award course: **Master of Engineering (Biomedical)**

4.1.4 Abbreviated name

ME (Biomedical)

4.1.5 Date of introduction

Introduced: Year 2009 Semester 1

4.1.6 Course Code

Course Code of Existing Award Course for amendment or deletion:
HC048

4.1.7 CRICOS Code

CRICOS Code of Existing Award Course for amendment or deletion:
061789G

4.1.8 Marketing plan and strategy

The course will be marketing following its approval using a number of approaches as follows:

- A profile article will be sought for the Engineers Australia magazine to target potential engineers willing to upgrade their qualifications.
- Marketing via Ausbiotech conferences and trade fairs.
- A single page brochure will be designed for mailing to potentially new students.
- The website of AMME will be updated to reflect the availability of the new degree.
- An internal mail out to a number of companies that have engineers who could benefit from the degree will be done. These companies will include all the ones connected with SUABE and AMME research collaborations, as well as many of the other 650 Australian medical device companies

known to A/Prof Andrew Ruys. This is considered as the most direct way to attract potential students for the proposed degree.

- Mail course brochures to overseas institutions.
- Place course brochures in international conferences and events such as Engineers Australia meetings and other relevant events.
- The marketing plan includes on shore marketing activities in India and China twice per year, use of University agents, extension of the existing MOU's with Harbin and Dalian Universities in China, preparation of marketing materials including the GSE website, and updating all IO marketing materials.

4.1.9 Availability of Course

Will international students be able to enrol full-time?

Yes

4.1.10 Mode of Study

Will international students be able to study the proposed course in “face-to-face” mode for at least 75% of the time each semester?

Yes

4.1.11 Incidental (Ancillary) Fees

Will the proposed course incur any compulsory costs other than tuition fees and compulsory subscriptions?

No

4.1.10 Commencement Semester

Indicate whether entry to the course is possible in each semester.

SEM1 or 2

If entry is permissible in Semester 2, please indicate whether subject choice will be restricted and whether the duration of the course will necessarily increase?

N/A

4.1.11 English Language Requirements

Will the minimum English language requirement for the proposed course differ from the usual requirements (i.e. overall IELTS score of 6.5 with a minimum of 6.0 in each band)?

Yes If yes please indicate IELTS equivalent

No

APPROVALS

Gregory Hancock

.....
Dean or delegate

The Proposed Course is suitable for CRICOS registration and International Office processing.

.....
Director International Office

SECTION 5: PLANNING SUPPORT OFFICE

Faculty: Engineering & Information Technologies

Faculty Contact person and/or: A/Professor Andrew Ruys **Ext. No:** 18610

Academic Proponent E-mail: a.ruys@aeromech.usyd.edu.au

5.1.1 Type of proposal: New

5.1.2 Type of course: Postgraduate Coursework

5.1.3 Name of Award course(s)

Name of **New** Award course: Master of Engineering (Biomedical)

5.1.4 Abbreviated name

ME (Biomedical Engineering)

5.1.5 Date of introduction

Introduced: Year 2008 Semester 1

5.1.6 Estimated percentage distribution of load across departments in one or more faculties:

Faculty	Department	Estimated percentage of load
Engineering & Information Technologies	AMME	100

5.1.7 Number of semesters required to complete the course in minimum time

2

5.1.8 Estimated Student Enrolments (i.e. Head Count)

Estimated Student Enrolments	2008	2009	2010	
Local fee-paying	Full-time	10	10	10
	Part-time	5	5	5
International fee-paying	Full-time	5	10	15
	Part-time	0	0	0
Total Student Enrolments		20	25	30

5.1.9 For undergraduate degrees only, please indicate the expected 'carry-on' rate from one academic year to the next.

N/A

APPROVALS

A handwritten signature in cursive script that reads "A. Thomas". The signature is written in black ink on a white background.

Nominated Faculty Officer

A handwritten signature in cursive script that reads "Gregory Hancock". The signature is written in black ink on a white background.

Dean of Faculty or delegate

Associate Professor Andrew J. Ruys
Program Coordinator: Biomedical Engineering
School of Aerospace, Mechanical & Mechatronic Engineering J07
University of Sydney
Sydney NSW 2006
Tel: +612-9351-8610; 0409-127-002
Email: a.ruys@aeromech.usyd.edu.au
<http://www.aeromech.usyd.edu.au/biomedical/>

Dear Andrew,

Columnna wishes to express support for the proposed postgraduate degree in biomedical engineering at the University of Sydney. One of our staff recently enquired about the existence of such a course within your school. The coursework for the proposed degree looks to provide a range of knowledge and skills that will be pertinent to our company.

This course also has potential to address the broader need that exists within our industry and aging community.

Yours sincerely,



Dr Philip Boughton

Research & Development Manager, Columnna Pty Ltd