Department of Biomedical Engineering

BEng (Hons) Biomedical Engineering

MEng Biomedical Engineering

Student Handbook

2023 – 2024

Version 1; Updated: September 2023

Published September 2023

‘The Strathclyde graduate will be recognised as deeply knowledgeable and adaptable, demonstrating the skills, attributes and confidence to thrive in an evolving, often challenging world. To meet the needs of professions and career pathways, this will be achieved through the design of our curricula and the provision of opportunities for all students to engage in work related activities, entrepreneurial events and programmes and globally conscious initiatives throughout their studies.’

Please retain this handbook as you will need to refer to it throughout your time at Strathclyde and perhaps for years to come in order to meet enquiries from employers and professional institutions.

The aim of this handbook is to answer the many questions you may have about the different aspects of studying for a degree at the University Strathclyde. The handbook contains practical information about the University, the Department and your course of study including course regulations, class syllabi and departmental procedures. It is an important reference document which will help you to ensure that your time here is organised efficiently and to maximum benefit.

The contents of this book are as far as possible up to date and accurate at the date of publication. Changes may be made from time to time and the University reserves the right to add to, amend, or withdraw information and resources, and to make any other alteration as it may deem desirable and necessary. Such changes will be published by incorporation in the next edition of the University regulations and student handbook.

It is the responsibility of each individual student to become familiar with all University Regulations which apply to them. The University’s regulations can be found in the University Calendar on the University’s web pages:

http://www.strath.ac.uk/staff/policies/academic/

and the Department of Biomedical Engineering encourages students to read Part 1: General Regulations with particular reference to sections 3, 4 and 5, which describe the University’s regulations regarding the library, examinations and student discipline respectively.

StrathLife – The Student Journey
This handbook should be read in conjunction with everything you need to know about student life and can be found here:

www.strath.ac.uk/studywithus/strathlife/

which provides information on the range of support and information services within the University.

Dr Craig Childs, Course Director

Welcome

From the Head of Department

Dear all

On behalf of the Department of Biomedical Engineering and the Faculty of Engineering, I would like to offer a warm welcome to the Department of Biomedical Engineering and the University of Strathclyde.

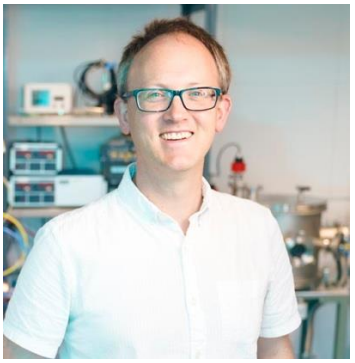
You are joining one of the longest established Departments of Biomedical Engineering in the world, a department that has been at the forefront of teaching and research in Biomedical Engineering and Prosthetics and Orthotics for over 60 and 50 years respectively. Our teaching programmes are multi-accredited and the department's staff do their utmost to ensure that all of our students are supported in every way possible throughout their studies. Our courses are strong on education, but we hope enjoyable and relevant to the aspirations of the modern Biomedical Engineering or Prosthetics and Orthotics student in pursuing a career in this exciting field.

As new undergraduate students, you also have your part to play in the success of your course and Department. The course team has put together an exciting curriculum, spanning the field of biomedical engineering, and I ask that you apply yourself to your studies with energy and enthusiasm. Wherever you go, you are now representatives of the Department of Biomedical Engineering and the University of Strathclyde.

Our Wolfson Centre underwent a complete renovation and upgrade a couple of years ago – to keep Biomedical Engineering at Strathclyde at the forefront of biomedical teaching and research for the next 60 years and beyond. We are delighted in having you join us in these revamped facilities. Our clinical teaching facilities for prosthetics and orthotics are located in the Curran Building, which also underwent a number of renovations this summer ahead of the 23/24 semester start.

You may be transitioning from school to university, which we fully understand is a major change. Educationally, you will be required to do a lot more independent learning, which necessitates good time management and motivation. You may be living away from home for the first time which also brings new financial independence and responsibilities. If you feel that you are struggling in any way please come and talk to the course director, or one of the other departmental staff, and we will do all we can to help.

We are delighted to have you join us.



Professor Stuart Reid FRSE
Head of Department
Department of Biomedical Engineering

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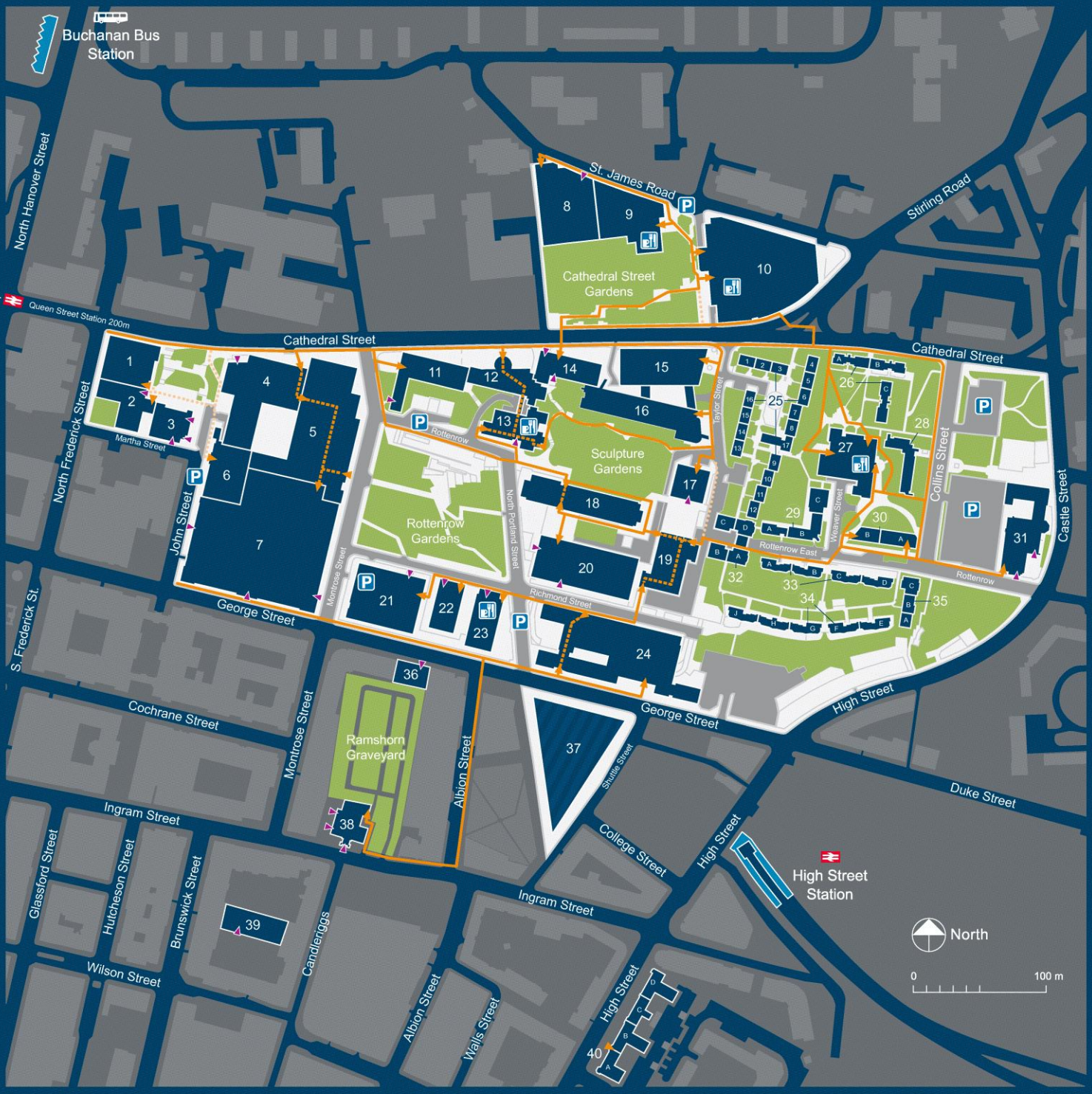
John Anderson Campus

University of Strathclyde Glasgow



Campus Buildings

Alexander Turnbull	36	Garnett Hall	26	Patrick Thomas Court	39
Andrew Ure Hall	40	Graham Hills	24	Ramshorn Theatre	38
Arbuthnott (Hamnett Wing)	15	Henry Dyer	11	Royal College	7
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Key

- University Buildings
- Accessible Routes External
- Accessible Routes through Buildings (Weekdays 8.00am - 6.00pm)
- Accessible 'Buddy' Routes (assistance required)
- Accessible Entrance
- Non-Accessible Entrances
- Public Car Parking, Pay and Display
- Catering Outlets
- Building under construction

Building and room codes

Each room on the campus has an alphabetic code followed by three numbers. The alphabetic code represents the building as per the table below, the first number gives the floor level and the last two give the room number on that floor. E.g. JW309 is on the third floor of the James Weir Building.

Code	Building	Code	Building
AR	Architecture	AB (RW)	Arbuthnott (Robertson Wing)
CL	Collins	LT	Livingstone Tower
CV	Colville	MC	McCance
CU	Curran	RC	Royal College
CW	Cathedral Wing (Business School)	DW	Sir William Duncan
GH	Graham Hills	SW	Stenhouse (Business School)
HD	Henry Dyer	SB	Strathclyde Business School
HW	Arbuthnott (Hamnett Wing)	TG	Thomas Graham
JW	James Weir	UC	University Centre
JA	John Anderson	WC	Wolfson Centre

Academic Year

University of Strathclyde Academic Calendar 2023-24

University of Strathclyde Academic Calendar 2023-24

Date Week Commencing	University & Timetabling System Weeks	University Holidays	Academic Calendar
Mon 31/07/2023	1		Resit Exams
Mon 07/08/2023	2		Resit Exams end Tue 08/08/2023
Mon 14/08/2023	3		
Mon 21/08/2023	4		
Mon 28/08/2023	5		
Mon 04/09/2023	6		
Mon 11/09/2023	7		Welcome and Development Week
Mon 18/09/2023	8		Wk 1 Semester 1
Mon 25/09/2023	9	Mon 25.09.23	Wk 2
Mon 02/10/2023	10		Wk 3
Mon 09/10/2023	11		Wk 4
Mon 16/10/2023	12		Wk 5
Mon 23/10/2023	13		Wk 6
Mon 30/10/2023	14		Wk 7
Mon 06/11/2023	15		Wk 8
Mon 13/11/2023	16		Wk 9
Mon 20/11/2023	17		Wk 10
Mon 27/11/2023	18		Wk 11
Mon 04/12/2023	19		Semester 1 Exams
Mon 11/12/2023	20		
Mon 18/12/2023	21	TBC	Christmas Vacation
Mon 25/12/2023	22		Christmas Vacation
Mon 01/01/2024	23		Christmas Vacation
Mon 08/01/2024	24		Consolidation and Development Week
Mon 15/01/2024	25		Wk 1 Semester 2
Mon 22/01/2024	26		Wk 2
Mon 29/01/2024	27		Wk 3
Mon 05/02/2024	28		Wk 4
Mon 12/02/2024	29		Wk 5
Mon 19/02/2024	30		Wk 6
Mon 26/02/2024	31		Wk 7
Mon 04/03/2024	32		Wk 8
Mon 11/03/2024	33		Wk 9
Mon 18/03/2024	34		Wk 10
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Mon 08/04/2024	37		Spring Break
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Mon 22/04/2024	39		
Mon 29/04/2024	40		
Mon 06/05/2024	41	Mon 06.05.24	
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Mon 27/05/2024	44	Mon 27.05.24	
Mon 03/06/2024	45		
Mon 10/06/2024	46		
Mon 17/06/2024	47		
Mon 24/06/2024	48		
Mon 01/07/2024	49		
Mon 08/07/2024	50	Fri 12.07.24	
Mon 15/07/2024	51	Mon 15.07.24	
Mon 22/07/2024	52		Resit Exams Wed 24/07/2024-06/08/24

The Faculty of Engineering

The Faculty of Engineering is one of the UK's leading centres of engineering education. It is the largest in Scotland, and among the largest in the UK, and has achieved the highest ratings in official assessments of teaching quality and research. In addition to links with the Research Councils and the professional Engineering Institutions, the Faculty is renowned for its close links with industry. Industrial contacts are a major influence on both research programmes and taught courses, helping to keep the Faculty's academic staff at the forefront of their subjects.

OFFICE BEARERS

Dean of the Faculty: Professor Stephen McArthur

Vice-Dean (Academic): Dr Julia Race
Associate Dean (Academic): Dr Phil Riches
Vice-Dean (Knowledge Exchange): Professor Stuart Galloway
Vice-Dean (Research): Professor Campbell Booth

Faculty Manager: Dr G Wilson
Senior Faculty Officer (academic): Mrs Stephanie McNulty s.mcnulty@strath.ac.uk
Faculty Officer (academic): Mrs Lisa Lyons lisa.lyons@strath.ac.uk

The Faculty is made up of 8 academic departments, viz:

Architecture	Biomedical Engineering
Chemical and Process Engineering	Civil Engineering
Electronic and Electrical Engineering	Design, Manufacture and Engineering Management
Mechanical & Aerospace Engineering	Naval Architecture and Marine Engineering

Departmental Information

Staff

The latter years of the BEng/MEng Biomedical Engineering is predominantly taught by staff in the Department of Biomedical Engineering. The following staff, with their contact details, may have a significant role on the course, including being Personal Development Advisers. Other staff, including those from other departments, will also contribute to the course, especially in the first two years, and their contact details will be given by them in due course.

HEAD OF DEPARTMENT	Email	Extension
Prof. Stuart Reid	stuart.reid@strath.ac.uk	3137
COURSE DIRECTOR		
Dr Craig Childs	craig.childs@strath.ac.uk	2228
COURSE ADMINISTRATOR & OFFICE SUPPORT		
GENERAL ENQUIRIES	contact-bioeng@strath.ac.uk	
Ms Daniella Alvarenga	daniella.alvarenga@strath.ac.uk	3025
Ms Gillian Boyd	gillian.boyd@strath.ac.uk	3143
Mrs Forough Ghenaatshoar	forough.ghenaatshoar@strath.ac.uk (IT)	3867
Mrs Linda Gilmour	linda.gilmour@strath.ac.uk	3298
Ms Eva Langan	eva.langan@strath.ac.uk	3108
Mrs Ashley MacIntyre	ashley.macIntyre@strath.ac.uk	3025
Mr Thomas Milne	thomas.milne@strath.ac.uk	3296
ACADEMIC STAFF		
Dr Mario Giardini	mario.giardini@strath.ac.uk	3042
Dr Asimina Kazakidi	asimina.kazakidi@strath.ac.uk	3295
Dr D Kahani	danial.kahani@strath.ac.uk	
Dr Helen Mulvana	helen.mulvana@strath.ac.uk	3842
Dr Michelle MacLean	michelle.maclean@strath.ac.uk	2891
Dr Chris McCormick	christopher.mccormick@strath.ac.uk	3438
Dr Philip Riches	philip.riches@strath.ac.uk	5703
Dr Craig Robertson	craig.a.robertson@strath.ac.uk	3030
Prof. Philip Rowe	philip.rowe@strath.ac.uk	3032
Dr Mairi Sandison	mairi.sandison@strath.ac.uk	3842
Prof. Will Shu	will.shu@strath.ac.uk	3031
Mr Stephanos Solomonidis	s.e.solomonidis@strath.ac.uk	3778
Dr Junxi Wu	junxi.wu@strath.ac.uk	2505
DEPARTMENT DISABILITY CONTACT		
Dr Craig Robertson	craig.a.robertson@strath.ac.uk	3030
TECHNICAL STAFF		
Mrs Katie Henderson	catherine.j.henderson@strath.ac.uk	3867
Mr Stephen Murray	s.j.murray@strath.ac.uk	3025
Mr Stuart O'Farrell	s.o-farrell@strath.ac.uk	5807

Members of staff can be contacted preferably via email, but also via phone. The number 0141 548 followed by the above extensions will connect to their office.

Health & Safety

University Health and Safety information may be found here:

http://www.strath.ac.uk/wellbeing/

For up-to-date information on the Covid-19 situation and what the implications are for your studies, for access to on-campus facilities and for our expectations regarding student conduct, refer to the follow university web-pages and guidance:

https://www.strath.ac.uk/coronavirus/students/

As the Covid-19 pandemic and resulting Scottish Government instructions evolve, the dynamic situation may necessitate changes to the university guidance, so it is important that you check these university Coronavirus webpages on a regular basis. Changes to the guidance will also be communicated to you via email (using your Strathclyde email address).

Information regarding cybersecurity and how to conduct yourself when using online learning and social media platforms may be found here:

https://www.strath.ac.uk/professionalservices/is/cybersecurity/10stepstocybersuccess/

This includes a link to the university's Cyber Security training, which must be completed by all students via MyPlace.

The main points to remember about online conduct are:

1. Carefully consider the types of personal information you wish to share about yourself online. (Personal information includes but is not limited to gender, sexuality, age, religion, relationship status, address, contact details, planned movements etc.)
2. Use your Strathclyde university email account (and not a personal email account) for all written communication to staff.
3. Keep yourself and your personal data safe online.
4. Do not reveal the personal information of other people online, even if you believe that the information is already widely known.
5. In discussion forums, keep your messages to the point and state who the message or post is coming from and add a descriptive title.
6. Make sure you have permission before using someone else's images or written content.
7. You have a responsibility for what you say. Please remember that once something is posted online it can be very difficult to remove.
8. Remember that text, images and video that you post, share or put in a message may be shared beyond the intended recipients: as soon as you post or send, the content is no longer in your control.
9. Remember that everything you post online contributes to your digital profile, and is potentially visible to friends, family, University staff and also to potential employers.

If you are concerned about a potential data protection breach, contact your Year Adviser and Course Director, as well as the University data protection team (dataprotection@strath.ac.uk).

With regards information security and the correct use of your own computer and mobile devices, you must familiarise yourselves with the university policies found here:

https://www.strath.ac.uk/staff/policies/informationsecurity/

https://www.strath.ac.uk/professionalservices/is/cybersecurity/mobiledevices/

Essential on-campus departmental Health and Safety policy is:

Emergency evacuation of buildings

If you discover a fire:

1. raise the alarm by operating the nearest fire alarm 'break-glass' call point.
2. leave the building by the nearest escape route

When you hear the fire alarm:

1. Evacuate the building immediately using the nearest escape route
2. Do not delay your departure by collecting personal belongings
3. Where possible, close all doors through which you pass
4. Once outside, proceed to the designated assembly point
5. Do not use lifts during a fire alert
6. Do not re-enter the building until advised by University Security Staff or Safety Services staff

Familiarising yourself with the emergency routes from the building and the location of fire alarm call points and fire-fighting equipment in advance of any fire alert will improve your response in the event of an emergency.

Procedure for summoning first aid assistance

In the event of an accident:

- All University Security staff are qualified to administer first aid. To summon assistance, telephone Security Control on emergency number 2222. If phoning from a mobile – 0141 548 2222.
- State your name, department and the telephone extension from which you are calling.
- Give your location and brief details of the casualty's injuries.
- If you consider the injuries are sufficiently serious to warrant hospital treatment, inform Security Control that an ambulance is required.
- Remain with the casualty until the arrival of the first aider who will take charge of the situation.

Ring x3333 for advice and non-emergency assistance. In a student residence, ring 8888 for assistance. Security Control can be found on the ground floor of the Livingstone Tower and is staffed 24 hours a day, 7 days a week.

Before participating in laboratory sessions, each student should have read and become familiar with the Departmental Safety Regulations. A copy of these regulations will be provided. Before research projects commence, all students must attend a Safety Talk organised by the Department.

The Departmental Safety Officer is Mr Brian Cartlidge, extension 3283 or 0141 548 3283.

Communication

Students are required to notify Student Experience of any change in your permanent home or term-time addresses. Student Experience sends at least four letters to each undergraduate student every year. It is therefore important that they have the correct home and term-time addresses. These letters advise students of their academic progress, provide an opportunity for students to check their undergraduate curriculum, and where applied for may assist the student to claim exemption from the Council Tax. Students can update their personal details on the University website http://pegasus.strath.ac.uk

The Department of Biomedical Engineering and the University will predominantly communicate with students using their Strathclyde email account. It is students' responsibility to check this email account daily for new Departmental and University messages.

Individual class lecturers and tutors may use the University's virtual learning environment (MyPlace) to communicate class matters to students (http://classes.myplace.strath.ac.uk/). It is the students' responsibility to ensure that they are able to engage with this environment as expected by individual tutors. Online training packages are available. Class tutors may also require assignments to be uploaded to MyPlace for assessment purposes, including Turnitin: a plagiarism detection software.

Smoking

The University has a policy on smoking.

Smoking is prohibited within all University buildings and within 15 feet (4.6m) of any University building entrance, doorway, stairway or covered area.

You are also asked to take a responsible attitude to ensure that areas are kept litter free and that you do not stand in close proximity to open windows.

Eating and drinking areas

There is a general shared social area on Level 2 of the Wolfson Building where eating and drinking is permitted.

Student Support Services

There are numerous support services within the University and these are detailed in the University Student Handbook which is issued to all new students. In this section of the Departmental Handbook we show you where you can find support within the Department.

Course Director

The Course Director is your initial contact regarding all University issues. Please contact Dr Craig Childs (craig.childs@strath.ac.uk) for any academic or personal issue affecting your studies.

If you feel that you cannot speak freely to the Course Director, you may alternatively contact the Departmental Office who will find an alternative, or indeed the Head of Department.

Staff-Student Committee

We welcome feedback at any time, positive or negative, on your student experience. If you have any issues or concerns, please contact the Course Director who would be very willing to address them. If you feel that you cannot speak freely to the Course Director, you may alternatively contact the Departmental Office, or indeed the Head of Department.

A Staff-Student Committee, which normally meets at least twice per year, provides a forum where academic problems may be raised by student representatives who have been selected from each year of the course. Students are encouraged to consider the benefits of becoming a Student Rep, further information on which can be found at:
https://www.strathunion.com/

When selected, the names of reps will be notified via email. The student reps are encouraged to attend the Staff-Student Committee which normally comprises two student reps from each year of each course, course directors and other members of staff as appropriate. Formal minutes of these meetings will be taken and you will see how we address the issues raised by students'. The University places great importance on these meetings and the staff-student committee meeting minutes will be seen at Faculty level and ultimately at Senate.

Disability Service

For information on this service please refer to the University Student Handbook. The service for students includes:

- Information and advice for disabled students and applicants.
- Assistance in accessing the Disabled Students' Allowance or similar funds for equipment and other help needed for study.
- Liaison with other agencies who can provide the sorts of assistance students might need, such as Sign Language Interpretation, readers or sighted guides.
- Help with arranging assessments, such as dyslexia assessments, where these are needed to support applications for assistance.
- Support in setting up appropriate exam arrangements, where students might need, for example, additional writing time or rest breaks.

Dr Craig Robertson is the Departmental Coordinator for students with disabilities. If you believe that you qualify for special examination arrangements, then please make yourself known to Dr Robertson after first visiting the Disability Service.
NB: It is important that arrangements are put in place several weeks prior to the start of the examinations.

The Course – general information

The BEng/MEng in Biomedical Engineering is a multidisciplinary course that combines knowledge of the physical and life sciences with advances in technology and engineering to generate applications and solutions to clinically relevant problems. The course structure is principally in the Engineering pathway with associated learning in life and clinical sciences.

The course aims to foster a multidisciplinary learning environment in which ideas and concepts from science, medicine and engineering merge to produce graduates with a broad range of key skills, capable of developing careers in biomedical engineering (research, industrial and NHS).

Learning outcomes

By the end of BEng or MEng Biomedical Engineering degrees, students should be able to demonstrate:

Knowledge and understanding of:

- human anatomy, physiology, cellular and molecular biology in healthy and diseased states
- key mechanical and electrical engineering concepts and mathematics
- the application of engineering methods to the study of human biological systems and processes, and especially with regards to rehabilitation, medical devices, tissue engineering and emerging trends in the subject.
- the research, clinical and industrial/commercial roles and environments of professional biomedical engineers.
- Key global market regulatory bodies and ethics governance relating to clinical studies (including trails) and medical devices.

Intellectual Skills:

- use engineering techniques coupled with clinical and life science knowledge to solve relevant problems in each discipline and at their interface.
- Be able to discuss clinical and technical issues with scientists, clinicians and engineers without the constraints placed by the terminology that normally isolate these professionals.
- formulate testable hypotheses and plan experimental and systematic investigations.
- apply appropriate analytical methods to data analysis.
- critically evaluate the result of their own research and that of others.
- assess and specify the regulatory, safety and ethical issues associated with any work they are engaged in.

Transferable skills:

- work independently or within a multidisciplinary team.
- communicate oral and written work effectively.
- utilise modern information and communications technology.
- Use common hardware and software to perform engineering analyses
- manage resources and time.
- transfer techniques and solutions from one field of knowledge to another

Course overview

Years 1 & 2
Core concepts in mathematics, mechanical engineering, electrical engineering, anatomy, physiology and molecular bioscience provide fundamental engineering and biomedical science knowledge. You take the majority of these classes alongside other engineers and biomedical scientists, while specialist classes will develop your Biomedical Engineering focus.

Year 3
You will start to apply your knowledge in specific areas of biomedical engineering (eg biomechanics and biomedical materials) as well as deepening your understanding of core engineering and biomedical science topics.

Year 4
Year 4 focuses on an individual research project. A generic skills class in research methods and professional studies will provide knowledge of research design and statistical analysis, insight into the role and environment of the biomedical engineer and an understanding of ethical, safety and quality management issues.

Year 5 (MEng only)
The group project is a major element of this year of the Masters course in which teamwork, creative collaboration, communication and effective management are developed. Advanced study in specialist areas such as medical device design, tissue engineering and robotic orthopaedic surgery will further develop and broaden your knowledge.

The main reason for most students to pursue the 5 year MEng option is to complete the educational requirements for Chartered Engineer status before graduating and therefore to avoid the need to return for further study at a later stage. The option to graduate after four years with a BEng Honours award is open to all students and many employers traditionally take on such graduates with a view to further in-house training which may also provide a route to Chartered status. However, current experience is that such employers look for a good class of degree and evidence of a well-rounded portfolio of achievement.

First Year
All students shall undertake classes amounting to 120 credits as follows:

Compulsory Classes		Level	Credits
BE100	Anatomy and Physiology for Biomedical Engineers	1	20
BE101	Biomedical Engineering	1	10
BE103	Analytical and Numerical methods in Biomedical Engineering	1	20
BE105	Cell Biology 1	1	10
EE107	Electronic and Electrical Principles 1	1	20
EM105	Electrical and Mechanical techniques and design	1	20
ME108	Engineering Analysis and numerical methods	1	10
ME109	CAD for BME	1	10

Second Year
All students shall undertake classes amounting to 120 credits as follows:

Compulsory Classes		Level	Credits
BE205	Fluid Mechanics in Biomedical Engineering	2	10
BE210	Human Cell Biology 2	2	10
BE208	Statics and Dynamics in Biomedical Engineering	2	20
EE269	Electronic and Electrical Principles 2	2	20
EE270	Digital Electronic Systems	2	20
ME209	Mathematical Modelling and Analysis	2	20
ME214	Mechanical Engineering Design 2	2	10

Third Year
All students shall undertake classes amounting to 120 credits as follows:

Compulsory Classes		Level	Credits
BE300	Biomedical Materials	3	20
BE301	Physiological Systems in Health and Disease	3	20
BE302	Practical Biomechanics	3	20
BE305	Cell Biology 3	3	10
BE306	Biomedical Imaging	3	10
EE312	Instrumentation and Microcontrollers	3	20
	Elective	3	20

Fourth Year
All students shall undertake classes amounting to 120 credits as follows:

Compulsory Classes		Level	Credits
BE401	Biomedical Electronics	4	10
BE404	Biomedical Instrumentation	4	10
BE406	Biomedical Engineering project	4	40
BE428	Professional Studies and Research Methods in Biomedical Engineering	4	20

together with 40 credits, no more than two 10 credit classes, chosen from:

	Optional Classes		
16429	Computer Aided Engineering Design	4	20
BE405	Sports Injury and Rehabilitation	4	20
BE424	Practical Biomechanics 2	4	20
BE425	The Medical Device Regulatory Process	4	10
BE426	Medical Robotics	4	10
BE427	Numerical Modelling in Biomedical Engineering	4	10
EE472	Control Principles	4	20
EE474	Robotics: systems and control	4	20
ME414	Advanced Mechanics and dynamics	4	20
BE431	Rehabilitation Technology	4	10

Fifth Year
All students shall undertake classes amounting to 120 credits as follows:

Compulsory Classes		Level	Credits
EF931	Project Management	5	10
BE513	Biomedical Engineering group project	5	60

together with 50 credits of classes taken from the list below, with at least 40 credits being taken from list A.

Fifth Year Options Classes

List A

BE900	Tissue Mechanics	5	10
BE901	Regenerative Medicine & Tissue Engineering	5	10
BE902	Prosthetics and Orthotics	5	10
BE903	Cardiovascular Devices	5	10
BE904	Clinical and Sports Biomechanics	5	10
BE905	Bio-signal Processing and Analysis	5	10
BE906	Biomaterials and Biocompatibility	5	10

List B

16565	Engineering composites	5	10
EE578	Advanced Digital Signal Processing	5	10
EE579	Advanced microcontroller applications	5	10
EE581	Image and video processing	5	10
EE582	Control techniques	5	10
BM918	Clinical Biochemistry	5	10
BM919	Medical Genomics	5	10
MP941	Advanced Techniques in Biochemistry	5	10
MP942	Advanced Techniques in Biomedical Research	5	10
MP946	Advanced Techniques in Molecular Biology	5	10

Registration/Curriculum Choice

Please note that it is your responsibility to ensure that you are registered correctly. If you take a class but have not registered officially for that class you will not be awarded a credit. Conversely, if you register for a class then do not take it you will be recorded as having failed unless you delete the class from your record.

You also must ensure that you are registered for 120 credits per year. If in doubt, please contact the Course Director.

Coursework

Try hard to keep up with your coursework - it is important. If you miss the deadlines without satisfactory reasons, you may find that your assessment for that class is heavily compromised. It should be noted that penalties will be incurred for late coursework (see below).

Extensions

Before requesting an extension, it is advised that students read this section fully. The extension request requirements vary depending on the length of extension requested and the method by which the request is submitted. There is also some guidance on what might constitute grounds for an extension request to be granted.

Students requesting an extension to the deadline for a piece of coursework must apply via the extensions tool in Myplace. Further guidance about using this tool is contained under the heading *'Myplace Extension Request'* below.

Please pay attention to the examples found under the Section 3 heading *'Grounds for Extending the Deadline for Coursework Submission'* below. These are taken from the Policy and Procedure on Extensions to Coursework Submission The policy intends to be supportive of students, and staff will monitor students' use of extensions in order to identify students who may require support. The policy provides examples of what might be grounds for granting an

extension and what is unlikely to be grounds for the granting of an extension. The list does not try to cover every possible scenario so students should discuss with staff any circumstances that are negatively impacting their studies.

Extension requests will normally be made in advance of a coursework submission deadline. In exceptional cases, students may apply for an extension retrospectively.

Extension of less than seven calendar days

Requests for an extension of less than seven calendar days do not require formal supporting evidence (e.g., a doctor's letter). However, students are encouraged to communicate to staff any circumstances that are negatively impacting their studies as early as possible, especially where other assessments or aspects of their studies are also impacted. This can be done by submitting a Self-Certificate form on Pegasus.

Extension of longer than seven days

For extensions that are longer than seven days, it is essential that students complete a 'Personal Circumstances Form' and submit it directly to Student Business for their Faculty at: studentbusiness-engineering@strath.ac.uk within five working days of the agreed extension date. There is information about the Personal Circumstances Procedure on the website.

Failure to submit evidence of medical or personal circumstances for extension requests of seven days or more could result in the extension request being rejected or revoked and/or any subsequent academic appeal being regarded as inadmissible.

Students should note that certified cases of medical and/or personal circumstances will be considered sympathetically and the rules will be applied in a caring manner. Where there are sensitivities or difficulties in obtaining evidence (for example, a death certificate), a compassionate approach will be taken. The rules are designed to be as clear as possible, to help students plan their work sensibly and ensure parity in the service provided to all students.

Grounds for Extending the Deadline for Coursework Submission

The list below does not try to cover every possible scenario but provides examples of what might be grounds for granting an extension and what is unlikely to be grounds for the granting of an extension. Students should not be discouraged from submitting a request if they do not see their situation described below.

Examples of Medical Circumstances

Medical conditions or illness, including physical and/or mental health problems that negatively impact a student's preparation for an assessment.

Examples of Personal Circumstances

- serious illness or death of a person close to the student
- family break-up
- being a victim of crime
- being in a serious car accident
- jury service
- significant relationship breakdown
- unexpected caring commitments
- homelessness
- Home Office requirements

- Fire
- flood
- adverse weather conditions
- exceptional travel circumstances outwith a student's control which prevented them from meeting the published submission date
- other exceptional circumstances that can be reasonably considered to negatively impact a student's ability to submit coursework on time

Examples of Insufficient Grounds for an Extension

The following circumstances would not be acceptable grounds for granting an extension:

- poor planning and time management
- error made in understanding the published dates of assessment submissions
- having another assessment due on or around the same date
- minor IT issues such as computer failure
- failure of third parties to deliver the assessment
- holidays, social events, moving house, or any event planned in advance of the submission deadline
- failure to make alternative travel plans when disruptions were advised in advance

Myplace Extension Request Process

Instructions for the submission of an extension request via Myplace are below. A version of these instructions with images of the screen to support the explanation is also available.

1. Go to the Myplace site for the class in which you wish to request an extension to the deadline of a piece of coursework
2. Click on the assignment link for the piece of coursework. This will open a page containing information about the assignment, the status of your submission and the deadline
3. Click on the Extensions section and select 'Request Extension'
4. You will be required to fill in three parts of a form:
    i. Select a reason from the dropdown list
    ii. Propose a new deadline (date and time)
    iii. Describe in more detail your reason for requesting an extension
5. Submit your extension request

You will receive a Myplace notice and an email to confirm that your request has been submitted. If you have downloaded the University's Mobile App and have logged in using your DS username, you will also receive a push notification on your device.

Your request will be considered, resulting in one of the following two outcomes:

1. Your extension request will be granted – either based on the date and time you proposed or based on an alternative date and time specified by the appropriate member of staff
2. Your extension request will not be granted*

The outcome of your extension request will be communicated to you via a Myplace notice and an email. If you have downloaded the University's Mobile App and have logged in using your DS username, you will also receive a push notification on your device.

If you submit an extension request and decide that you no longer require it, you can cancel the request up until the point at which it is approved. After it has been approved, you cannot cancel the request but you can, of course, submit the work in time for the original deadline.
If your extension request is not granted and you would like to access support please contact your Course Director. For details of central University support services, please see the following:

Disability and Wellbeing Service (including Student Counselling Service and Student Health)
Phone: 0141 548 3402
Email: disability-wellbeing@strath.ac.uk
Disability & Wellbeing Service
Room 4.36, Level 4,
Graham Hills Building
50 George Street
Glasgow G1 1QE
For more information visit the Disability and Wellbeing Service webpage.

Study Skills Service
Phone: 0141 548 4064/4062
Email: studyskills@strath.ac.uk
Level 6
Livingstone Tower
26 Richmond Street
Glasgow G1 1XH
For more information visit the Study Skills Service webpage.

Learner Development Services
TL453, Prof. Mary Dunn Wing
Learning and Teaching Building
Glasgow G1 1XQ
For more information visit https://www.strath.ac.uk/studywithus/strathlife/academicsupport/

International Student Support
Phone: 0141 548 4273
Email: infoandadvice@strath.ac.uk
For more information visit the International Student Support webpage.

Strathclyde Students' Union's The Advice Hub
Phone: 0141 567 5040
Email: strathunion.advice@strath.ac.uk
For location see Strath Union's Advice Hub webpage.

Penalties for the Late Submission of Coursework

Coursework is deemed to be late when it is submitted after the published deadline without an agreed extension, and in the absence of personal circumstances.

The Policy and Procedure on Late Submission of Coursework provides a detailed account of the policy and procedures for the late submission of coursework. You should read this document carefully, noting that there may be exceptions to the policy outlined for specific types of coursework, such as (but not limited to) group work or presentations. Staff will communicate any such instances to students. However, in all instances, the range and timing of penalties will be applied according to a commitment to fairness and supporting all students in their studies alongside agreed procedures. Staff will monitor the late submission of assessments in order to identify any students who may require support. For regular coursework, the Policy and

Procedure on Late Submission of Coursework outlines the penalties to be applied, and these are summarised below.

Penalties for Late Submission

Coursework that is submitted late, but within seven calendar days of the published deadline date and time, will be subject to penalties, as shown in the table below. The table demonstrates the application of a sliding scale of penalties, where a late submission within 24 hours of the deadline will incur a penalty of 10% applied to the original mark, and for each subsequent 24 hour period, an additional 5% penalty will be applied to the original mark. The table also shows that the application of penalties will be capped for coursework that is of a Pass standard. Coursework submitted after seven calendar days of the published deadline date and time will receive a mark of zero. Students who can demonstrate that they faced exceptional circumstances on the deadline day, and who submit their coursework within 4 hours of the published date and time, will not have their coursework subject to penalties. This 4 hour period is called the 'grace period' – see below the table for further information.

Example	Day of submission	Penalties applied
1.	Coursework submitted after the deadline, student has an approved extension and submits within the approved extension period.	No penalty to be applied.
2.	Late submission on the day of the deadline (or approved extended deadline), student has communicated exceptional circumstances and is granted a grace period of up until four hours after the deadline.	No penalty to be applied.
3.	Late submission within one calendar day (less than 24 hours) of the deadline, student has no approved extension.	10 percentage point penalty applied to original mark, unless the penalty reduces the student's mark to below 40%, in which case the mark is capped at 40%.
4.	Late submission more than one calendar day (more than 24 hours) after the deadline but less than two full calendar days (less than 48 hours) after the deadline has expired, student has no approved extension.	15 percentage point penalty (10 points for first day, 5 points for second day or part day), capped at 40% (50% MEng).
6.	Late submission more than two full calendar days (longer than 48 hours) after the deadline but less than three calendar days (72 hours), student has no approved extension.	20 percentage point penalty (10 for first day, 5 for second day, 5 for third day or part day), applied to original mark, capped at 40% (50% MEng)
7.	Late submission more than three full calendar days (longer than 72 hours) after the deadline but less than four full calendar days (less than 96 hours), student has no approved extension.	25 percentage point penalty (10 for first day, 5 for second day, 5 for third day, 5 for fourth day or part day), applied to original mark, capped at 40% (50% MEng)
8.	Late submission more than four full calendar days (more than 96 hours) after the deadline but less than five full calendar days (less than	30 percentage point penalty (10 for first day, 5 for second day, 5 for third day, 5 for

	120 hours), student has no approved extension.	fourth day, 5 for fifth day or part day), applied to original mark, capped at 40% (50% MEng)
9.	Late submission more than five full calendar days (more than 120 hours) after the deadline but less than six full calendar days (less than 144 hours), student has no approved extension.	35 percentage point penalty (10 for first day, 5 for second day, 5 for third day, 5 for fourth day, 5 for fifth day, and 5 for sixth day or part day), applied to original mark, capped at 40% (50% MEng)
10.	Late submission more than six full calendar days (more than 144 hours) after the deadline but less than seven full calendar days (less than 168 hours), student has no approved extension.	40 percentage point penalty (10 for first day, 5 for second day, 5 for third day, 5 for fourth day, 5 for fifth day, 5 for 6th day and 5 for the 7th part day), applied to original mark, capped at 40% (50% MEng)
11.	Late submission more than seven full calendar days after the deadline. For example, a deadline was set for Midday on a Wednesday and a student submits an assessment after midday the following Wednesday	A mark of zero will be applied to the work.

Requesting the application of the grace period

If you experience unexpected circumstances before the time set on the day of the deadline and it results in a delay to your submission of less than four hours, you can request that the grace period is applied to your coursework submission via the late submissions tool in Myplace. If the reason provided is acceptable for use of the grace period, this will mean that a penalty is not applied to your mark. **Requests for the grace period to be applied must be submitted within 4 hours of the published date and time and no longer** – we strongly suggest that you submit your request as soon as you have submitted your coursework. To request that the grace period is applied:

1. Submit your coursework
2. In the assignment page containing information about the status of your submission and the deadline, click on the Late Submissions section to expand it
3. From the 'Reason for grace period' dropdown list, select the reason that best describes why you are requesting the grace period
4. Submit your request

The grace period will be automatically applied to your submission. However, if it becomes apparent that the grace period has been misused, a member of staff may revoke it and apply the appropriate late penalty. Instructions with images of the screen to support this explanation is also available.

Where a penalty is applied in Myplace, you can view the grade awarded to your work, the late penalty deducted and the final grade received after the deduction of the penalty. You can do this by expanding the *'late submissions'* section on the assignment page, once the grades have

been released. Instructions with images of the screen to support this explanation is also available.

Penalty for late submission	The penalty applied as a percentage
Performant grade	The mark you would have received if there was no penalty
Pass mark	The mark required to pass the assignment
Marks deducted	The number of marks deducted (not the percentage deducted)
Effective percentage point penalty	How many percentage points were deducted
Grade	The mark returned to you shows you your Performant Grade minus the Marks Deducted

In the case of coursework to be submitted through Myplace, issues with Myplace which prevent students from submitting their coursework before the deadline will not result in late penalties. In this situation, staff will amend the deadline to allow enough time for students to successfully upload and submit their coursework after the issue has been resolved.

If you think you are unlikely to meet a coursework deadline due to medical issues or personal circumstances, please apply for an extension as early as possible.

Pass marks and academic progress

Normally the pass mark for each class is 40%, except in the 5th MEng year where the pass mark is 50%. However, there are a number of reasons why you should set your sights higher than this, not least being the fact that your marks will appear on your Academic Transcript, copies of which are often sought by prospective employers. In addition, where the classes contribute to the grading of your final degree classification, it is important for you to secure the highest possible marks. Students in their first, second and third years, and fourth year (MEng only), who perform well, will be rewarded by the award of a Dean's Certificate for meritorious performance.

By passing a class, students acquire the credit for that class. 120 credits are taken each year of the course. Progress on the degree requires students to accumulate at least the following number of credits

Progress into year…	Accumulated credits
2	100
3	220
4	360
5	480

In addition to the above requirements, a credit-weighted average of 60% is required to progress to the next year of the MEng degree course. If a student has a credit-weighted average below 60% they will be required to move to the BEng degree course, provided all other progress requirements have been satisfied.

Faculty Compensation Scheme

The Faculty operates a Compensation Scheme which is designed to assist Boards of Examiners to take decisions about student progress at the end of each of the first, second and third years of undergraduate study and the first four years of an integrated Masters degree. Fail marks in the range 30-39% may be eligible for compensation under the scheme and converted to a pass provided the weighted credit average across the students prescribed curriculum is 45% or higher. Up to 20 credits may be compensated in this way. The scheme can be applied only to the student's first attempts and, therefore, is normally used only at the June meetings of the Boards of Examiners when the results from the January and May/June degree examinations are considered. Classes in which coursework is outstanding (i.e. not submitted) are not eligible for compensation.

Please note that the mark does not change, but rather the credits for the class are awarded based on your satisfactory overall performance in other classes in that year.

Examinations and Resit Attempts

If a student does not pass a particular examination and it is not compensated, it is essential to resit outstanding examinations at the next examination diet or at the next available opportunity (or complete supplementary work to a satisfactory standard) so that eventually the total credits required for the final degree can be accumulated.

Note that although Examination Boards normally allow undergraduates two attempts to gain a particular credit (or submit supplementary work), such attempts must be at two consecutive offerings of the examination. It should also be noted that the marks used to determine the final honours or MEng grading are based on those obtained at the **first examination attempt**.

The August diet of examinations is usually dedicated to resit examinations. Students should ensure that they do not book holidays over this period in case they need to resit an examination.

Medical Certificates and Impaired Performance

If a student believes that their academic performance has been impaired due to medical or personal circumstances they should inform the course director and attach supporting evidence such as a doctor's note.

You may also self-certify an illness or personal circumstances on Pegasus, however, unbiased evidence **must** be submitted if some remediating action is to occur.

It is vitally important, therefore, that if you have personal circumstances, which may have affected an assessment, either coursework or exam, then you must submit evidence of this circumstance within 5 days of the assessment. Even if you think you've done "alright", please submit the evidence which may be used to mitigate the performance just in case you haven't.

All submitted evidence will be treated confidentially. A small Faculty committee will look at the evidence and inform the department what action they can take based on the submitted evidence. The details of the evidence are not circulated and disclosed to the department.

If you do not submit evidence in time for the board of examiners, and an assessment was affected, then you will have to go through an appeal process to change the decision of the board. Do not wait for the results to come out before submitting personal circumstances evidence!

Award of the degrees

It is important to understand that your performance in the earlier years of your course can have a bearing on your final award. This means that continued high performance will be rewarded but with emphasis on the later stages of the course. You should also be aware that, in line with recommendations of the accrediting institutions, the performance to be taken into account is based on **first diet assessment**.

For those joining the course after September 2018 (i.e. those with registration numbers starting 2018 or 2019), calculation of your final mark is given by:

BEng
Composition of final mark:
30% of Year 3 mark
70% of Year 4 mark

Year 3: Weighted average of first attempt at compulsory credits (elective excluded).
Year 4: Weighted average of first attempt at compulsory credits.

MEng
Composition of final mark:
20% of Year 3 mark
40% of Year 4 mark
40% of Year 5 mark

Year 3: Weighted average of first attempt at compulsory credits (elective excluded).
Year 4: Weighted average of 120 credit 4th year curriculum.
Year 5: Weighted average of 120 credit 5th year curriculum.

For those joining the course before September 2017 (i.e. those with registration numbers starting 2017 or earlier), calculation of your final mark is given by:

BEng
Composition of final mark:
15% of Year 2 mark
25% of Year 3 mark
60% of Year 4 mark

Year 2*:* Weighted average of first attempt at compulsory credits.
Year 3: Weighted average of first attempt at compulsory credits (elective excluded).
Year 4: Weighted average of first attempt at compulsory credits.

MEng
Composition of final mark:
15% of Year 2 mark
25% of Year 3 mark
30% of Year 4 mark
30% of Year 5 mark

Year 2: Weighted average of first attempt at compulsory credits.
Year 3: Weighted average of first attempt at compulsory credits (elective excluded).
Year 4: Weighted average of 120 credit 4th year curriculum.
Year 5: Weighted average of 120 credit 5th year curriculum.

Notwithstanding the above, since there has been a regulation change, for students with registration numbers starting with 2017 or earlier, both calculations will be used. If there is a discrepancy in the final mark such that the final marks suggest different awards (see next section), the higher of the two marks will be taken.

Classification of awards

The Honours bands may vary slightly from year to year at the discretion of the Final Honours Examination Board on the advice of the External Examiner. To let you know what to aim for, the bands will normally be of the order of:

Course	Degree classification	Indicative performance required
BEng	1st	≥ 70%
	2.1	60-69%
	2.2	50-59%
	3rd	40-49%
MEng	Distinction	≥ 70%
	Merit	60-69%
	Pass	50-59%

Examinations (General information)

It is important to note that:

- published exam dates may change and therefore you should not make arrangements to leave the area prior to the official end of the examination period. No special arrangements will be made in such cases.

- students will normally be given two attempts to pass such classes during the course of the academic year. Students who fail to complete a class at the first attempt will be given one additional assessment opportunity before the September Board of Examiners. This will either be a re-submission of coursework or a formal examination in the August diet.

- For the purposes of degree classification, only first diet marks will be considered.

- those who are permitted to carry over classes to subsequent years will be given the opportunity to resit them during the course of the next academic year. Students should note that failure to pass any compulsory class after four attempts will result in transfer to the BEng pass degree in Engineering Studies.

Use of calculators in examinations

It is recommended that students have a **basic** scientific calculator for use in examinations as, although calculators may normally be taken into the examination venue, they must not be used to store text nor formulae nor be capable of communication. Invigilators may require calculators to be reset.

Use of dictionaries in examinations

Students whose native language is not English are permitted to use paper-based English/native language dictionaries in University examinations, except during language examinations. These dictionaries will be subject to scrutiny by the Invigilator in Charge of each examination. Electronic dictionaries are not permitted in University examinations.

Absence

Students who fail to present themselves for an examination at the time and place published will be deemed to have forfeited that opportunity to sit the examination; except that in cases of absence through illness or other sufficient cause the Board of Examiners will take into consideration documentary evidence in assessing a candidate's position.

Students must sit all terminal tests and examinations unless prevented by illness in which case a medical certificate must be produced.

For absences of 7 days or less. Students who have been absent for 7 days or less should record a self-certification online via PEGASUS using the Personal Circumstances link under the services tab.

For absences of more than 7 days. Where sickness results in absence of more than 7 days, the student is required to submit a medical certificate (signed by a medical practitioner who is not a member of the student's family) to Student Experience. Student Experience will inform the relevant Department and, if the absence continues for 14 days or more, the SAAS or relevant grant awarding body.

For absences from an examination or failure to complete assessed coursework. The self-certification convention does not apply and a student absent from an examination, class test or who fails to submit an assessment/assignment on time due to sickness must submit a formal medical certificate.

In considering results, the Board of Examiners is concerned to take into account medical or other circumstances which may have adversely affected a student's performance. It is very important that the University is made aware of such circumstances in writing and, where relevant, with the production of a medical certificate. Students should provide information on adverse circumstances both to their Adviser of Study and to Student Experience. They may also find it useful to arrange to see their Personal Development Adviser.

Academic Dishonesty

The University regards academic dishonesty as a serious offence. Allegations of academic dishonesty will be fairly assessed and appropriate action will then be taken. An allegation that has been dismissed as a disciplinary offence may still incur an academic penalty for poor scholarship.

The University is aware that there are a variety of temptations for students to engage in academically doubtful or dishonest activities during formal examinations, or in relation to assignments, practical work, dissertations or thesis preparation. In setting assessed assignments of whatever form, all teaching staff actively consider how to minimise the opportunities for students to cheat. Promoting a general climate of academic integrity within the student body is important.

Examples of Academic Dishonesty

1. cheating in written examinations:
   illicit copying or communicating; possession of prohibited materials

2. false candidature:
   being replaced by a false candidate or impersonating a candidate

3. collusion:
   the representation of a piece of unauthorised group work as the work of a single candidate

4. commissioning, stealing or acquiring:
   submitting an assignment done by another person as the student's own work

5. duplication:
   the inclusion in coursework of material identical or substantially similar to material which has already been submitted for another assessment within the University

6. false declaration:
   making a false declaration in order to receive special consideration by an Examination Board/Committee or to obtain extensions to deadlines or exemption from work

7. falsification of data:
   presentation of data in laboratory reports, projects, etc based on work purported to have been carried out by the student, which have been invented, altered or copied by the student

8. plagiarism:
   the unacknowledged use of another's work as if it were the student's own work. Examples, which apply both to conventional sources and information downloaded from the internet, are:
   a. inclusion of more than a single phrase from another's work without the use of quotation marks and acknowledgement of source;
   b. summarising another's work by changing a few words or altering the order of presentation without acknowledgement;
   c. copying another's work;
   d. use of another's ideas without acknowledgement or the presentation of work which is substantially the ideas of another.

Academic Appeals Procedure

Should you wish to appeal against a decision of the Exam Board, please see the Course Director who can advise regarding the process. The grounds for appeal are given below.

An appeal against the transfer of candidature or termination of registration may be made by a student to the Faculty Board of Study (or Faculty Appeals Committee) on any of the following grounds:

a) that there were procedural irregularities in the conduct of the examination or of the assessment;
b) that there were medical, personal or other circumstances affecting the student's performance of which the Examiners were not aware when the decision was taken;
c) that there was inadequate assessment, prejudice or bias on the part of one or more of the examiners or assessors.

Any such appeal must be supported by documentary evidence and should be submitted in writing to the Faculty Manager by the deadline stated in the formal examination results letter. Appeals received after the deadline will not be heard, except in extenuating circumstances, and may be too late to be considered for the next academic year. Final year students who wish to appeal a classification outcome must not graduate in July as appeals are heard after July graduations.

Students who wish to appeal and who are awaiting medical certificates or doctor's letters should write to the Faculty Office advising of their intent to appeal by the deadline advised when results are issued. The Faculty Office for Engineering is located on Level 6 of the James Weir Building. The Faculty Manager can be consulted for advice on submitting letters of appeal.

Senior Faculty Officer	Stephanie McNulty	stephanie.mcnulty@strath.ac.uk
Faculty Officer	Lisa Lyons	lisa.lyons@strath.ac.uk

If the Faculty appeal is rejected, students have the ultimate right of appeal to Senate. Please see the Course Director in this instance for advice.

Attendance and Performance

Every applicant admitted to a course of study shall be required to attend regularly and to perform satisfactorily the work of each class in their curriculum. A student who, in the opinion of the Head(s) of the Department(s) (or nominees(s)) offering a class, does not satisfy the requirements as to attendance and to performance and having been informed in writing, shall not be entitled to take the examination in the subject of that class. The names of such students shall be reported immediately to the relevant Board of Study.

A registered student may subsequently be permitted by the Head of Department to take the examination in the subject of the class at the next available opportunity subject to satisfactory completion of appropriate coursework.

These regulations will be applied to all Engineering classes (this includes laboratories, design classes, works visits, etc., as well as formal lectures and tutorials). Staff responsible for each class will monitor attendance as appropriate.

The regulations are emphasised for the simple reason that they are in the students' interests. Poor attendance makes the course more difficult for you and is usually associated with poor performance. If a student has to miss classes for any good reason (medical, domestic, etc) he/she must inform their Year Adviser in writing.

We do not interpret **regular attendance** as necessarily meaning 100% attendance. An **occasional** missed lecture, for example, is not a problem. Staff responsible for each class will make it clear if your attendance is heading towards a problem.

Change of Address

Students are required to notify Student Experience of any change in your permanent home or term-time addresses. Student Experience sends at least four letters to each undergraduate student every year. It is therefore important that they have the correct home and term-time addresses. These letters advise students of their academic progress, provide an opportunity for students to check their undergraduate curriculum, and where applied for may assist the student to claim exemption from the Council Tax. Students can update their personal details on the University website http://pegasus.strath.ac.uk

Equality and Diversity

The University of Strathclyde is committed to achieving and promoting equality of opportunity in the learning, teaching, research and working environments.

We value the diversity of our students and support the development of mutual respect and positive relations between people.

The University has in place an Equality Outcomes which meet the requirements the Equality Act 2010.

You are advised to familiarise yourself with the University approach to equality and diversity and relevant developments and information by visiting the website:

www.strath.ac.uk/equalitydiversity/

It is important that you understand your rights and responsibilities. Any discriminatory practice, including cyber bullying, on your part may lead to the University initiating disciplinary action.

If you have any queries, please bring these to the attention of staff or the University's Equality and Diversity office.

Email: equalopportunities@strath.ac.uk Tel: 0141 548 2811

Athena SWAN

The University and Department currently holds a Bronze Athena SWAN award, recognising our commitment to advancing women's careers in science, technology, engineering, maths and medicine (STEMM) employment in academia.

The Athena SWAN Charter has been developed by the Equality Challenge Unit to encourage and recognise commitment to combating the under-representation of women in STEMM research and academia.

If you would like any additional information, please contact the Equality and Diversity office.

Disability and Wellbeing

The University is committed to providing an inclusive learning and working environment for disabled people.

If you have, or think you have, a disability we encourage you to disclose it as soon as possible. Declaring your disability will enable you to access any additional support that you may need and help to ensure you become a successful student. The information you provide will be treated as confidential and will not be shared with other staff without your consent.

The University has a dedicated Disability Service that offers specific advice, information and assistance to disabled students, including information on the Disabled Students Allowance (DSA). Further information is available from the website:

www.strath.ac.uk/professionalservices/disabilityandwellbeing/

In addition, each academic Department/ School (for HaSS) has at least one Departmental Disability Contact (DDC), who act as a first point of contact for disabled students. The Departmental Disability Contact list is available on the website at:

www.strath.ac.uk/professionalservices/disabilityandwellbeing/contact/

Please inform your course tutor, the DDC and a member of the Disability Service of your needs as soon as possible. The Disability Service will then formally communicate your needs to your Department/ School.

Email: disability-wellbeing@strath.ac.uk Tel: 0141 548 3402

Issues with Physical Access on campus

If you experience an issue with physical access anywhere on campus, please email: physicalaccess@strath.ac.uk where a member of Estates staff will be able to help.

Classroom Protocol

At the University we are committed to providing a safe learning environment where dignity is respected and discrimination or harassment, including cyber bullying does not occur on the basis of age, disability, gender reassignment, marriage and civil partnership, pregnancy and maternity, race, religion or belief, sex, sexual orientation and socio-economic background. No student should intentionally be made to feel threatened or excluded from class participation.

You are reminded of your responsibility for the duration of your studies by showing respect to fellow classmates and staff. More information on the protocol is available at:

www.strath.ac.uk/studywithus/strathlife/whatitslikestudyingatuniversity/

Student Complaints

If you wish to register a complaint about the course, staff, another student, or any other University issue, please see the Course Director who can advise on the procedures. In addition, please refer to the website for the complaints procedure:

http://www.strath.ac.uk/staff/policies/academic

The Course – regulations

You are encouraged to consult the Regulations governing your course on a regular basis. The Regulations set out the framework for your studies and specify the criteria for your progression through the course. The language is carefully chosen to cover all eventualities and may need some interpretation or clarification.

Please see link below for Regulations.

2023-24_Biomedical_Engineering.pdf (strath.ac.uk)

The Course – class details

Year 1

The following pages contain class descriptors for the different classes in year 1. Since different departments teach different classes, the class descriptors may differ slightly in format.

MODULE DESCRIPTION FORM

DEPARTMENT OF BIOMEDICAL ENGINEERING

BE100 Anatomy and Physiology for Biomedical Engineers

Module Registrar: Dr Craig Childs	**Taught To (Course):** BEng/MEng Biomedical Engineering BEng/MEng Sports Engineering		
Other Lecturers Involved: Dr Craig Robertson and selected Research Staff	**Credit Weighting:** 20	**Semester:** 1 and 2	
Assumed Prerequisites: .	**Compulsory class**	**Academic Level:** SCQF7	**Suitable for Exchange: Y/N**

Module Format and Delivery (HOURS i.e. 1 credit = 10hrs of study):

Lecture	Tutorial	Laboratory	Groupwork	External	Online	Project	Assignments	Private Study	**Total**
18	26				44			112	200

Educational Aim

This module aims to provide a student with the basic knowledge of the anatomical structure of the major body systems, together with an understanding of their physiological functioning. This knowledge is fundamental to understand and to develop specific topics that will be taught later in the course.

Learning Outcomes

On completion of the module the student is expected to be able to:

LO1 Understand the levels of organisation of cells, tissues, organs and systems, and associated terminology.

LO2 Describe the basic structure and function of connective, muscle and nerve cells and tissues, and their interactions in the musculoskeletal and nervous systems.

LO3 Describe the structure and function of the respiratory and cardiovascular systems, and the co-ordination between them.

Syllabus

The module will teach the following:

Introduction to cells, tissues, organs and systems

Anatomy
- Skeleton (axial & appendicular) and joints
- Muscles of the upper and lower limbs
- Neuroanatomy and components of the central & peripheral nervous systems
- Lungs and other components of the respiratory system
- Heart and other components of the cardiovascular system

Physiology
- The cell, and cell types
- Bone cells, and skeletal system
- Nerve cells, and nervous system
- Muscle cells, muscular system, and fundamentals of muscle contraction and force production
- Cardiovascular system
- Respiratory system

Assessment of Learning Outcomes

Criteria

For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

LO1 Understand the levels of organisation of cells, tissues, organs and systems, and associated terminology.
C1 Identify and classify tissues, organs and systems
C2 Identify and describe characteristics of main tissues, organs and systems
C3 Identify and describe interactions between different tissues and systems

LO2 Identify and describe the basic structure and function of connective, muscle and nerve cells and tissues, and their interactions in the musculoskeletal and nervous systems.
C1 Identify and describe the basic structure and function of the skeletal and muscle systems, and their interactions.
C2 Identify and describe the basic structure and function of nervous tissue and the nervous system.
C3 Qualitatively describe the relationship between structure and function within the musculoskeletal and nervous systems.

LO3 Identify and describe the structure and function of the respiratory and cardiovascular systems, and the co-ordination between them.
C1 Identify and describe the structure and function of the lungs and other components of the respiratory system.
C2 Identify and describe the structure and function of the heart and other components of the cardiovascular system.
C4 Identify and describe the coordination between systems.

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

Principles of Assessment and Feedback
(within Assessment and Feedback Policy at: https://www.strath.ac.uk/staff/policies/academic/)

Please state briefly how these are incorporated in this module.

Summative assessment is by two examinations; one at the end of each semester, covering the preceding semester's topics. Each of these examinations consists of two elements, a multiple choice quiz and an interactive virtual dissection.

The class uses MyPlace extensively, supported by an online anatomy and physiology learning and teaching resource, with interactive quizzes ensuring that summative assessment has an impact on learning, as the student has the knowledge to close the gap between current and required performance. These quizzes provide adequate student-teacher reflection and discussions around students' learning.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

	Examinations				Courseworks		Projects	
	Number	Month(s)	Duration	***Weighting***	Number	***Weighting***	Number	***Weighting***
	2	Dec & May	2hrs each	50% each				
L/Outcomes	Dec exam diet LO1 & LO2; April/May exam diet LO1 & LO3							

Indicate which learning outcomes (L01, L02 etc) are to be assessed by exam/coursework/project as required.

Coursework / Submissions deadlines (*academic weeks*):

Resit Assessment Procedures:

Two hour exam at the August examination diet in the same format as the end of semester exams, covering content from the whole module.

PLEASE NOTE:
Students must gain a summative mark of 40% to pass the module. Students need to gain at least 35% in each assessment**. Students who fail the module at the first attempt will be re-examined during the August diet. This re-examination will consist entirely of exam. No marks from any previous attempts will be transferred to a new resit attempt.**

Recommended Reading

***Purchase recommended **Highly recommended reading *For reference *** Fundamentals of Anatomy and Physiology; 10th Edition, Frederic H Martini, Judi L Nath & Edwin F Bartholomew. Pearson Education ISBN-13: 9781292057217

Additional Student Feedback
(Please specify details of when additional feedback will be provided)

Date	Time	Room No

Session:

Approved:

Course Director Signature:
Date of Last Modifications:

(Updated May 2018)

MODULE DESCRIPTION FORM

BE101 Biomedical Engineering

Module Registrar: Dr Christopher McCormick		**Taught To:** BEng Biomedical Engineering MEng Biomedical Engineering	
Other Lecturers Involved: Dr Kimia Witte		**Credit Weighting:** 10	**Semester:** 1
Compulsory/optional/elective class: Compulsory		**Academic Level:** SHE 1	
Prerequisites:			

Module Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Project	Assignments	Private Study	Total
16	6			36	42	100

Educational Aim

The application of high technology devices in medicine has social, ethical, legal and marketing implications in addition to the fundamental design and clinical performance aspects. The aim of the class is to provide an insight into these areas. We will deal with two main applications: orthopaedic implants and artificial kidneys. The process of evolving the design specification from knowledge of normal body function and the matching of material properties to the body environment will be described. Students will be given the opportunity to explore these issues through a group project activity focused on a selected medical device or intervention.

Learning Outcomes

On completion of the module the student is expected to be able to understand:

LO1 What materials are used in Biomedical Engineering and how they are assessed for compatibility with body tissues.

LO2 How knowledge of normal function is translated into design specifications for artificial limbs/splints and artificial kidney devices.

LO3 How the performance of the device is evaluated.

LO4 What ethical, social and economic issues arise in prescribing these devices.

(UK SPEC suggests no more than 4 learning outcomes per module. Statements must be broad and be syllabus free and link in with the intended learning outcomes on the programme specifications.)

Syllabus

The class comprises 3 sections:

		Lectures
Section 1	Prosthetics and Orthotics	8
Section 2	Haemodialysis – a kidney replacement therapy	8
Section 3	Group Project Presentation	6 hours of tutorial + independent study

Assessment of Learning Outcomes

Criteria

Section 1
Introduction to Prosthetics and Orthotics.
Pathologies, causal factors, statistics.
Biomechanics of prostheses/orthoses.
Patient-device interfaces
Fitting and manufacturing techniques. CAD/CAM systems.
Prosthetic/Orthotic components.

Section 2

Functions of the kidney. Acute and chronic kidney failure.
Treatment options – drugs, transplantation, dialysis. Patient statistics, survival rates, costs.
Haemodialysis (the artificial kidney) principles of operation, linking patient to machine.

Monitoring control.
Design of the artificial kidney – mass transfer considerations, device geometry.
Device performance – clinical and engineering approaches
Patient-machine interaction – prescribing treatment schedules, clinical and socio-economic issues

Section 3

Understand the key features of a selected pathology and the impact that this has on the people with this condition and society more generally

Demonstrate knowledge of current medical/surgical treatments for this pathology

Discuss the role that biomedical engineering principles have played in the development and deployment of these treatments and identify opportunities for further improvements.

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

Principles of Assessment and Feedback

The University's Assessment and Feedback Policy can be found at: www.strath.ac.uk/staff/policies/academic/

Please state briefly how these are incorporated in this module.

Formal lecturers supplemented by handout notes.

Closed book examination.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

Examination			Coursework		Project	
Number	Duration	Weighting	Number	Weighting	Number	Weighting
1	1 hrs	50%			1	50%
LO1-LO4					LO1-4	

Indicate which learning outcomes (L01, L02 etc) are to be assessed by exam/coursework/project as required.

Coursework / Submissions deadlines:

The group project brief will be issued in Week 9 with submission and presentation of the poster in Week 11.

Resit Examination Procedures:

Resit will consist entirely of an exam.

PLEASE NOTE:
Students need to gain a summative mark of 40% to pass the module. Students who fail the module at the first attempt will be re-examined during the August diet. This re-examination will consist entirely of an exam.

Recommended Reading:

No text is recommended given the multi-disciplinary nature and basic subject matter of class. Supplementary materials will be made available through Myplace.

Additional Student Feedback:

(Please specify details of when additional feedback will be provided)

Students will be given the opportunity to practice answering knowledge and understanding based questions at different points through the semester, with feedback on these attempts provided at class level. Feedback on group project work will be provided through targeted discussions during the allocated tutorial time.

MODULE DESCRIPTION FORM

BE103 NUMERICAL AND ANALYTICAL METHODS IN BIOMEDICAL ENGINEERING

Module Registrar: Professor Stuart Reid				**Taught To (Course):** BEng Biomedical Engineering MEng Biomedical Engineering		
Other Lecturers Involved: Dr Philip Riches				**Credit Weighting:** 20	**Semester: 1 &** 2	
Compulsory/optional/elective class: Compulsory				**Academic Level**: SHE 1		
Prerequisites: None						
Module Format and Delivery (hours):						
Lecture	Tutorial	Laboratory	Project	Assignments	Private Study	Total
24	24	0	0	0	152	200

General Aims

This module aims to provide essential and basic numerical and analytical techniques for biomedical engineering problems and subsequent classes in Biomedical Engineering.

Specific Learning Outcomes

On completion of the module the student is expected to be able to:

LO1 use appropriate algebraic and geometric techniques to solve numerical and analytical problems in biomedical engineering

LO2 use basic calculus techniques to solve numerical and analytical problems in biomedical engineering

(UK SPEC suggests no more than 4 learning outcomes per module. Statements must be broad and be syllabus free and link in with the intended learning outcomes on the programme specifications.)

Syllabus

The module will teach the fundamental concepts of the following:

Algebra and geometry: basic algebra; functions; trigonometry; vectors; complex numbers; matrices

Calculus: Motivation and definitions; standard derivatives; rules of differentiation; implicit differentiation; parametric differentiation and applications; indefinite integration; definite integration; methods of integration; applications of integration.

Assessment of Learning Outcomes

Criteria

For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

[Note: Criteria break the LO down into 'teachable' elements but do not become syllabus orientated i.e. no mention of CAD package names, components etc.]

LO1 use appropriate algebraic and geometric techniques to solve numerical and analytical problems in biomedical engineering
C1 demonstrate core knowledge of functions; trigonometry; vectors; complex numbers; matrices
C2 identification of appropriate methodology for each problem
C3 ability to implement appropriate technique correctly

LO2 use basic calculus techniques to solve numerical and analytical problems in biomedical engineering
C1 demonstrate core knowledge of differentiation and definite and indefinite integration
C2 identification of appropriate methodology for each problem
C3 ability to implement appropriate technique correctly

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

Principles of Assessment and Feedback

The University's Assessment and Feedback Policy can be found at: www.strath.ac.uk/staff/policies/academic/
Specific details relating to this class are as follows:

Regular tutorial sessions will deliver high quality feedback situations (3) providing not only clear guidance on the expected level of performance (4) but also good data about how students are progressing which will help shape future teaching (12).

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

Examination			Coursework		Project	
1	3	100				

Indicate which learning outcomes (LO1, LO2 etc) are to be assessed by exam/coursework/project as required.

Coursework / Submissions deadlines:

N/A

Resit Examination Procedures:

August resit, 100% exam.

PLEASE NOTE:

Students need to gain a summative mark of 40% to pass the module. Students who fail the module at the first attempt will be re-examined during the August diet. This re-examination will consist entirely of an exam.

Recommended Reading:

TBC

Additional Student Feedback:

(Please specify details of when additional feedback will be provided)

MODULE DESCRIPTION FORM

BE105 Cell Biology 1

Module Registrar: Dr Mairi Sandison	**Taught To:** Cohorts for whom class is compulsory; those taking class as an elective	
Other Lecturers Involved: Dr Peter Childs, Dr Kimia Witte, Dr Monica Kerr	**Credit Weighting:** 10	**Semester:** 2
Compulsory/optional/elective class:	**Academic Level:** 1	

Prerequisites: None

Module Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Project	Assignments	Private Study	Total
18		3		4	75	100

Educational Aim

This module aims to

1. To familiarise students with the fundamentals of cell structure, function and metabolism
2. To introduce students to the basic concepts underlying macromolecule structure and interactions and molecular genetics
3. To introduce students to cell biology laboratory techniques

Learning Outcomes

On completion of the module the student is expected to be able to:

LO1 Describe the basic structure and function of animal cells, including the structure and roles of organelles, membranes and the different types of macromolecules found within cells, as well as their functional interactions

LO2 Demonstrate knowledge and understanding of energy and metabolism at the cellular level and of cellular transport mechanisms.

LO3 Demonstrate an understanding and an appreciation of the importance of genetics in cell function, development and reproduction.

LO4 Gain practical experience of working in a cell biology laboratory setting and in generating and interpreting data

Syllabus

The module will teach the following:

Cell and organelle structure and function
Structure and roles of carbohydrates and lipids
Structure and function of cell membranes
Protein structure and functions

Cell signalling
Cellular phenotypes and differentiation
The cell cycle
Basic laboratory techniques
Diffusion, facilitated diffusion and osmosis
Active transport, endocytosis and exocytosis
Enzymes: action and classification
Energy and metabolism: glycolysis
TCA cycle and electron transport chain

Structure of nucleotides, nucleic acids, DNA and chromosomes
DNA replication
Protein synthesis: transcription and translation
DNA mutations and repair
Concepts of inheritance

Assessment of Learning Outcomes

Criteria
For each of the Module Learning Outcomes the following criteria will be used to make judgements on student

LO1 Describe the basic structure and function of animal cells and organelles
C1 Describe the structures and roles of macromolecules and enzymes in animal cells and how they interact
C2 Explain the structure of cell membranes and mechanisms of membrane transport
C3 Describe the principal functions of the main cell organelles and how this relates to their structure/composition

LO2 Demonstrate knowledge and understanding of enzymatic reactions and cellular metabolism and of cellular transport mechanisms
C1 Understand the role of enzyme activity, especially in glycolysis
C2 Describe the TCA cycle
C3 Describe the principal mechanisms involved in cellular transport and signalling

LO3 Demonstrate an appreciation and understanding of the importance of genetics in cell function and organism development
C1 Describe the structure of chromosomes and DNA
C2 Describe how DNA is replicated
C3 Describe the processes involved in protein synthesis and the consequences of DNA mutation

LO4 Gain practical experience of working in a cell biology laboratory setting and in generating and interpreting data
C1 Participate in a practical laboratory class to generate an individual data set
C2 Develop basic laboratory skills (pipetting)
C3 Understand how to interpret basic experimental data

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

Principles of Assessment and Feedback

This module ensures that summative assessment has a positive impact on formative learning by providing students with mock exam questions so that they have opportunities to experience what is required by summative assessment in a safe environment. For example, students will work on tasks similar to the final exam for which feedback will be provided (e.g. practice MCQs). Students will then have a clear understanding of what is required and have had practice in the task.

Clear instructions will be given to students about coursework requirements and expectation through lecture and tutorial sessions and written guidelines. Interaction and dialogue with staff will be encouraged during this activity.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

Examination			Coursework			
Number	Duration	Weighting	Number	Weighting		
1	2 hours	70	1	30		
LO1-LO3			LO4			

Coursework / Submissions deadlines:

Coursework will be in the form of a laboratory report, with participation in the associated laboratory class being compulsory: submission date tbc

Resit Examination Procedures:

A resist assignment or resit exam during the exam diet.

PLEASE NOTE:
Students need to gain a summative mark of 40% to pass the module. Students who fail the module at the first attempt will be re-examined during the August diet.

Recommended Reading:

Fundamentals of Anatomy & Physiology, Frederic H. Martini et al, published by Pearson Education Inc
Becker's World of the Cell, Jeff Hardin et al, published by Pearson Education Inc
Molecular Biology of the Cell, Bruce Alberts et al, published by Garland Science

Additional Student Feedback:

FACULTY OF ENGINEERING

MODULE DESCRIPTION FORM

EM105 - ELECTRICAL & MECHANICAL TECHNIQUES AND DESIGN 1

Module Code: EM105	**Module Title:** Electrical & Mechanical Techniques And Design 1	
Module Registrar: M Macdougall		
Other Lecturers Involved: Dr. M Wilson, G Brown, R Blue	**Credit Weighting** 20	**Semester:** 1 2
Compulsory/optional/elective class: C	**Academic Level:** 1	

Pre-requisites: Entry to Year 1

MODULE FORMAT AND DELIVERY (HOURS):

Lectures	Tutorial	Assignments	Laboratories	Private Study	Total
4	0	30	64	102	200

EDUCATIONAL AIM *THIS MODULE AIMS TO:*

1. introduce students to the practical and profesional skills required of an engineer
2. introduce students to keeping a detailed logbook/worksheet
3. introduce students to technical report writing
4. introduce students to presenting as part of a group, to a small audience
5. underpin theoretical concepts introduced elswhere in year 1 modules
6. introduce students to individual and group project work
7. introduce students to software supporting circuit design and analysis
8. expose students to problems requiring system integration and design
9. encourage innovation in the context of project work
10. facilitate the development of a range of transferable skills

LEARNING OUTCOMES *ON COMPLETION OF THE MODULE, THE STUDENT IS EXPECTED TO BE ABLE TO;*

LO 1: construct, test and explain the operation of simple electronic and electrical circuits

LO 2: understand and discuss the practical reasons for differences between measurments and theoretical calculations

LO 3: deliver project-based work, encompassing aspects such as team-working and time management

LO 4: keep a detailed logbook record/worksheet summarising key aspects of experiments and project work, and transfer this information to reports and presentations

(UK SPEC suggests no more than 4 learning outcomes per module. Statements must be broad and be syllabus free and link in with the intended learning outcomes on the programme specifications.)

SYLLABUS *THE MODULE WILL TEACH THE FOLLOWING:*

Teaching Support Labs: Recognition and selection of electronic components; use of test equipment; experimental investigation of Kirchhoff's laws; experimental investigation of Thevinin's and Norton's theorems applied to DC circuits; appreciation of the difference between theory and experiment; construction techniques including soldering and assembly; maximum power transfer theorem and impedance measurements; appreciation of PCB technology; AC circuits including phasor diagrams; filter circuits and frequency response; combinational and sequential logic circuits; counter circuits; operational amplifier circuits; simulation of circuits using PSpice and Tinkercad software.Project Labs:

EME students will undertake a joint project in semester 1, manufacturing and testing a remote-controlled buggy chassis and steering system; and two other projects in semester 2.

BME students will undertake project online group research project on one of the topic Biometrics in semester 1 and 2 other projects in semester 2.

Project 2 – Group project designing a TS lab/project work including lab notes/worksheet and testing using simulations (PSpice, Tinkercad……)

Project 3 Group project investigating the operation of an electronic or electrical device.

Professional Development: Technical writing skills, presentation skills, project-planning skills, management skills, logbook-writing skills, group-working skills, personal development planning skills.

ASSESSMENT OF LEARNING OUTCOMES - CRITERIA

For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

[Note: Criteria break the LO down into 'teachable' elements but do not become syllabus orientated i.e. no mention of CAD package names, components etc.]

LO1

C 1: recognition and selection of appropriate electronic, electrical and mechanical components

C 2: selection of appropriate electronic instrumentation and degree of skill in its use

C 3: ability to inter-connect components to realise complete circuits

C 4: ability to apply basic electronic signal conditioning techniques

C 5: demonstration of an appreciation of earthing concepts and safety devices

LO2

C 1: explanation of the behaviour of simple electronic circuits using first principles

C 2: discussion of the reasons for the differences between measurements and theoretical calculations

C 3: ability to summarise outcomes of experiments/projects with sound technical conclusions

LO3

C 1: planning and management of elementary project work, working cooperatively in a group

C 2: demonstration of innovative thinking in solving engineering problems

C 3: ability to investigate and suggest practical applications of basic circuits

LO4

C 1: utilisation of a logbook/worksheet to maintain an adequate record of laboratory work

C 2: compilation of professional technical reports, incorporating the correct use of references

C 3: contributing effectively to the creation and delivery of technical group presentations

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

12 PRINCIPLES OF ASSESSMENT FEEDBACK

Please state briefly how these are incorporated in this module.

Detailed feedback on early worksheet/logbook entries is provided following completion of a couple of the early Teaching Support labs, and following completion of the first Project. Students can discuss this feedback with teaching staff in subsequent labs and online, and make improvements to style and content. An opportunity is available to receive online feedback, via myplace, on a first draft of their technical reports, before submitting the

final version for marking. Comprehensive written feedback is provided on technical report and final logbook submissions, to inform the students as they complete similar tasks in subsequent years.

(on Learning & Teaching web pages: www.strath.ac.uk/learnteach/teaching/staff/assessfeedback/12principles/)

ASSESSMENT METHOD(S) INCLUDING PERCENTAGE BREAKDOWN AND DURATION OF EXAMS

To Pass the module, students need to gain a summative mark of;					40%	
Examination	Duration		Weighting %		Learning Outcomes	
Coursework	Number	4	Weighting %	100	Learning Outcomes	LO1-LO4
Project	Number		Weighting %		Learning Outcomes	

COURSEWORK / SUBMISSIONS DEADLINES: Technical report S2 Week 3; Group presentation S2 Week 10; Teaching Support & Project logbook submission S2 Week 10.

RESIT ASSESSMENT PROCEDURES: Resubmission of course work

ADDITIONAL INFORMATION RELEVANT TO COURSE DELIVERY AND ASSESSMENT

In order to pass the module, the following five criteria must be fulfiled:

- meet minimum attendance criteria
- achieve a mark of at least 40% for logbook/worksheet assessment
- achieve a mark of at least 40% for Technical Report submission
- achieve a mark of at least 40% for Group Project Presentation

Being a practical course, attendance is critical, and those with attendance below 80% will be considered not qualified to pass the class. In recognition of the fact that students may miss labs for legitimate reasons, catch-up lab sessions are run at the end of each semester.

As students entering first year have varying levels of practical experience, induction sessions covering health and safety issues, and to demonstrate the proper use of basic lab equipment (oscilloscopes, DMMs and protoboards) are provided. Additionally, guiding questions are provided in the lab notes/worksheets to provide students with direction and focus, in terms of both delivery of sub-tasks, and to inform key points for discussion in logbook entries/worksheets.

RECOMMENDED READING

Robert L Boylestad, "Introductory Circuit Analysis", Latest Edition, Pearson Education ISBN-13 978-1292098951

Thomas L Floyd, "Digital Fundamentals", Latest Edition, Pearson Education ISBN-13 978-1292075983

ADDITIONAL STUDENT FEEDBACK; SPECIFY DETAILS OF WHEN ADDITIONAL FEEDBACK WILL BE PROVIDED.

Semester	S1	Week	7	Nature	Comprehensive (interim) feedback on early worksheets for teaching support labs
Semester	S2	Week	1	Nature	Comprehensive feedback on 1st Project.
Semester	S2	Week	6	Nature	Comprehensive written feedback on technical report.
Semester	S2	Week	10	Nature	Feedback on group presentation
Semester		Week		Nature	
Semester		Week		Nature	
Further comments about feedback	Students are provided with feedback early to allow them to improve their practice throughout the semester, and students are always invited to discuss feedback with teaching staff in subsequent laboratory sessions, completing the feedback loop.				

SIGNATURE (MODULE REGISTRAR):

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DATE OF LAST MODIFICATIONS: 16/09/2020

FACULTY OF ENGINEERING

MODULE DESCRIPTION FORM

EE107 - ELECTRONIC & ELECTRICAL PRINCIPLES 1

Module Code: EE107	**Module Title:** Electronic & Electrical Principles 1	
Module Registrar: Dr M Wilson		
Other Lecturers Involved: M Macdougall	**Credit Weighting** 20	**Semester:** 1 2
Compulsory/optional/elective class: C	**Academic Level:** 1	

Pre-requisites: Higher Physics and Maths, or equivalents

MODULE FORMAT AND DELIVERY (HOURS):

Lectures	Tutorial	Assignments	Laboratories	Private Study	Total
66	50			84	200

EDUCATIONAL AIM *THIS MODULE AIMS TO:*

Develop a firm grounding in the understanding, analysis and design of analogue and digital circuits.

LEARNING OUTCOMES *ON COMPLETION OF THE MODULE, THE STUDENT IS EXPECTED TO BE ABLE TO;*

LO 1: Demonstrate the ability to apply fundamental circuit analysis techniques to DC and AC circuits.

LO 2: Understand the fundamentals of amplifiers and feedback, and the basic principles and design of operational amplifier circuits.

LO 3: Demonstrate an understanding of combinational logic circuit design, analysis and synthesis.

LO 4: Understand the behaviour, design and application of specific combinational and sequential logic circuits.

(UK SPEC suggests no more than 4 learning outcomes per module. Statements must be broad and be syllabus free and link in with the intended learning outcomes on the programme specifications.)

SYLLABUS *THE MODULE WILL TEACH THE FOLLOWING:*

Fundamentals:- Units of measurement, SI units, symbols and notations; charge flow and current; voltage drop; resistivity, resistance and Ohm's law, I-V characteristics of resistors; I-V characteristics of non-linear devices; open and short circuits; power and energy.

DC Circuits:- Kirchhoff's laws; the application of Ohm's and Kirchhoff's laws to DC circuit analysis, series, parallel and series-parallel resistive circuits; voltage division and current division; Thévenin's Theorem, Norton's Theorem and source conversion; maximum power transfer theorem; circuit analysis using superposition; mesh analysis of circuits.

AC Circuits:- Phasors and complex algebra; properties of capacitors and inductors; reactance of capacitors and inductors; impedance and admittance; phasor diagrams; extension of DC circuit analysis techniques to AC circuits; RMS values, power and energy, power factor.

Passive Circuits:- Input impedance; output impedance; insertion losses; voltage transfer function, frequency response of magnitude and phase.

Amplifier Fundamentals:- Gain, input and output impedance; amplifier modelling; amplifiers in cascade; frequency response.

Feedback:- Introduction to negative feedback, multiple feedback configurations.

Operational Amplifiers:- Introduction to the operational amplifier, the differential stage, inverting and non-inverting configurations, common amplifier circuits.

Introduction to Digital Systems:- Binary, decimal and hexadecimal numbering systems; arithmetical operations and negative numbers in binary; comparisons and relationships between analogue and digital systems.

Digital Analysis:- Boolean algebra, Karnaugh and inverse maps; minimisation of Boolean expressions, basic logic gates, analysis of circuits containing logic gates; timing diagrams and propagation delay.

Design:- Design procedures; design of combinational logic circuits; use of "don't care" terms; Binary Coded Decimal (BCD); minterms and maxterms; design of circuits containing only NAND or only NOR gates; design of basic digital systems.

MSI Devices and Sequential Logic:- Introduction to the adder, comparator, multiplexer and decoder devices; active-low and active-high inputs and outputs; introduction to sequential circuits, S-R latches and flip-flops, D latches and flip-flops, J-K flip-flops and counters.

ASSESSMENT OF LEARNING OUTCOMES - CRITERIA

For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

[Note: Criteria break the LO down into 'teachable' elements but do not become syllabus orientated i.e. no mention of CAD package names, components etc.]

LO1

C 1: Describe and employ circuit analysis tools such as voltage and current division, Kirchhoff's laws.

C 2: Demonstrate ability to use simplification techniques such as source conversion and reduction.

C 3: Apply mesh analysis, superposition, Thevenin's and Norton's theorems to solve circuits.

C 4: Manipulate complex numbers in the solution of AC problems using phasors.

LO2

C 1: Understand the fundamentals of amplifiers and feedback.

C 2: Understand and apply top-down design to amplifier circuits.

C 3: Demonstate the ability to design operational amplifier circuits.

C 4: Analyse the behaviour of circuits by way of finding their transfer function in standard form.

LO3

C 1: Understand and apply the laws of Boolean algebra to simplify expressions.

C 2: Employ truth tables, Karnaugh and inverse maps to the solution of combinational logic problems.

C 3: Analyse combinational logic circuits and build Boolean expressions and truth tables describing the overall behaviour.

C 4: Apply design procedures to synthesise digital circuits, including: minterms; maxterms; don't care terms; implementation using universal NAND and NOR gates.

LO4

C 1: Show an understanding of various MSI circuits, including adders, comparators, multiplexers, decoders.

C 2: Employ MSI circuits appropriately in the design of digital circuits and solution of basic digital problems.

C 3: Show an understanding of sequential logic circuits including S-R Latches, J-K flip-flops, counters.

C 4: Employ sequential logic circuits in the design of digital circuits and solution of basic digital problems.

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

12 Principles of Assessment Feedback

Please state briefly how these are incorporated in this module.

Students sit a formative class test (multiple-choice quiz), via myplace in week 7 of semester 1, with feedback provided by worked solutions made available on myplace. Formal feedback on the summative class tests is provided in lectures or tutorials. In all cases, students then have the opportunity to discuss the solutions with teaching staff in tutorials, completing the feedback loop.

(on Learning & Teaching web pages: www.strath.ac.uk/learnteach/teaching/staff/assessfeedback/12principles/)

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

To Pass the module, students need to gain a summative mark of;					40%	
Examination	Duration	2	Weighting %	70	Learning Outcomes	LO1-LO4
Coursework	Number	2	Weighting %	30	Learning Outcomes	LO1-LO4
Project	Number		Weighting %		Learning Outcomes	

Coursework / Submissions Deadlines:

Resit Assessment Procedures: Examination

Additional Information relevant to Course Delivery and Assessment

The coursework consists of two summative class tests - in the exam period at the end of semester 1, and in week 6 of semester 2 - each worth 15% of the final mark. Class tests are used to assess interim progress.

Recommended Reading

Robert L Boylestad, "Introductory Circuit Analysis", Latest Edition, Pearson Education ISBN-13 978-1292098951

Thomas L Floyd, "Digital Fundamentals", Latest Edition, Pearson Education ISBN-13 978-1292075983

Additional Student Feedback; Specify details of when additional feedback will be provided.

Semester	S1	Week	9	Nature	Full worked solutions for formative quiz made available on myplace.
Semester	S2	Week	1	Nature	Worked solutions for S1 class test in lecture or tutorial slots.
Semester	S2	Week	8	Nature	Worked solutions for S2 class test in either lecture or tutorial slots.
Semester		Week		Nature	
Semester		Week		Nature	
Semester		Week		Nature	
Further comments about feedback	Specific feedback on problem-solving skills is available to students via weekly tutorials, also supported by weekly small-group tutorials.				

Signature (Module Registrar):

Date of Last Modifications: 16/09/2020

MODULE DESCRIPTION FORM

ME108 Engineering Analysis and Numerical Methods

Module Registrar: Dr Haofeng Chen haofeng.chen@strath.ac.uk	**Taught To (Course): Cohorts for whom class is compulsory**	
Other Lecturers Involved: Dr Zhangming Wu, Prof Donald Mackenzie	**Credit Weighting: 10 (ECTS 5)**	**Semester: 1 and 2**
Assumed Prerequisites: none	**Compulsory class**	**Academic Level: 1**

Module Format and Delivery (HOURS i.e. 1 credit = 10hrs of study):

Lecture	Tutorial	Laboratory	Groupwork	External	Online	Project	Assignments	Private Study	**Total**
20		16					30	34	100

Educational Aim

This module aims to teach the basic principles of programming and the solution of mathematical problems with numerical techniques.

Learning Outcomes

On completion of the module the student is expected to be able to :

LO1 Demonstrate understanding of the use of mathematical methods and their role in formulating equations to represent a variety of problems in engineering.

LO2 Demonstrate the ability to implement basic programming principles and develop effective algorithms in Matlab environment.

LO3 Demonstrate the ability to identify and implement appropriate numerical methods to solve specific mathematical problems.

Syllabus

The module will teach the following:

1. Introduction to Matlab; Matlab as a calculator; Matlab as a programming language.
2. Programming principles: variables and arrays; operators, expressions and statements; algorithms, programming logic and flow diagrams; computer arithmetic and errors.
3. Fundamentals of programming in Matlab: data types; input and output; functions and structures; parameters and variables; memory allocation.
4. Mathematical methods: linear algebra, vectors & matrices.
5. Numerical Methods: solution of simultaneous linear and nonlinear equations; differentiation and integration; numerical quadrature; interpolation and curve fitting.

Assessment of Learning Outcomes

Criteria

For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

LO1 Demonstrate understanding of the use of mathematical methods and their role in formulating equations to represent a variety of problems in engineering.
C1 Students will be able to demonstrate the ability to identify appropriate equations and solution schemes for simple engineering systems.
C2 Students will be able to identify different systems and particular solution approaches that are suitable for that system.

LO2 Demonstrate the ability to implement basic programming principles and develop effective algorithms in the Matlab environment.
C1 Students will be able to demonstrate basic programming skills by the construction of flow charts to summarise key

steps of a problem
C2 Students will construct Matlab scripts to demonstrate the ability to implement numerical schemes based on the flow charts, to solve simple numerical problems.

LO3 Demonstrate the ability to identify and implement appropriate numerical methods to solve specific mathematical problems.
C1 Students will be able to demonstrate selection of an appropriate method to solve a range of problem types.
C2 Students will demonstrate ability to numerically solve problems in linear and non-linear algebra and calculus.

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

12 Principles of Assessment and Feedback
(on Learning & Teaching web pages: www.strath.ac.uk/learnteach/teaching/staff/assessfeedback/12principles/)

Summative feedback. Coursework submissions will be returned with marks and written feedback to allow students to reflect on their performance. Scripts from the final examination will not be returned to students.

Formative feedback. Tutorial sessions will provide opportunities for students to discuss their work and course material with members of staff. Formative feedback may also be given during personal appointments with the course Lecturers/Demonstrators.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

- **Attendance at *project tutorials* is compulsory: satisfactory completion represents 10% of the overall mark.**

	Examinations				Courseworks		Projects	
	Number	Month(s)	Duration	***Weighting***	Number	***Weighting***	Number	***Weighting***
	1	May	1hrs	40%	2	50%	8	10%
L/Outcomes	All LOs				All LOs		All LOs	

Indicate which learning outcomes (L01, L02 etc) are to be assessed by exam/coursework/project as required.

Coursework / Submissions deadlines: Week 8, sem 1&2

Resit Assessment Procedures: 2 hour resit examination in August diet.

PLEASE NOTE:
Students need to gain a summative mark of 40% to pass the module. Students who fail the module at the first attempt will be re-examined during the August diet. This re-examination will consist entirely of exam.

Recommended Reading

No set texts used or recommended for the class. Relevant course material will be provided during lectures or on Myplace.

Additional Student Feedback
(Please specify details of when additional feedback will be provided)

Date	Time	Room No
Weekly tutorial	TBC	TBC

Students can expect to receive feedback in the form of staff comments on assessments in addition to receiving the mark for each element of assessment. Students should also receive continuous formative feedback through the weekly tutorial sessions, and should make full use of these opportunities.

Session: 2015-16

Approved:

Course Director Signature: 

Date of Last Modifications: 24 August 2015

MODULE DESCRIPTION FORM

ME109 CAD FOR BME

Module Registrar: Dr A McLaren andrew.mclaren@strath.ac.uk	**Taught To (Course): Students on BME degree.**	
Other Lecturers Involved:	**Credit Weighting: 10 (ECTS 5)**	**Semester: 2**
Assumed Prerequisites:	**Compulsory class**	**Academic Level: 1**

Module Format and Delivery (HOURS i.e. 1 credit = 10hrs of study):

Lecture	Tutorial	Laboratory	Groupwork	External	Online	Project	Assignments	Private Study	**Total**
8		24					16	52	100

Introduction to engineering modelling and communication (Weeks 1-12). 1hr lecture per week for all students for first 8 weeks and 2hr lab in groups for full semester, as per timetable. Students will be expected to work through structured tutorial material during the labs and in their own time. Support will be provided in computing laboratories.

Educational Aim

This module aims to give an introduction to the use of engineering modelling and communication using the PTC Creo three dimensional modelling system and to introduce engineering tolerances and their relation to manufacturing processes.

Learning Outcomes

On completion of the module the student is expected to:

LO1: Have a working knowledge of the general functionality of the PTC Creo features-based parametric 3D modeller

LO2: Be able to create simple part models, simple assembly models and simple drawings.

Syllabus

The module will teach the following:

CAD and Analysis Software: Introduction to PTC Creo.

Engineering modelling and communication: The role of modelling in a modern engineering environment, review of geometric modelling, introduction to features-based modelling, design intent, tolerances, part and assembly models and drawings.

Assessment of Learning Outcomes

Criteria

For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

LO1: Have a working knowledge of the general functionality of the PTC Creo features-based parametric 3D modeller.
C1: Assignments using PTC Creo, will allow students to demonstrate the ability to produce engineering drawings of simple components and assemblies to appropriate standards.
C2: Undertake simple analyses of components using the parametric 3D modeller to discuss results to assess if suitability of component for the relevant application.

LO2: Be able to create simple part models, simple assembly models and simple drawings.
C1 Demonstrate the ability to model parts and assemblies; to produce associated engineering drawings to appropriate standards
C2: Demonstrate the ability to discuss appropriate materials, methods of part manufacture and links to dimensional and geometric tolerances.

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

12 Principles of Assessment and Feedback
(on Learning & Teaching web pages: http://www.strath.ac.uk/learnteach/informationforstaff/staff/assessfeedback/12principles)

This course combines traditional lecture based learning with assisted lab based tutorials and exercises, which gives the students an opportunity to learn the software by working through weekly exercises and assignments with the help of experienced lab tutors. Students are encouraged to work in pairs to understand and solve basic engineering problems, allowing feedback both from other students and peers.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

	Examinations/Tests				Courseworks		Projects	
	Number	Month	Duration	***Weighting***	Number	***Weighting***	Number	***Weighting***
					2	100% (cw1 : 30%) (cw2 : 70%)		
L/Outcomes					LO1, LO2,			

Coursework / Submissions deadlines:
Sem 1: 1st assignment on PTC Creo (due in early November)
Sem 1: 2nd assignment on PTC Creo (due in December)

Resit Assessment Procedures:
Submission of new coursework and/or laboratory report prior to the commencement of the August examination diet.

PLEASE NOTE:
Students need to gain a summative mark of 40% to pass the module. Students who fail the module at the first attempt will be re-examined during the Summer. This re-examination will consist entirely of a coursework.

Recommended Reading

****Purchase essential; ***Purchase recommended; **Highly recommended reading;**
***Simply for reference (do NOT purchase)**

* BS308-1:1993 "Engineering drawing practice. Recommendations for general principles.", British Standards. Can be downloaded free via the Strathclyde University Library web-site EResources/Databases/List of all databases/ British Standards Online or using the following link. (https://bsol-bsigroup-com.proxy.lib.strath.ac.uk/Home).
* BS308-2:1985 "Engineering drawing practice. Recommendations for dimensioning and tolerancing of size.", British Standards. Can be downloaded free via the Strathclyde University Library web-site EResources/Databases/List of all databases/ British Standards Online or using the following link. (https://bsol-bsigroup-com.proxy.lib.strath.ac.uk/Home).
* BS308-3:1990 "Engineering drawing practice. Recommendations for geometric tolerancing.", British Standards. Can be downloaded free via the Strathclyde University Library web-site EResources/Databases/List of all databases/ British Standards Online or using the following link. (https://bsol-bsigroup-com.proxy.lib.strath.ac.uk/Home).

Additional Student Feedback
(Please specify details of when additional feedback will be provided)

Date	Time	Room No

Assessment of this class is by coursework submitted online or in hard copy. Students can expect to receive feedback in the form of staff comments on assessed coursework in addition to receiving the mark for each element of assessment. Students should also receive continuous formative feedback through the weekly laboratory and tutorial sessions, and should make full use of these opportunities.

Session: 2015/16

Year 2

The following pages contain class descriptors for the different classes in year 1. Since different departments teach different classes, the class descriptors may differ slightly in format.

MODULE DESCRIPTION FORM

BE205 Fluid Mechanics in Biomedical Engineering

Module Registrar: Dr Christopher McCormick	**Taught To:** BEng/MEng Biomedical Engineering	
Other Lecturers Involved:	**Credit Weighting:** 10	**Semester:** 1
Compulsory/optional/elective class: Compulsory	**Academic Level:** 2	

Prerequisites:

Module Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Project	Assignments	Private Study	Total
15	6			9	70	100

Educational Aim

This module aims to give students fundamental knowledge of the principles of fluid mechanics enabling an insight into the complexities of physiological flows. The basic principles underlying the measurement of pressure and flow will be explored in relation the diagnosis and treatment of cardiovascular disease, hydrocephalus, and urinary flows.

Learning Outcomes

On completion of the module the student is expected to be able to:

LO1 apply the equations of fluid statics to obtain solutions to clinical and non-clinical problems in fluid mechanics; and

LO2 apply the equations of fluid dynamics to obtain solutions to clinical and non-clinical problems in fluid mechanics.

(UK SPEC suggests no more than 4 learning outcomes per module. Statements must be broad and be syllabus free and link in with the intended learning outcomes on the programme specifications.)

Syllabus

Hydrostatics:
Pressure and head; Pascal's law for pressure at a point; variation in pressure within a static fluid.
Fundamental principles of fluid mechanics: the flow of ideal fluids, viscous fluids; conservation of mass and volume, momentum and energy: The Bernoulli and Poiseuille equations; Venturi and orifice meters
Fluids and their properties: definitions, shear stress in a moving fluid, Newtonian and non-Newtonian Fluids Measurement of viscosity, pressure and flow
Fluid properties: density, temperature effect on viscosity, surface tension, contact angle
Hydrodynamics:
Basic concepts – uniform and steady flow, streamlines and stream tubes, laminar and turbulent flow, Reynolds number.
Physical similarity and dimensional analysis: Buckingham's 'Pi' method.

Assessment of Learning Outcomes

Criteria
For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

LO1 Apply the equations of fluid statics to obtain solutions to clinical and non-clinical problems in fluid mechanics
C1 Identify key aspects of the problem, identify relevant assumptions, draw correct free body diagrams and apply appropriate equations using consistent system of units

LO2 Apply the equations of fluid dynamics to obtain solutions to clinical and non-clinical problems in fluid mechanics
C1 Identify key aspects of the problem, identify relevant assumptions, draw correct free body diagrams and apply appropriate equations using consistent system of units

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

Principles of Assessment and Feedback

The University's Assessment and Feedback Policy can be found at: www.strath.ac.uk/staff/policies/academic/

Specific details relating to this class are as follows:

The module includes both formative and summative assessments, student outcomes being assessed by means of examination and based on electronic resources provided by the University's Virtual Learning Environment 'MyPlace' and internet. MyPlace will be used also to promote interaction between individual students and their tutors, and to tailor feedback on performance to individual students; likewise, student feedback will be sought to improve both content and delivery of the course.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

Examination			Coursework		Project	
Number	Duration	Weighting	Number	Weighting	Number	Weighting
1	2 hours	60%	2	40%		
LO1-2			LO1-2			

Indicate which learning outcomes (L01, L02 etc) are to be assessed by exam/coursework/project as required.

Coursework / Submissions deadlines:

To be arranged.

Resit Examination Procedures:

Resit and/or resubmission of coursework as per 1st attempt.

PLEASE NOTE:
Students need to gain a summative mark of 40% to pass the module. Students who fail the module at the first attempt will be re-examined during the August diet. This re-examination will consist entirely of exam.

Recommended Reading:

Textbooks:

Mechanics of fluids, 8th edition (BS Massey, AJ Ward-Smith), Taylor & Francis, London, 2006 (electronic access)

Electronic resources:
Links to appropriate on-line learning resources will be provided on MyPlace

Additional Student Feedback:

(Please specify details of when additional feedback will be provided)

Feedback on coursework to be provided on MyPlace

MODULE DESCRIPTION FORM

BE207 Human Cell Biology 2

Module Registrar: Dr Michelle Maclean	**Taught To:** BEng/MEng Biomedical Engineering	
Other Lecturers Involved: Dr Damion Corrigan	**Credit Weighting:** 10	**Semester:** 2
Compulsory class:	**Academic Level:** 2	
Prerequisites: BE105 Cell Biology 1		

Module Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Project	Assignments	Private Study	Total
15	3	4			78	100

Educational Aim

This module aims to
4. Familiarise students with the principal technologies used in modern cell and molecular biology.
5. Provide students with an understanding of the human haematological system and the roles of key blood cells
6. Introduce you to microbial cells, and the fundamentals of the human immune system in fighting microbial infection

Learning Outcomes

On completion of the module the student is expected to be able to:

LO1 Explain a range of molecular, genetic and cell biology techniques for protein and DNA analysis and manipulation and give examples of their use in understanding cell behaviours, in clinical investigations and in industrial applications.

LO2 Discuss the function of the human haematological system, including the roles of key blood cell types, and their role in blood typing, blood clotting and wound healing.

LO3 Describe the main components and cell types involved in the human immune system and understand the roles that these play in mediating immune responses to microbial infection and autoimmune disease.

LO4 Describe the structure and function of the different types of microbial cells, and discuss the roles they play in human health and disease.

(UK SPEC suggests no more than 4 learning outcomes per module. Statements must be broad and be syllabus free and link in with the intended learning outcomes on the programme specifications.)

Syllabus

The module will include the following:

Cell & molecular biology techniques
[Microscopy; antibodies, fluorescent indicators & cell labelling; immunohistochemistry, immunocytochemistry & ELISA; electrophoresis & blots]
Gene expression & regulation
Mitochondrial genomes
Techniques for genetic manipulation and analysis:
[hybridization & sequencing; polymerase chain reaction; bacterial genetics, plasmids & cloning; transgenic organisms & expression systems]

Human Haematological System
[Blood cells and their functions; Blood transfusions and complications; Blood typing; Blood clotting and wound healing]

Immunology
[Cell types and lymphokines involved in immune reactions; Humoral and cellular immunity; T cells and regulation of the immune system; Antibodies and B cells; The complement system; Autoimmune reactions]

Microbiology
[Bacterial structure & function; biofilm formation; importance for human health (mutualism)]
Pathogenic bacteria, viruses and parasites
Microbiological complications in bioengineering

Assessment of Learning Outcomes

Criteria
For each of the Module Learning Outcomes the following criteria will be used to make judgements on student

LO1: ***Explain a range of molecular and cell biology techniques for protein and DNA analysis and manipulation.***
C1 Explain how antibody-based methodologies (immunohistochemistry, immunocytochemistry and ELISA) can be used for protein detection and quantification.
C2 Describe the processes of gel electrophoresis and blotting.
C3 Explain how hybridization, sequencing and polymerase chain reaction techniques operate.
C4 Describe the primary techniques used for genetic manipulation of prokaryotic and eukaryotic cells.

LO2 ***Discuss the function of the human haematological system.***
C1 Describe the function of blood and the key cellular and non-cellular components, indicating their roles. cell types, and their role in blood typing, blood clotting and wound healing. Describe the extracellular matrix and the cytoskeleton and discuss their roles in cell adhesion and motility.
C2 Discuss the processes involved in blood donation and transfusion, including issues related to blood typing and transfusion-related reactions.
C3 Explain the role of the blood in clotting and wound healing.

LO3 ***Describe the main components and cell types involved in the human immune system***
C1 Describe the major components of the lymphatic system, and the cell types and lymphokines involved in immune reactions
C2 Explain the roles of humoral and cellular immunity, and the involvement of T cells, B cells and antibodies
C3 Describe the pathways involved in the complement system and the role it plays in the immune response
C4 Describe disorders of the immune system (autoimmune disease, allergies)

LO4 ***Describe the structure and function of different microorganisms and the roles they play in human health and disease.***
C1 Describe the structure and function of bacteria, viruses and other microorganisms
C2 Explain the process and implications of biofilm formation.
C3 Discuss examples of pathogenic bacteria, viruses and parasites and their roles in human disease.

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

Principles of Assessment and Feedback

The University's Assessment and Feedback Policy can be found at: www.strath.ac.uk/staff/policies/academic/

Please state briefly how these are incorporated in this module.

- Clear instructions will be given to students about assessment requirements and expectation through lectures/tutorials, and through notifications and information provided using MyPlace, the University's Virtual Learning Environment
- MyPlace tools will also be used to assess outcomes and promote interaction between individual students and their tutors, and to tailor feedback on performance to individual students. Likewise student feedback will be sought to improve both content and delivery of the course.
- Interaction and dialogue around learning will be encouraged during lectures and interactive tutorial sessions.
- This module ensures that summative assessment has a positive impact on formative learning by providing students with practice revision questions so that they have an opportunity to experience what is required by summative assessment in a safe environment. For example, students will work on tasks similar to the final assessment for which feedback will be provided (e.g. practice MCQs and short answer questions). Students will then have a clear understanding of what is required and have had practice in the task.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

Examination			Group Presentation		Assignment	
Number	Duration	Weighting	Number	Weighting	Number	Weighting
1	1 hour	70%	1	10%	1	20%
LO1-LO4			LO2-LO4		LO1	

Indicate which learning outcomes (L01, L02 etc) are to be assessed by exam/coursework/project as required.

Coursework / Submissions deadlines:

Students will submit an assignment in week 7
Students will take part in a group presentation activity in weeks 10-11.

All submission dates/deadlines will be conveyed to the class during lectures and via MyPlace.

Resit Examination Procedures:

Examination in the resit diet.

PLEASE NOTE:
Students need to gain a summative mark of 40% to pass the module. Students who fail the module at the first attempt will be re-examined during the August diet. This re-examination mark will be based entirely on the resit exam.

Recommended Reading:

Access to comprehensive lecture slides, notes and electronic resources will be provided on MyPlace. Students wishing to carry out additional reading to supplement their learning may wish to consult some of the following texts:

- *Molecular Biology of the Cell*. Alberts, Johnson, Lewis, Raff, Roberts, & Walter. (New York: Garland Science).
- *Biology*. Campbell & Reece. (Benjamin Cummings; London: Pearson Education).

Additional Student Feedback: Formative assessment tasks and feedback will be provided regularly throughout the module (through scheduled virtual interactive sessions, and posts on MyPlace) – details of these will be announced via MyPlace.

(Please specify details of when additional feedback will be provided)

MODULE DESCRIPTION FORM

BE208 Statics and Dynamics in Biomedical Engineering

Module Registrar: Dr Philip Riches		**Taught To:** BEng/MEng Biomedical Engineering	
Other Lecturers Involved: Dr Craig Childs		**Credit Weighting:** 20	**Semester:** 1 & 2
Compulsory/optional/elective class: Compulsory		**Academic Level:** 2	
Prerequisites:			
Module Format and Delivery (hours):			

Lecture	Tutorial	Laboratory	Project	Assignments	Private Study	Total
30	30	6			134	200

Educational Aim

This module aims to provide students with the basic skills to analyse static and dynamic rigid body problems, from first principles, contextualised to the human body. Further, the module aims to develop skills, knowledge and understanding in the areas of structural analysis and elementary stress analysis, as appropriate for biomedical engineering applications.

Learning Outcomes

On completion of the module the student is expected to be able to:

LO1 Demonstrate knowledge and understanding of static equilibrium as applied to the human body.

LO2 Demonstrate knowledge and understanding of linear and rotational kinematics, kinetics and energy as applied to the human body.

LO3 Have a basic understanding of elementary strength of materials with applications to simple determinate and indeterminate systems.

LO4 Have an understanding of equilibrium and compatibility in relation to 2-dimensional stress and strain and be able to apply this knowledge to problems involving the analysis of stress and strain in the context of elementary design of engineering components.

(UK SPEC suggests no more than 4 learning outcomes per module. Statements must be broad and be syllabus free and link in with the intended learning outcomes on the programme specifications.)

Syllabus

This module will teach the following:

Part 1:
Mechanics of Rigid Bodies
Basic concepts – Force, moment, equilibrium, Free body diagrams, force components, velocity, acceleration, Friction, angular motion, centrifugal force, moment of inertia
Human body centre of mass determination
2D Kinematics of human motion
Calculation of Joint forces and moments
Momentum, impulse, work done
Work, energy, power

Part 2:
Tensile test – uniaxial systems. Engineers' theory of bending, stresses and deformation. Direct and bending effects. Shear stress due to torsion and bending. Beam deformation. Two dimensional stress and strain.

Assessment of Learning Outcomes

Criteria
For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

[Note: Criteria break the LO down into 'teachable' elements but do not become syllabus orientated i.e. no mention of CAD package names, components etc.]

LO1 Demonstrate knowledge and understanding of static equilibrium as applied to the human body
C1 Apply the appropriate equations of static equilibrium to solve Biomedical Engineering-oriented problems

LO2 Demonstrate knowledge and understanding of linear and rotational kinematics, kinetics and energy as applied to the human body
C1 Apply the appropriate equations to solve Biomedical Engineering-oriented problems
C2 to determine joint forces and moments from segment acceleration
C3 Applying appropriate equations, describe motion in terms of work done, potential and kinetic energy and joint power

LO3 Have a basic understanding of elementary strength of materials with applications to simple determinate and indeterminate systems
C1 In examinations and tutorials identify key aspects of the problem, identify relevant assumptions, draw correct free body diagrams and apply relevant mechanical principles
C2 Undertake lab experiments in a proficient manner and produce a clear readable lab report.

LO4 Have an understanding of equilibrium and compatibility in relation to 2-dimensional stress and strain and be able to apply this knowledge to problems involving the analysis of stress and strain in the context of elementary design of engineering components.
C1 In examinations and tutorials identify key aspects of the problem, identify relevant assumptions, and apply relevant mechanical principles.

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

Principles of Assessment and Feedback

The University's Assessment and Feedback Policy can be found at: www.strath.ac.uk/staff/policies/academic/
Specific details relating to this class are as follows:

Informal feedback will be provided at regular tutorial sessions primarily through verbal discussion with individuals or groups on tutorial exercises attempted in advance by students (note: to receive this feedback students should participate in these tutorials but attendance is not mandatory).

Solutions to selected tutorial questions are presented and discussed in the tutorial sessions.
Laboratory reports and results and discussed with students.

Full solutions will be provided to all tutorials and exams, post assessment, along with reasons for techniques used, and to highlight common errors in the solution.

Formal, summative feedback will be provided by the return of examination marks to students after assessment (note: exam scripts will not be returned to students and no collective discussion of exam performance will be facilitated). Individual feedback on the exam may be arranged if appropriate.

Students are encouraged to collaborate in the calculations and models provided in the tutorial exercise and demonstration calculations provided during the course. However, it is emphasised that the analysis reports they submit must be entirely their own work – i.e. background research plus results they have personally generated and interpreted.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

Examination			Coursework		Project	
Number	Duration	Weighting	Number	Weighting	Number	Weighting
2	2 hrs each	70% (2 x 35%)	2	30% (2 x 15%)		
LO1-LO4			LO1-LO4			

Indicate which learning outcomes (L01, L02 etc) are to be assessed by exam/coursework/project as required.

Coursework / Submissions deadlines:

1 x 15% End of Semester 1; 1 x 15% End of Semester 2.

Resit Examination Procedures:

One 2 hour exam at August exam diet.

PLEASE NOTE:
Students need to gain a summative mark of 40% to pass the module. Students who fail the module at the first attempt will be re-examined during the August diet. This re-examination will consist entirely of exam.

Recommended Reading:

Applied Mechanics by J Hannah & MJ Hillier, 3rd Edition, Longman Scientific & Technical, 1995 ISBN 0-582-25632 1

Principles of Biomechanics and Motion Analysis, Griffiths, LWW
Mechanics of Engineering Materials by Benham, Crawford and Armstrong

Additional Student Feedback:

(Please specify details of when additional feedback will be provided)

MODULE DESCRIPTION FORM

BE210 Cell Biology 2

Module Registrar: Dr Michelle Maclean	**Taught To:** BEng/MEng Biomedical Engineering	
Other Lecturers Involved: Dr Mairi Sandison	**Credit Weighting:** 20	**Semester:** 1 and 2
Compulsory/optional/elective class: Compulsory	**Academic Level:** 2	
Prerequisites: BE105 Cell Biology 1		

Module Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Project	Assignments	Private Study	Total
20	5	20	15	30	110	200

Educational Aim

This module aims to

1. Provide the students with theoretical knowledge of a range of molecular, genetic and cell biology techniques, and give examples of their use in understanding cell behaviours, in clinical investigations and in industrial applications.

2. Provide students with training and practical experience in a range of cell biology laboratory skills, in order to support the theoretical learning from lectures.

3. Provide students with training in data presentation and descriptive analysis skills, and the writing of lab reports for accurate communication of their experimental methods and results.

Learning Outcomes

On completion of the module the student is expected to be able to:

LO1: Explain a range of molecular, genetic and cell biology techniques for cell, protein and DNA analysis and manipulation and give examples of their use in understanding cell behaviours, in clinical investigations and in industrial applications.

LO2: Demonstrate understanding, competence and safe practice, in a range of cell biology laboratory techniques which will be undertaken in the practical laboratory sessions

LO3: Effectively communicate experimental work, using skills developed in tutorials on data presentation (using Excel) and lab report writing

Syllabus

The module will teach the following:

Basic laboratory skills:
- *Units of measurement*
- *Data handling and presentation*
- *Laboratory report writing skills*

Physical Techniques in Cell Biology:
- *pH, centrifugation*
- *spectrophotometry*
- *gel electrophoresis and blots*
- *chromatographic methods*

Cell & molecular biology techniques
- *Microscopy*
- *fluorescent indicators & cell labelling*
- *immunohistochemistry, immunocytochemistry & ELISA*

Genetic manipulation and analysis techniques:
- *polymerase chain reaction and sequencing*
- *plasmids and cloning*
- *microarrays*

Diversity of cell structures and behaviours
- *Mammalian cell phenotypes*
- *Stem cells*
- *Bacterial structure and function*

Mammalian and Microbial Cell Culture Methods
- *Aseptic technique*
- *Microbial cell culture and handling*
- *Mammalian cell culture and handling*

Assessment of Learning Outcomes

Criteria

For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

LO1: ***Explain a range of molecular and cell biology techniques for cell, protein and DNA analysis and manipulation.***

C1 Have knowledge of a range of physical, molecular, genetic and cell biology techniques which can be used in cell biology research.
C2 Be able to explain the underlying theory/principles underpinning each of these cell biology techniques.
C3 Demonstrate an understanding of the structural differences between mammalian cells and microbial cells, and techniques which can be used for their culture
C4 Give examples of how these laboratory techniques can be used in understanding cell behaviours, in clinical investigations and in industrial applications.

LO2: ***Demonstrate understanding, competence and safe practice, in a range of cell biology laboratory techniques which will be undertaken in the practical laboratory sessions***

C1 Demonstrate knowledge of safe working practice within a biological laboratory, including aseptic technique.
C2 Show competence in the handling of laboratory equipment, and the following of test protocols.
C3 Apply the underpinning theory learnt during LO1, to support the understanding of the practical techniques and skills being used in the lab, and also interpreting the experimental data generated.

LO3: ***Communicate experimental work, using skills developed in tutorials on data presentation (using Excel) and lab report writing.***

C1 Demonstrate the ability to analyse and present experimental results using data presentation software.
C2 Report and communicate experimental work in the form of a written lab report (including aims, methods, results, conclusions)

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

Principles of Assessment and Feedback

The University's Assessment and Feedback Policy can be found at: www.strath.ac.uk/staff/policies/academic/

Please state briefly how these are incorporated in this module.

- Clear instructions will be given to students about assessment requirements and expectation through lectures/labs, and through notifications and information provided using MyPlace, the University's Virtual Learning Environment
- MyPlace tools will also be used to assess outcomes and promote interaction between individual students and their tutors, and to tailor feedback on performance to individual students. Likewise student feedback will be sought to improve both content and delivery of the course.
- Interaction and dialogue around learning will be encouraged during lectures and interactive laboratory sessions.

This module ensures that summative assessment has a positive impact on formative learning by providing students with practice revision questions so that they have an opportunity to experience what is required by summative assessment in a safe environment. For example, students will work on tasks similar to the final assessment for which feedback will be provided (e.g. practice MCQs and short answer questions). Students will then have a clear understanding of what is required and have had practice in the task.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

Examination	Coursework	Project

Number	Duration	Weighting	Number	Weighting	Number	Weighting
1	1-hr	60%	1 x Assignment Compulsory lab sessions	10%	2 (group lab report)	15% each
LO1 – LO2			LO1 – LO3		LO1 - LO3	
Indicate which learning outcomes (L01, L02 etc) are to be assessed by exam/coursework/project as required.						

Coursework / Submissions deadlines:

Students will submit an assignment in Week 6, Semester 1.
Students will submit completed lab worksheets after each lab session.
Students will submit group project lab reports in Semester 2 (dates tbc).

All submission dates/deadlines will be conveyed to the class during lectures/labs and via MyPlace

Resit Examination Procedures:

Resubmission/resit of failed elements(s)

Recommended Reading:

Access to comprehensive lecture slides, notes and electronic resources will be provided on MyPlace. Students wishing to carry out additional reading to supplement their learning may wish to consult some of the following texts:

- ***Fundamentals of Anatomy & Physiology***. Martini, Nath, Bartholomew. (Pearson Education Limited). *[Full text available online via University Library]*
- ***Molecular Biology of the Cell.*** Alberts, Johnson, Lewis, Raff, Roberts, & Walter. (New York: Garland Science). [*Available to loan from the University library*]
- **Biology.** Campbell & Reece. (Benjamin Cummings; London: Pearson Education). [*Available to loan from the University library*]

Additional Student Feedback:

(Please specify details of when additional feedback will be provided)

Feedback on activities will be provided regularly throughout the module, through scheduled on campus sessions, and posted on MyPlace) – details of these will be announced via MyPlace. Feedback on the assignment and the group lab reports will be provided within 3 weeks of submission deadline.

FACULTY OF ENGINEERING

MODULE DESCRIPTION FORM

EE269 - ELECTRONIC AND ELECTRICAL PRINCIPLES 2

Module Code: EE269	**Module Title:** Electronic and Electrical Principles 2	
Module Registrar: Dr H. Gleskova		
Other Lecturers Involved: Dr C. Michie, Dr P. Niewczas	**Credit Weighting** 20	**Semester:** 1 2
Compulsory/optional/elective class: C	**Academic Level:** 2	

Pre-requisites: Electronic and Electrical Principles 1, or similar

MODULE FORMAT AND DELIVERY (HOURS):

Lectures	Tutorial	Assignments	Laboratories	Private Study	Total
44	20	44	12	80	200

EDUCATIONAL AIM *THIS MODULE AIMS TO:*

To introduce students to the analysis and design of analogue circuits and systems as used in electronics, energy & power systems, communications, control and analogue signal processing applications

LEARNING OUTCOMES *ON COMPLETION OF THE MODULE, THE STUDENT IS EXPECTED TO BE ABLE TO;*

LO 1: Apply various mathematical tools & physical principles in the analysis of DC and AC circuits based on sinusoidal signals.

LO 2: Calculate and simulate the transient response of circuits containing capacitors and inductors and to analyse circuits driven by non-sinusoidal voltage waveforms.

LO 3: Understand an ideal operational amplifier and the corresponding amplifier circuits including active filters.

LO 4: Apply negative feedback to electronic circuits including instability in negative feedback.

(UK SPEC suggests no more than 4 learning outcomes per module. Statements must be broad and be syllabus free and link in with the intended learning outcomes on the programme specifications.)

SYLLABUS *THE MODULE WILL TEACH THE FOLLOWING:*

TOPICS

Overview of analogue circuits and electronics for real world applications. Examples from audio & acoustics, modem communication systems, sensors & actuators, control systems, electrical energy & power systems. Interfacing between analogue and digital systems.

Definition and properties of ideal circuit components and general concepts of system modelling using a network of ideal components.

Phasor description for sinusoidal waveforms.

Properties of basic RC, RL and RLC circuits.

Review of circuit theorems for network analysis, including Thevenin and Norton equivalents, superposition, mesh current and node voltage methods. Use of matrix methods and Cramer's rule. Examples of electronic circuit designs, including dependent sources to model transistor operation.

Power dissipation and power delivery with definitions of real, reactive and complex power. Conditions for maximum power transfer.

Coupled coils and the ideal transformer for impedance matching, with applications to electrical and electronic circuits.

Switching operations in electronic circuits. General concepts of steady-state, natural and transient response of circuits. Single energy and two-energy transients. Step and pulse response of basic RC and RL circuits and associated time constants. Examples of transients in DC and AC circuits and relevance to analogue and digital circuit design. Transients and resonance in RLC circuits.

Representation of analogue waveforms and signals in the frequency domain through the Fourier spectrum. General concepts behind the Fourier Series, Fourier Transform and Laplace Transform. Comparison between Fourier and Laplace methods.

Use of the Fourier and Laplace Transform for solving circuits where the driving source is non-sinusoidal and solutions for simple circuits driven by pulsed, ramped waveforms, etc. Natural response of RLC circuits.

General concepts of signals and system analysis using Fourier and Laplace methods. Impulse response and transfer function for systems using simple circuits as illustrative examples. Examples and applications in noise filtering and analogue signal processing using basic RC, RL and RLC circuits.

Ideal Amplifiers: Inverting, non inverting amplifiers, equivalent circuit representation, analysis of circuits containing these devices.

Amplifier characteristics: D.C. gain, frequency response in terms of magnitude and frequency, graphical representation of these effects (Bode Plots)

Negative feedback: Basic nfb equation; types of nfb; nfb in inverting and non inverting operational amplifier based circuits; use of nfb to stabilise voltage gain, extend bandwidth, change input/output impedances, reduce distortion and noise; stability criteria, gain and phase margins.

Idealised Op-Amp characteristics and the use of these properties to simplify circuit analysis.

Oscillators: Conditions for oscillations (Barkhausen Criterion), operational amplifier based on Wien bridge, RC phase shift, Colpitt's and Hartley Oscillators, analysis and design of these circuits.

Operational amplifier circuits: summers, integrators, differentiators, voltage to current and current to voltage converters, impedance converters.

Active filters: Butterworth and Chebyshev approximations; Sallen Key circuits; LC ladder simulation. Introduction to multiple feedback filters e.g Bi-quad and state variable filter.

Limitations of non ideal operational amplifier: input offset voltage and current, input bias current, reduction of current and voltage offsets, slew rate limitations; common mode rejection ratio, choice of appropriate component values.

LABORATORIES

(0) Geeting ready with PSpice

(1) Revision of PSpice

(2) Operation & design of op-amp circuits

(3) Transients in RC, RL and RLC circuits

(4) Design and construction of a variable frequency sinusoidal oscillator

(5) Analogue generator for square and triangular waves

ASSESSMENT OF LEARNING OUTCOMES - CRITERIA

For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

[Note: Criteria break the LO down into 'teachable' elements but do not become syllabus orientated i.e. no mention of CAD package names, components etc.]

LO1

C 1: Demonstrate ability to apply mesh current (including Cramer's rule) and node voltage methods to DC or AC circuits with sinusoidal waveforms.

C 2: Demonstrate understanding of the principles of mutual inductance, the ideal transformer and impedance matching.

C 3: Demonstrate ability to perform basic power calculations and maximise power delivery in AC circuits.

LO2

C 1: Demonstrate ability to calculate voltage/current transients in DC and AC circuits with sinusoidal power sources containing capacitor, inductor, or both.

C 2: Demonstrate ability to transfer analogue signals from time to s-domain and vice versa.

C 3: Demonstrate ability to apply Laplace Transform method to RL or RC circuits.

LO3

C 1: Demonstrate understanding of idealised inverting and non-inverting electronic amplifiers.

C 2: Demonstrate ability to design and analyze simple op-amp circuits.

C 3: Demonstrate understanding of the limitations of practical amplifier devices and circuit limitations resulting from non-ideal behaviour of op-amps.

LO4

C 1: Demonstrate application of the negative feedback to electronic circuits and the ability to derive and use the relevant equations.

C 2: Demonstrate ability to use negative feedback to stabilize voltage gain, extend bandwidth, or change input/output impedances.

C 3: Demonstrate understanding of instability in negative feedback circuits and the ability to extend these concepts to electronic oscillators.

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

12 PRINCIPLES OF ASSESSMENT FEEDBACK

Please state briefly how these are incorporated in this module.

1. Student performance will be clarified using the online assessment and laboratories and appropriate and timely feedback will be provided.

2. The timetable is fixed/agreed at the start of the module; such arrangement will encourage good time management in the context of learning.

3. Students will get direct feedback on the assessment of laboratory exercises and/or reports.

4. Interaction and dialogue between students and teachers will be an integral part of the tutorial and laboratory sessions.

5. Self-assessment of progress will be facilitated by providing a series of tutorial problem sheets supported by numerical answers and worked examples within tutorials and lecture sessions.

6. Students will be invited to give feedback on the assessment methods and criteria via the staff-student committee.

7. Mutual support and group working will be encouraged in the tutorial classes.

8. The module will be delivered in a supportive, encouraging and motivational atmosphere.

9. The experience of assessing this module will be fed back to other teachers via the process of module review.

(on Learning & Teaching web pages: *www.strath.ac.uk/learnteach/teaching/staff/assessfeedback/12principles/*)

ASSESSMENT METHOD(S) INCLUDING PERCENTAGE BREAKDOWN AND DURATION OF EXAMS

To Pass the module, students need to gain a summative mark of;					**40%**	
Examination	**Duration**	4	**Weighting %**	70	**Learning Outcomes**	L1, L2, L3, L4
Coursework	**Number**	5	**Weighting %**	30	**Learning Outcomes**	L1, L2, L3, L4
Project	**Number**		**Weighting %**		**Learning Outcomes**	

COURSEWORK / SUBMISSIONS DEADLINES:
RESIT ASSESSMENT PROCEDURES: Examination

ADDITIONAL INFORMATION RELEVANT TO COURSE DELIVERY AND ASSESSMENT

Completion of all laboratory exercises is needed to obtain the credits.

RECOMMENDED READING

'Electric Circuits' by James W Nilsson & Susan A Riedel, Pearson Prentice Hall

'Introduction to Electric Circuits' by Richard C Dorf & James A Svoboda, Wiley

'Electronic Devices' by Thomas L Floyd, Merrill Publishing Company

'Electronic Devices and Circuits' by Theodore F Bogart, Merrill Publishing Company

'Electronics, A Systems Approach' by Neil Storey, Addison Wesley

'Electronic Design, Circuits and Systems' by C.J Savant, Martin S Roden, Gordon L Carpenter, Benjamin/Cummings Publishing Company Inc

ADDITIONAL STUDENT FEEDBACK; SPECIFY DETAILS OF WHEN ADDITIONAL FEEDBACK WILL BE PROVIDED.

Semester	S2	**Week**	1	**Nature**	Feedback on S1 class test
Semester		**Week**		**Nature**	
Semester		**Week**		**Nature**	
Semester		**Week**		**Nature**	
Semester		**Week**		**Nature**	
Semester		**Week**		**Nature**	
Further comments about feedback	Feedback on lab work/reports is received within three weeks after the submission.				

SIGNATURE (MODULE REGISTRAR):
DATE OF LAST MODIFICATIONS: 16/09/2020

FACULTY OF ENGINEERING

MODULE DESCRIPTION FORM

EE270 - DIGITAL ELECTRONIC SYSTEMS

Module Code: EE270	**Module Title:** Digital Electronic Systems	
Module Registrar: Dr. L. Crockett		
Other Lecturers Involved: Dr. P. Murray, Dr. D. Crawford	**Credit Weighting** 20	**Semester:** 1 2
Compulsory/optional/elective class: C	**Academic Level:** 2	

Pre-requisites: EE107 - Electronic & Electrical Principles 1

MODULE FORMAT AND DELIVERY (HOURS):

Lectures	Tutorial	Assignments	Laboratories	Private Study	Total
22	22	40	22	94	200

EDUCATIONAL AIM *THIS MODULE AIMS TO:*

To introduce students to the use of digital electronics and Finite State Machines (FSMs). To enable students to create and test digital designs using VHDL and Electronic Design Automation (EDA) software tools.

LEARNING OUTCOMES *ON COMPLETION OF THE MODULE, THE STUDENT IS EXPECTED TO BE ABLE TO;*

LO 1: Know how to define, design, and derive the outputs of combinatorial and sequential digital circuits, including counters and Finite State Machines (FSMs).

LO 2: Be able to design,optimise, implement, and debug state machines.

LO 3: Gain experience of working with EDA tools, and be capable of designing and simulating digital circuits, including schematic design entry and VHDL coding.

LO 4: Know how to program Field Programmable Gate Arrays (FPGAs) and understand how to specify inputs and outputs.

(UK SPEC suggests no more than 4 learning outcomes per module. Statements must be broad and be syllabus free and link in with the intended learning outcomes on the programme specifications.)

SYLLABUS *THE MODULE WILL TEACH THE FOLLOWING:*

BASIC DIGITAL CIRCUIT DESIGN AND ANALYSIS: Revision of logic gates; laws of Boolean algebra; Boolean function manipulation; simple digital circuit analysis; minterms and maxterms; Karnaugh maps; "don't care" terms. Binary coded decimal format; NAND or NOR only circuit implementation; multiplexers; decoders. Introduction to sequential systems; feedback and stability; design of latch circuits and flip-flops (SR, D, JK, and T-types); flip-flop setup and hold times . Characteristic tables and equations; transition/state tables; synthesis of digital sequential circuits from transition tables; timing diagrams.

SEQUENTIAL CIRCUITS AND FINITE STATE MACHINES: Counter circuits; shift registers. Finite state machine design; state diagrams; Mealy and Moore types; optimisation; design examples. Minimisation of states by row matching and implication charts. Issues with Mealy machines and analysis of "false outputs". Optimal state assignment and minimisation of next state and output expressions. Design and implementation of state machines from a given specification; implementation, simulation, behavioural testing and debugging of circuits.

BINARY ARITHMETIC: Binary number representations (unsigned and signed); Arithmetic circuits: full adder circuit, design of binary arithmetic circuits (adders, subtractors); overflow and sign extension.

DIGITAL DEVICES AND DESIGN FLOWS Field Programmable Gate Arrays (FPGAs); Application Specific Integrated Circuits (ASICs); processors; comparisons between devices; suitability for different applications. Design flows, in particular for FPGA design; methods of design entry; EDA software tools; simulation and implementation steps.

VHDL: Motivation for Hardware Description Languages (HDLs). Circuit description using VHDL: entity / architecture pairs; input and output ports; signals, constants, components etc. VHDL objects and data types; operators; arrays; defining one's own types and subtypes; enumerated types; IEEE std_logic and related types; support for arithmetic. Sequential and concurrent design elements and statements; processes and sensitivity lists. Hierarchy; working with libraries. Testbenches and simulation; designing appropriate test inputs; VHDL synthesis, writing synthesisable VHDL.

PRACTICAL DESIGN CASE STUDIES Creating digital circuits with schematic entry. Working with FPGAs (steps from design to implementation on the FPGA). Designing and testing circuits in VHDL. Prototyping with an FPGA development board: working with inputs and outputs.

ASSESSMENT OF LEARNING OUTCOMES - CRITERIA

For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

[Note: Criteria break the LO down into 'teachable' elements but do not become syllabus orientated i.e. no mention of CAD package names, components etc.]

LO1

C 1: The student should understand the behaviour of basic digital elements, and be capable of using them to design different types of digital circuit, both combinatorial and sequential.

C 2: The student should be able to describe and analyse digital circuits using Boolean Algebra, state equations, diagrams and tables, circuit diagrams, and timing diagrams.

C 3: The student should understand how to construct shift registers and counters of different types.

C 4: The student should be capable of working with finite state machines, and be able to design FSMs to solve particular problems.

LO2

C 1: The student should understand how to proceed from a given specification to a functional state machine.

C 2: The student should be able to follow the required steps from design to implementation, including state minimisation, state assignment, schematic logic implementation, and the design of test bench waveforms.

LO3

C 1: The student should be familiar with different types of digital device, their characteristics, and methods of creating designs for them. In particular, the student should understand the relevance of VHDL to FPGA design.

C 2: The student should be capable of designing digital circuits using the VHDL language, creating appropriate testbenches for design verification, and running and interpreting simulations.

C 3: The student will gain experience of working with industry standard EDA tools.

C 4: The student should understand the principles of binary arithmetic, how arithmetic circuits like adders and subtractors are implemented, and support for arithmetic in the VHDL language.

LO4

C 1: The student should be familiar with the steps required to take a design from VHDL to a bitstream file for programming the FPGA.

C 2: The student should know how to associate the inputs and outputs of a design with physical Input Output Blocks (IOBs) on the FPGA, using a constraints file.

C 3: The student should have basic awareness of the architecture of FPGAs.

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

12 Principles of Assessment Feedback

Please state briefly how these are incorporated in this module.

1. Course goals and assessment criteria are clearly explained in course handout, introductory lecture and MyPlace. Students will be made aware of what constitutes good performance, through lectures and handouts with examples of good practice.
2. Students have regular opportunities to ask questions during scheduled tutorial and lab sessions.
3. After coursework hand-ins, feedback will be provided to highlight aspects which were completed well, and areas for improvement in the future.
4. Students will be encouraged to reflect upon their own performance.

(on Learning & Teaching web pages: www.strath.ac.uk/learnteach/teaching/staff/assessfeedback/12principles/)

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

To Pass the module, students need to gain a summative mark of;					**40%**	
Examination	**Duration**	2	**Weighting %**	50	**Learning Outcomes**	ALL
Coursework	**Number**	6	**Weighting %**	50	**Learning Outcomes**	ALL
Project	**Number**		**Weighting %**		**Learning Outcomes**	

Coursework / Submissions Deadlines:

Semester 1:

•2 x quizzes (5% each) weeks 6 and 10

•1 x assignment (15%) week 11

TOTAL : 25%

Semester 2:

• 2 x quizzes (5% each) weeks 5 and 9

• 1 x design project (15%) week 11

TOTAL : 25%

Resit Assessment Procedures: Examination

Additional Information relevant to Course Delivery and Assessment

The examination of the class will be via a single, 2 hour exam in the April/May diet comprised of questions on the material taught in both semesters 1 and 2.

RECOMMENDED READING

NOTE: These are not compulsory purchases, but may provide useful reference material for the course.

1. Digital Fundamentals, Thomas Floyd, published by Pearson, 2008.
2. Students Guide to VHDL, Peter Ashenden, published by Morgan Kaufmann, 2008.
5. VHDL by Example: A Concise Introduction for FPGA Design, Blaine Readler, Full Arc Press, 2014.

ADDITIONAL STUDENT FEEDBACK; SPECIFY DETAILS OF WHEN ADDITIONAL FEEDBACK WILL BE PROVIDED.

Semester	S1	**Week**	6	**Nature**	Feedback from Myplace Quiz
Semester	S1	**Week**	10	**Nature**	Feedback from Myplace Quiz
Semester	S2	**Week**	1	**Nature**	Feedback on S1 Assignment
Semester	S2	**Week**	5	**Nature**	Feedback from Myplace Quiz
Semester	S2	**Week**	9	**Nature**	Feedback from Myplace Quiz
Semester	S2	**Week**	14	**Nature**	Feedback on S2 Assignment
Further comments about feedback					

SIGNATURE (MODULE REGISTRAR):

DATE OF LAST MODIFICATIONS: 16/09/2020

MODULE DESCRIPTION FORM

ME209 MATHEMATICAL MODELLING AND ANALYSIS

Module Registrar: Dr H Chen	**Taught To (Course): Cohorts for whom class is compulsory**	
Other Lecturers Involved: Prof Nigel Mottram +anotherTBC	**Credit Weighting: 20 (ECTS 10)**	**Semester: 1 and 2**
Assumed Prerequisites: 16132 Engineering Mechanics 1, ME101 Heat and Flow 1, ME103 Engineering Analysis, MM117 Mathematics 1M	**Compulsory class**	**Academic Level: 2**

Module Format and Delivery (HOURS i.e. 1 credit = 10hrs of study):

Lecture	Tutorial	Laboratory	Groupwork	External	Online	Project	Assignments	Private Study	**Total**
48	12	12					10	118	200

Educational Aim

Mathematics (Semester 1)
To give students competence in the differential and integral calculus of functions of several independent variables, and in the solution of ordinary differential equations (with particular emphasis on the Laplace transform method).

Engineering Analysis (Semester 1 and 2)
This class develops the general approach to the solution of engineering problems and involves mathematical modelling, numerical methods and the application of computer software. A wide range of engineering topics is presented and includes problems in structures, dynamics, fluids and heat transfer to emphasise the general applicability of the solution processes. The integration of mathematical techniques and the use of the computer as an essential tool in the modelling, simulation and solution of problems in engineering is an important objective of the class. It is also designed to demonstrate the power of mathematical methods to the formulation and manipulation of equations to represent complex engineering systems.

The first 6 weeks of both semester 1 and semester 2 present the fundamentals of numerical methods and formulation techniques in an engineering context and is taught in a lecture/tutorial format. In the last 6 weeks of each semester the emphasis changes to the application of the techniques previously developed to a range of engineering problems using the MATHCAD software. This part is taught in a computer based learning environment.

Learning Outcomes

On completion of the module the student is expected to be able to

Mathematics (Semester 1)

LO1 Have knowledge and understanding of concepts and methods introduced in Mathematics module (MM217).

Engineering Analysis (Semester 1 and 2)

LO2 have an understanding of the use of mathematical methods and their role in formulating equations to represent a variety of problems in engineering, and be able to apply mathematical methods for the formulation of ordinary differential equations and linear equation systems.
LO3 be able to choose and apply a variety of numerical methods to solve ordinary differential equations, simultaneous equations, and to numerically differentiate and integrate data and equations.
LO4 be able to model simple problems involving dynamic simulation techniques and apply mathematical software such as Mathcad to the solution of engineering problems.

Syllabus

ME209 Mathematical Modelling and Analysis is a combined module which consists of two separate modules Mathematics (MM217) and Engineering Analysis 2 (16265). The module will teach the following:

Mathematics (Semester 1)
Ordinary Differential Equations: first-order separable, linear; second-order linear; constant coefficients with forcing functions exp(kx), sin(kx), cos(kx) and polynomials, including sums of these.

Partial Differentiation: first and second derivatives, total differential, small errors, differentiation in a given direction, chain rule, implicit functions, stationary points; indicate extension to functions of more than two variables.

Double Integration: interpretation as a volume, evaluation as an iterated integral, change of order, change of variable from Cartesian to polars, application to centre of mass, moments of inertia.

Laplace Transform: definition, standard results, application to ODEs.

Engineering Analysis (Semester 1 and 2)
Concepts of mathematical modelling: case studies in formulation of equation systems and differential systems for structural, dynamic, fluid and thermal problems.

Mathematical methods: Linear algebra, matrices in engineering mechanics, linear operators, definitions; square matrices; inversion, and determinants and singularity; Gaussian elimination, LU decomposition.

Numerical methods: Solution of simultaneous linear and nonlinear equations; Jacobi and Gauss Seidel Iteration method; Newton Raphson method; Numerical differentiation and integration, applications to multiple integrals, numerical quadrature, evaluation of areas, interpolation and curve fitting.

Solution of ordinary differential equations: classification of solution methods with engineering applications in dynamics, thermodynamics, fluid mechanics, solid and structural mechanics using computer-aided engineering techniques. Numerical solution of ordinary differential equations, initial value problems, predictor corrector methods. Runge Kutta methods.

Software applications: Use of Mathcad.

Assessment of Learning Outcomes

Criteria

For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

LO1
C1 How student understands standard methods for solving simple ordinary differential equations of first and second-order, and methodology of the Laplace transform method for solving ordinary differential equations (January exam).
C2 How student appreciates basic aspects of the calculus of functions of several variables, including the notions of directional derivative and double integration (January exam).

LO2
C1 How student understands the use of mathematical methods and their role in formulating equations to represent a variety of problems in engineering, and how to apply mathematical methods for the formulation of ordinary differential equations and linear equation systems (Coursework 1 and 2, Class based examinations).

LO3
C1 How to choose and apply a variety of numerical methods to solve ordinary differential equations, simultaneous equations, and to numerically differentiate and integrate data and equations (Class based examinations)

LO4
C1 how to model simple problems involving dynamic simulation techniques and apply mathematical software to the solution of engineering problems (Coursework 1 and 2).

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

12 Principles of Assessment and Feedback
(on Learning & Teaching web pages: www.strath.ac.uk/learnteach/informationforstaff/staff/assessfeedback/12principles/)

- In order to promote student engagement and self-regulation in learning, the Principles of Assessment and Feedback is adapted to suit current disciplinary context. The assessment method adopted in this module includes examination, class test and coursework assignments, with proper feedback for student learning.

- Regular formative feedback will be provided by verbal discussion on an individual or group basis of work during the tutorials timetabled for the classes.
- For the assessment of coursework reports, both summative assessment and formative feedback will be provided. The summative assessment will positively influence how students interact with formative assessment and feedback.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

	Examinations				Courseworks		Projects	
	Number	Month(s)	Duration	***Weighting***	Number	***Weighting***	Number	***Weighting***
	see below	see below	see below	75%	see below	25%		
L/Outcomes	LO1, LO2, LO3				LO2, LO4			

Indicate which learning outcomes (L01, L02 etc) are to be assessed by exam/coursework/project as required.

Mathematics Semester 1 – 50% 2 hour January exam.
Engineering Analysis Semester 1 - 25% continuous assessment (consisting of 12.5% for 1 class based exam 50mins in week7 and 12.5% for 1 coursework assignment). Semester 2 – 25% continuous assessment (consisting of 12.5% for 1 class based exam 50 mins in week7 and 12.5% for 1 coursework assignment).

Coursework / Submissions deadlines:
Week 12

Resit Assessment Procedures:
3 hour examination in August.

PLEASE NOTE:
Students need to gain a summative mark of 40% to pass the module. Students who fail the module at the first attempt will be re-examined during the August diet. This re-examination will consist entirely of exam.

Recommended Reading

; **Highly recommended reading; *Simply for reference (do NOT purchase)

Mathematics
* Thomas, G.B. & Finney, R.L. "Calculus and Analytic Geometry" (Addison-Wesley). D515.15 THO, ISBN: 0201400154.
* Kreyszig, E., "Advanced Engineering Mathematics" (Wiley). D510.2462 KRE, ISBN: 047133328X.

Engineering Analysis - Notes are provided on Myplace
** "Numerical Methods for Engineers" by Chapra and Canale, ISBN 0-07-100412-2

Additional Student Feedback
(Please specify details of when additional feedback will be provided)

Students will receive regular one to one feedback during the tutorials timetabled for the class.

Session: 2012-2013

Approved:

Course Director Signature:

Date of Last Modifications: 18 September 2012

(Updated September 2012)

MODULE DESCRIPTION FORM

ME214 MECHANICAL ENGINEERING DESIGN 2

University of Strathclyde

Module Registrar: Tugrul Comlecki tugrul.comlekci@strath.ac.uk	**Taught To (Course): Cohorts for whom class is compulsory**	
Other Lecturers Involved: Prof J Thomason; + other tbc	**Credit Weighting: 10 (ECTS 5)**	**Semester: 1**
Assumed Prerequisites: 16165 (2015/16) and ME105 (2016-onwards)	**Compulsory class**	**Academic Level: 2**

Module Format and Delivery (HOURS i.e. 1 credit = 10hrs of study):

Lecture	Tutorial	Laboratory	Groupwork	External	Online	Project	Assignments	Private Study	**Total**
24		36						40	100

Educational Aim

This module aims to:

Develop competency in mechanism design using the PTC Creo software suite, building on the part creation, assembly and drawing creation competencies developed in ME 105.

Develop competency in materials selection for engineering design, using the CES Selector software.

Learning Outcomes

On completion of the module the student is expected to be able to:

LO1 Use a modern features-based 3D modeller to animate assemblies.

LO2 Use a modern features-based 3D modeller to carry out simple mechanism design studies.

LO3 Use material selection software to make rational choices on the basis of engineering, economic and environmental properties.

Syllabus

The module will teach the following:

Mechanism design
Introduction to engineering mechanisms. Review of rigid body kinematic and kinetic relationships. An overview of PTC Creo mechanism elements, functionality, and procedures. How to build a mechanism using PTC Creo and carry out animation, dynamic interference checking and establish motion envelopes. How to carry out kinematic and kinetic analyses of a range of simple mechanisms and to validate results against available closed form solutions. An overview of advanced mechanism design and interfacing to flexible body dynamics.

Material selection for engineering design
Introduction to CES software to find, plot and compare materials data. Basic material selection procedures and the development of performance metrics. How to carry out a material selection study for a simple design.

Assessment of Learning Outcomes

Criteria

For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

LO1
C1 Describe the software tool being used, highlighting the animation procedures and limitations.

C2 Develop a modelling strategy (highlighting assumptions) and select appropriate idealisations which are compatible with the objectives of the animation simulation being undertaken.
C3 Employ an analysis and simulation system to achieve the objectives of the animation task set.
C4 Demonstrate sound engineering judgement and effective communication skills.

LO2
C1 Describe the software tool being used, highlighting possible uses and limitations for mechanism design.
C2 Develop a modelling strategy (highlighting assumptions) and select appropriate idealisations which are compatible with the objectives of the mechanism simulation being undertaken.
C3 Employ a mechanism deisgn system to achieve the objectives of the task set and to validate the results obtained as far as practical.
C4 Demonstrate sound engineering judgement and effective communication skills.

LO3
C1 Describe the material selection software tool being used, highlighting the functionality and procedures.
C2 Develop a selection strategy which is compatible with the objectives of the design scenario being considered.
C3 Employ a material selection system to achieve the objectives of the task set.
C4 Demonstrate sound engineering judgement and effective communication of material data.

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

12 Principles of Assessment and Feedback
(on Learning & Teaching web pages: http://www.strath.ac.uk/learnteach/informationforstaff/staff/assessfeedback/12principles)

This course combines traditional lecture based learning with assisted lab based tutorials and exercises, which gives the students an opportunity to learn the software by working through weekly exercises and assignments with the help of experienced lab tutors. Students are encouraged to work in pairs to understand and solve basic engineering problems, allowing feedback both from other students and staff.

Students are provided with marking schedules which provide an indication of marks assigned and performance required and the marking schedule also provides an indication of the challenges and where effort is best employed.

There are generally 3 hours of manned laboratory sessions per week and students who attend will have ample opportunity for feedback on progression. In addition, on release of coursework marks, students have the opportunity to seek further feedback.

The significant laboratory content also provides students with the opportunity to develop and practice the required competences before summative assessment takes place.

The essence of the laboratory element is interaction and dialogue and discussion amongst students is also encouraged, students are encourage to reflect on their development during the laboratory element of the course.

Students are generally engaged in the timing of assessment and also the topic in some cases. Social integration during the learning process is much in evidence during the laboratory sessions.

The experience of using industry-leading application software on challenged and interesting design problems is generally found to be highly motivational and the achievement of competencies much in demand by industry can also improve self-esteem.

Staff involved in this subject reflect on the module delivery each year and share their own experiences with a view to updating the module and improvement of the student learning experience.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

	Examinations/Tests				Courseworks		Projects	
	Number	Month	Duration	***Weighting***	Number	***Weighting***	Number	***Weighting***
	1	Nov (tbc)	1hr	30%	1	70%	0	0
L/Outcomes	LO1 (C1, C2, C4)				LO1, LO2, LO3			

Coursework / Submissions deadlines: To be agreed with class, taking cognizance of workload.
Resit Assessment Procedures: Resubmission of new coursework prior to the commencement of the August Examination diet. In some cases resubmission of the failed / non-submitted original coursework will be acceptable. In this case a brief oral examination may also be required.

PLEASE NOTE:
Students need to gain a summative mark of 40% to pass the module. Students who fail the module at the first attempt will be re-examined by further coursework.

Recommended Reading

*******Essential reading; ****Purchase essential; ***Purchase recommended; **Highly recommended reading; *Simply for reference (do NOT purchase)**

***** Course notes and self-learning material provided.
** Mechanism and Mechanical Devices Sourcebook, 5th Ed, Neil Sclater, McGraw-Hill, ISBN-10: 0071704426, 2011.
** Materials Selection in Mechanical Design, 4th Ed, Michael Ashby, Butterworth-Heinemann, ISBN-10: 1856176630, 2010.

Additional Student Feedback
(Please specify details of when additional feedback will be provided)

Date	Time	Room No
Weekly tutorial	TBC	TBC

Assessment of this class is by a class test and a coursework submitted online or in hard copy. Students can expect to receive feedback in the form of staff comments on assessments in addition to receiving the mark for each element of assessment. Students should also receive continuous formative feedback through the weekly tutorial sessions, and should make full use of these opportunities.

Session: 2015/16

Approved:

Course Director Signature: Ian J Taylor

Date of Last Modifications: 16 August 2015

Year 3

The following pages contain class descriptors for the different classes in year 1. Since different departments teach different classes, the class descriptors may differ slightly in format.

In year 3 there is the chance to choose any class that you wish from the University catalogue, providing you have the appropriate pre-requisites and that it fits with the year 3 timetable. This class is known as an elective.

MODULE DESCRIPTION FORM

BE300 Biomedical Materials

Module Registrar: Professor Will Shu	**Taught To:** Biomechanical Materials	
Other Lecturers Involved: Dr Phil Riches	**Credit Weighting:** 20	**Semester:** 2
Compulsory/optional/elective class: Compulsory	**Academic Level:** SCQF9	
Prerequisites: Knowledge of simple mechanics		

Module Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Project	Assignments	Private Study	Total
24		12	12		152	200

Educational Aim

This module aims to develop knowledge, understanding, and practical experience of synthetic materials used in different biomedical applications, together with a qualitative understanding of the mechanical behaviour of a variety of tissues.

Learning Outcomes

On completion of the module the student is expected to be able to:

LO1 understand the relationship between the structure of materials and their behaviour as a basis for materials selection in biomedical applications

LO2 provide qualitative discussion on the relationship between natural tissue structure, function and mechanical behaviour

LO3 Describe appropriate techniques for the determination of the mechanical behaviour of different biomedical materials (synthetic and natural)

(UK SPEC suggests no more than 4 learning outcomes per module. Statements must be broad and be syllabus free and link in with the intended learning outcomes on the programme specifications.)

Syllabus

The module will teach the following:

Synthetic biomedical materials (metal, ceramic, composite and polymers) will be described in terms of their basic behaviour (brittle, ductile, plastic, elastic, viscoelastic) applied to Biomedical Engineering applications.

Selection and characterisation of appropriate materials for implantable devices and Tissue Engineering applications. The basic understanding will be established by means of examples and with reference to back-up software, which will cover materials science in an interactive programme.

Bone, articular cartilage ligaments and tendons will be described structurally. Appropriate mechanical tests will facilitate descriptive analysis, including the use of storage and loss moduli.

Tensile testing, microscopy (SEM, AFM) and nanoindentation and their experimental factors will be discussed in terms of their appropriateness for biomedical material characterisation.

Assessment of Learning Outcomes

Criteria
For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

[Note: Criteria break the LO down into 'teachable' elements but do not become syllabus orientated i.e. no mention of CAD package names, components etc.]

LO1 Understand the relationship between structure of metals & ceramics and their behaviour as a basis for materials selection in biomedical applications
C1 identify the types of bonding present in metals and ceramics, and explain how material structure and processing influences those properties
C2 ability to perform basic calculations of material strength, elastic modulus, etc., for each class of material

LO2 Provide qualitative discussion on the relationship between tissue structure, function and mechanical behaviour
C1 relate the microstructure of bone, articular cartilage and ligaments/tendons to its mechanical behaviour
C2 to utilise basic experimental viscoelastic theory (storage and loss moduli) to describe natural tissues

LO3 Describe appropriate techniques for the determination of the mechanical behaviour of different biomedical materials (synthetic and natural)
C1 be able to describe the physics behind the latest microscopy techniques
C2 discuss the appropriates of experimental techniques for difference tissues

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

Principles of Assessment and Feedback

The University's Assessment and Feedback Policy can be found at: www.strath.ac.uk/staff/policies/academic/
Specific details relating to this class are as follows:

The lecturers will interact, and actively discuss and debate topics, with the students. High quality feedback will be provided to encourage students to correct their work and develop their ideas. Students will be encouraged to take the time and put in the effort to learn about the field. Student feedback will be sought to improve content and style of the course.

We will assess "good" reports and "bad" reports to ascertain the assessment requirements of a lab report, providing clear examples of the level expected. This allied with quality, appropriately timed feedback will ensure student success and satisfaction.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

Examination			Coursework		Project	
Number	Duration	Weighting	Number	Weighting	Number	Weighting
1		50%	2	50%		
LO1-2			LO3			

Indicate which learning outcomes (L01, L02 etc) are to be assessed by exam/coursework/project as required.

Coursework / Submissions deadlines:

Resit Examination Procedures:

One 2 hour exam in the August diet.

PLEASE NOTE:
Students need to gain a summative mark of 40% to pass the module. Students who fail the module at the first attempt will be re-examined during the August diet. This re-examination will consist entirely of exam.

Recommended Reading:

Callister WD "Materials Science & Engineering" (Wiley: New York)
Ashby M "Materials Selection in Mechanical Design" (Butterworth-Heinemann)
Young RJ and Lovell PA "Introduction to Polymers" (CRC Press, Boca Raton, FL, USA)
McCrum NG, Buckley CP, Bucknall CB "Principles of Polymer Engineering" (Oxford University Press)
Brydson JA "Plastics Materials" (Butterworth, London)
Park JB and Lakes RS 'Biomaterials - An Introduction' Plenum Press, New York
Ratner et al 'Biomaterials Sciences: an introduction to materials in medicine' Elsevier Academic Press
Biomechanics of the musculo-skeletal system, Nigg and Herzog, Wiley 2002
Tissue Mechanics, Cowin & Doty, 2007, Springer

A variety of journal articles will be used

Additional Student Feedback:

(Please specify details of when additional feedback will be provided)

MODULE DESCRIPTION FORM

BE301 Physiological Systems in Health & Disease

Module Registrar: Dr Helen Mulvana	**Taught To:** BEng/MEng Biomedical Engineering	
Other Lecturers Involved: tbc	**Credit Weighting:** 20	**Semester:** 1
Compulsory/optional/elective class: Compulsory	**Academic Level:** SCQF9	
Prerequisites: Fundamental anatomical and physiological knowledge		

Module Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Group Projects	Assignments	Private Study	Total
16	8	0	48	8	120	200

Educational Aim

The general educational aim is to provide students in Biomedical Engineering with a deeper understanding of key characteristics of physiological systems, their co-dependencies for normal function and how pathology and disease arise from disrupted homeostasis. The course will highlight how homeostatic mechanisms at all size scales (molecular to whole body) are central to health. Understanding the role of (and interactions between) physiological systems will assist students in determining the source(s) and the effects and progression of major diseases and syndromes as well as the development of chronic conditions associated with ageing. The course will involve guided group and peer learning and will require students to assess how biomedical engineering interventions/innovation can assist in the diagnosis, treatment and restoration of normal function.

Learning Outcomes

On completion of the module the student is expected to be able to:

LO1 Develop an understanding of the function of, and interactions between, physiological systems involved in maintaining normal homeostasis.

LO2 Develop an understanding of the relationship between disrupted homeostasis, pathology and health status.

LO3 Be able to openly discuss, share and present current knowledge of the physiological systems selected for study as directed by module instructors and facilitators to peer groups (e.g. cardiovascular control and cardiovascular disease, carbohydrate metabolism and diabetes, calcium and phosphate metabolism and disorders of bone, motor function and movement disorders, the immune system and autoimmune conditions).

LO4 Identify current state-of-art biomedical engineering solutions or advances where technological innovations could impact on the detection, management and compensation to pathology in physiological control systems.

(UK SPEC suggests no more than 4 learning outcomes per module. Statements must be broad and be syllabus free and link in with the intended learning outcomes on the programme specifications.)

Syllabus

At the core of this module will be the use of directed group working supported by module instructors. Students will form self-selected groups and will be presented with a set of four topics for study. The topics selected for study will be exemplar physiological systems where an understanding of normal function and control can be linked to ill health and disease. The syllabus will emphasise the importance of understanding integrative processes operating at the cellular, organ and systems levels in health and disease. Topics will be introduced with sufficient background material to enable focused group enquires (self learning) into normal control mechanisms, the health consequences of disruption to these mechanism and the role of biomedical engineering approaches to better diagnosis, assessment and management of disease states.

The topics presented to the student body may vary on a year-to-year basis reflecting recent developments in the field of study but will include topics linked to major diseases and syndromes. Example themes are listed below:

- Control of the cardiovascular system
- Carbohydrate regulation
- Motor control and the musculoskeletal system
- Immunological reactions and inflammation

Each topic will be introduced through expert led lectures. The lectures will also serve as the vehicle to pose a set of learning outcomes to be undertaken by groups of students. The focus of individual student groups will be directed to one element from the following topics in each of the four themes.

- Current state of knowledge of the normal state
- Current understanding of the major diseases linked to the topic under review
- Current knowledge of management of the pathologies that link to the topic
- Current and future role of biomedical engineering in diagnosis, treatment and recovery of health.

With four topics and four major themes to be explored, each group of students will be expected to cover each of the above at least once during the module. Peer learning and peer assessment will be integral to the running of the module with student groups being required to make a series of presentations (oral and poster) that share their learning and that provide clear links to materials/resources that can be assessed by the class.

Discussion of the challenges and solutions in applying engineering principles to the repair/modulation/ replacement of components of key physiological systems in specific diseases and other medical conditions will be central to the delivery of the module. Furthermore, a key aspect of the syllabus module is to introduce the students to interdisciplinary approaches to study and exploration of basic physiological control principles and to see them in the context of disease processes. The syllabus will induce students to review the knowledge base from an interdisciplinary perspective and to consider how advances in health care can be achieved through translational biomedical engineering. At the end of the module, the students should be able to work collaboratively with others in a group context so as to achieve a group task. In this way student-centred activities form part of the teaching and learning strategy.

Assessment of Learning Outcomes

Criteria

As a result of course participation, the student should:

LO1

C1 Be able to describe individual components of key physiological systems their role in maintaining homeostasis, and their inter-dependence on normal functioning of other systems in the body
C2 State normal ranges for physiological states resulting from key homeostatic mechanisms
C3 Be able to communicate the above and direct others to key information sources

LO2

C1 Using specific examples highlight major health issues related to each topic covered in the module
C2 Understand the major pathological consequences of disrupted homeostatic mechanisms
C3 Reflect on the associated morbidity and mortality of different disease states and chronic conditions in the absence of intervention.
C4 Be able to cite key sources of information on etiology, diagnostics and current treatment trends
C5 Be able to communicate the above and direct others to key information sources

LO3

C1 Develop skills in group working.
C2 Develop skills in information retrieval and critical appraisal
C3 Develop skills in sharing information through oral and poster presentation formats
C4 Engage in peer assessment.

LO4

C1 Using specific examples, be able to identify current biomedical engineering interventions
C2 Understand the current limitations of man-made/engineered biomaterials in the successful development of artificial organs or medical devices designed to be compatible with and to be able to endure the internal human body environment
C4 Engage in foresight/horizon scanning on future innovations in engineering based solutions to health conditions linked to disorders of homeostasis and the translational challenges.
C3 Be able to communicate the above in group presentations and discussions.

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

Principles of Assessment and Feedback

The University's Assessment and Feedback Policy can be found at: www.strath.ac.uk/staff/policies/academic/

Specific details relating to this class are as follows:

A final poster presentation will be made by each student on a topic of their choice associated with the materials covered in the course. The posters will be assessed by the instructors and will carry a weighting of 40%. 4 sets of group presentations will be held during the course and these presentations will be assessed by the instructors and by the student's peers and will carry an overall weighting of 60%. The allocation of marks related to peer versus instructor assessment will be set at ratio of 2:1 (i.e. 66% based on instructor assessment, 33% based on peer group assessment).

Student engagement will be encouraged through interaction with the course tutors and peer discussions on key physiological systems, their functions and interactions between them. Directed group learning and peer group dissemination/assessment will be employed. Tutorials aim to facilitate learning, and instant feedback will be provided to groups.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

Class Tests			Coursework		Project	
Number	Duration	Weighting	Number	Weighting	Number	Weighting
1	90mins	40%	4	60%		
All			LO3, LO4			

Indicate which learning outcomes (L01, L02 etc.) are to be assessed by exam/coursework/project as required.

Coursework / Submissions deadlines:

4 sets of group presentations equally spaced during teaching weeks of semester 1.

1 individual poster presentation to be submitted at the end of semester 1.

Resit Examination Procedures:

Redo final poster assessment and complete one additional individual post assignment on one topic from course.

PLEASE NOTE:
Students need to gain a summative mark of 40% *(please delete as appropriate)* to pass the module. Students who fail the module at the first attempt will be re-examined during the August diet. This re-examination will consist entirely of exam/coursework/viva *(please delete as appropriate).*

Recommended Reading:

Fundamentals of Anatomy and Physiology; 8th Edition, Frederic H Martini & Judi L Nith. Pearson International Edition ISBN-10: 0321545982

Additional guidance on recommended reading material will be provided throughout the course.

Additional Student Feedback:

(Please specify details of when additional feedback will be provided)

MODULE DESCRIPTION FORM

BE302 Practical Biomechanics

Module Registrar: Dr Philip Riches				**Taught To:** BEng/MEng Biomedical Engineering		
Other Lecturers Involved: Dr Andrew Kerr and Dr Craig Childs				**Credit Weighting:** 20		**Semester:** 2
Compulsory/optional/elective class: Compulsory				**Academic Level:** SCQF9		
Prerequisites: BE200 or equivalent						
Module Format and Delivery (hours):						
Lecture	Tutorial	Laboratory	Project	Assignments	Private Study	Total
20		24			156	200

Educational Aim

This module aims to develop knowledge, understanding, and practical experience of kinematic and kinetic analysis of human movement.

Learning Outcomes

On completion of the module the student is expected to be able to:

LO1 describe and implement appropriate experimental techniques for the analysis of human movement

LO2 understand the process of inverse dynamics in 2D and 3D and be able to calculate and analyse ankle, knee and hip joint forces

LO3 ability to comparatively compare biomechanical data to interpret non-normal gait deviations

(UK SPEC suggests no more than 4 learning outcomes per module. Statements must be broad and be syllabus free and link in with the intended learning outcomes on the programme specifications.)

Syllabus

The module will teach the following:
Planar (2D) kinematics

Planar (2D) inverse dynamics

2D and 3D motion analysis concepts and requirements

Computer-based analysis of 2D and 3D motion analysis data

Interpretation of kinematic and kinetic data in health/injury/pathology

Assessment of Learning Outcomes

Criteria
For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

[Note: Criteria break the LO down into 'teachable' elements but do not become syllabus orientated i.e. no mention of CAD package names, components etc.]

LO1 describe and implement appropriate experimental techniques for the analysis of human movement
C1 knowledge and understanding of appropriate marker sets for human movement analysis
C2 Understanding of the experimental steps (e.g. calibration etc.) for human movement analysis

LO2 understand the process of inverse dynamics in 2D and 3D and be able to calculate and analyse ankle, knee and hip joint forces.
C1 derive equations to determine planar joint forces and moments from experimental data
C2 write appropriate software to implement these equations and graphically represent the analysis outcome

LO3 ability to comparatively compare biomechanical data to interpret non-normal gait deviations
C1 detail normal kinematics and kinetics of gait
C2 identify common deviations of non-normality and relate to injury or pathology

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

Principles of Assessment and Feedback

The University's Assessment and Feedback Policy can be found at: www.strath.ac.uk/staff/policies/academic/

Specific details relating to this class are as follows:

We will assess "good" reports and "bad" reports to ascertain the assessment requirements of a lab report, providing concrete examples of the level expected. This allied with quality, appropriately timed feedback will ensure student success and satisfaction.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

Examination			Coursework		Project	
Number	Duration	Weighting	Number	Weighting	Number	Weighting
1	2	50%	3	50%		
LO1-3			LO1-3			

Indicate which learning outcomes (L01, L02 etc) are to be assessed by exam/coursework/project as required.

Coursework / Submissions deadlines:

Semester 2: Week 5
Semester 2: Week 9
Semester 2: Week 12

Resit Examination Procedures:

Exam only

PLEASE NOTE:
Students need to gain a summative mark of 40% to pass the module. Students who fail the module at the first attempt will be re-examined during the August diet. This re-examination will consist entirely of coursework.

Recommended Reading:

Principles of biomechanics and motion analysis, Griffiths IW (2006) Lippincott Williams and Williams
Robertson D Gordon, Research Methods in Biomechanics (2004) Human Kinetics

Additional Student Feedback:

(Please specify details of when additional feedback will be provided)

MODULE DESCRIPTION FORM

BE305 Cell Biology 3

Module Registrar: Dr Michelle Maclean	**Taught To:** BEng/MEng Biomedical Engineering	
Other Lecturers Involved:	**Credit Weighting:** 10	**Semester:** 1
Compulsory/optional/elective class: Compulsory	**Academic Level:** 3	
Prerequisites: BE105 Cell Biology 1 and BE210 Cell Biology 2		

Module Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Project	Assignments	Private Study	Total
20		6	10	5	59	100

Educational Aim

This module aims to

1. Provide students with an understanding of the human haematological system and the roles of key blood cells in wound healing and the immune system;
2. Familiarise students with the fundamentals of the human immune system and its key role in preventing and fighting infection;
3. Introduce students to the different types of microorganisms which can cause infection, and how they can evade the human immune system.

Learning Outcomes

On completion of the module the student is expected to be able to:

LO1: Discuss the function of the human haematological system, including the roles of key blood cell types, and their role in blood typing, blood clotting, and immunological protection.

LO2: Describe the main components and cell types involved in the human innate and acquired immune system, and understand the roles that these play in mediating immune responses to microbial infection and autoimmune disease.

LO3: Describe the structure and function of the different types of microbial cells, and discuss the roles they play in human health and disease.

Syllabus

The module will teach the following:

Human Haematological System

- *Blood cells and their functions;*
- *Blood transfusions and blood typing;*
- *Blood clotting*

Immunology

- *Cell types and lymphokines involved in immune reactions;*
- *Innate and Acquired immunity*
- *Innate defences and the complement system;*
- *T cells and regulation of the immune system;*
- *Antibodies and B cells;*
- *Autoimmune disorders and diseases*

Microbial Infection

- *Microbial structure & function;*
- *Pathogenic bacteria, viruses and parasites;*
- *Biofilm formation and microbiological complications in bioengineering*

Assessment of Learning Outcomes

Criteria

For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

LO1: ***Discuss the function of the human haematological system.***
C1 Describe the function of blood and the key cellular and non-cellular components, indicating their roles. cell types, and their role in blood typing, blood clotting and wound healing.
C2 Discuss the processes involved in blood typing and transfusion-related reactions.
C3 Explain the role of the blood in clotting and wound healing.

LO2: ***Describe the main components and cell types involved in the human immune system*.**
C1 Describe the major components of the lymphatic system, and the cell types and lymphokines involved in immune reactions.
C2 Explain the role of the physical and cellular innate defences, including the complement system.
C3 Explain the roles of humoral and cellular immunity, and the involvement of T cells, B cells and antibodies.
C4 Describe disorders of the immune system (autoimmune disorders, immunodeficiency diseases)

LO3: ***Describe the structure and function of different microorganisms and the roles they play in human health and disease.***
C1 Describe the structure and function of bacteria, viruses and other microorganisms
C2 Discuss mechanisms by which pathogenic bacteria, viruses and parasites can initiate infection within a host.
C3 Explain the process and implications of biofilm formation, and problems this can cause for medical devices.

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

Principles of Assessment and Feedback

The University's Assessment and Feedback Policy can be found at: www.strath.ac.uk/staff/policies/academic/
Please state briefly how these are incorporated in this module.

- Clear instructions will be given to students about assessment requirements and expectation through lectures/labs, and through notifications and information provided using MyPlace, the University's Virtual Learning Environment
- MyPlace tools will also be used to assess outcomes and promote interaction between individual students and their tutors, and to tailor feedback on performance to individual students. Likewise student feedback will be sought to improve both content and delivery of the course.
- Interaction and dialogue around learning will be encouraged during lectures and interactive laboratory sessions.

This module ensures that summative assessment has a positive impact on formative learning by providing students with practice revision questions so that they have an opportunity to experience what is required by summative assessment in a safe environment. For example, students will work on tasks similar to the final assessment for which feedback will be provided (e.g. practice MCQs and short answer questions). Students will then have a clear understanding of what is required and have had practice in the task.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

Examination			Coursework		Project	
Number	Duration	Weighting	Number	Weighting	Number	Weighting
1	1.5-hr	60%	Lab Report	25%	Group Project (poster)	15%
LO1 – LO3			LO3		LO1 - LO3	

Indicate which learning outcomes (L01, L02 etc) are to be assessed by exam/coursework/project as required.

Coursework / Submissions deadlines:
Students will submit an assignment (lab report) in Week 8, Semester 1.
Students will submit a group project activity (poster) in week 11.

All submission dates/deadlines will be conveyed to the class during lectures/labs and via MyPlace

Resit Examination Procedures:

Resubmission/resit of failed elements(s)

Recommended Reading:

Access to comprehensive lecture slides, notes and electronic resources will be provided on MyPlace. Students wishing to carry out additional reading to supplement their learning may wish to consult some of the following texts:

- ***Fundamentals of Anatomy & Physiology***. Martini, Nath, Bartholomew. (Pearson Education Limited). *[Full text available online via University Library]*
- ***Molecular Biology of the Cell.*** Alberts, Johnson, Lewis, Raff, Roberts, & Walter. (New York: Garland Science). [*Available to loan from the University library*]
- **Biology.** Campbell & Reece. (Benjamin Cummings; London: Pearson Education). [*Available to loan from the University library*]

Additional Student Feedback:
(Please specify details of when additional feedback will be provided)

Feedback on activities will be provided regularly throughout the module, through scheduled on campus sessions, and posted on MyPlace) – details of these will be announced via MyPlace. Feedback on the assignment and the group lab reports will be provided within 3 weeks of submission deadline.

MODULE DESCRIPTION FORM

DEPARTMENT OF BIOMEDICAL ENGINEERING
BE306 BIOMEDICAL ENGINEERING

Module Registrar: Helen Mulvana	**Taught To (Course):** BEng / MEng Biomedical Engineering cohorts for whom class is compulsory		
Other Lecturers Involved:	**Credit Weighting:** 10	**Semester:** S1	
Assumed Prerequisites: none	**Compulsory**	**Academic Level:** 3	**Suitable for Exchange:** Y

Module Format and Delivery (HOURS i.e. 1 credit = 10hrs of study):

Lecture	Tutorial	Laboratory	Groupwork	External	Online	Project	Assignments	Private Study	**Total**
16	6		12					66	100

Educational Aim

This module aims to equip biomedical engineering students with a detailed understanding of diagnostic imaging, how images are created, what they represent. Students will develop an understanding of the applications of imaging in medical diagnostics, treatment monitoring and surgical guidance, with a particular focus on applications using ultrasound.

Learning Outcomes

On completion of the module the student is expected to be able to

LO1 Appraise the main imaging modalities currently used in diagnostic medicine, their applications and limitations

LO2 Interpret and describe the technical and physical principles of ultrasound imaging, what is being imaged and how the information is applied in diagnostic medicine

LO3 Identify and assess the physical principles and potential future applications or emerging science in diagnostic ultrasound imaging

LO4 Evaluate the current limitations in ultrasound imaging and therefore an appreciation of fit in the clinical diagnostic pathway.

Syllabus

The module will teach the following:
The understanding of medical diagnostic imaging and its role in medicine and the modalities routinely used. This will include basic principles of decision-making criteria applied in clinical practice when selecting an appropriate medical imaging modality for a particular task. Following this, the physical principles of the main imaging modalities used in diagnostic practice (to include surgical guidance, treatment monitoring, etc) – X-ray & CT (radiography), MRI, Nuclear medicine, Ultrasound will be delivered including how each are used, their limitations and future prospects. The module will then focus on the technical knowledge of way that ultrasound images are generated, and the physical principles that underpin the generation of ultrasound images and therefore what they depict based on the interaction of sound waves with tissue; this will cover B-mode, Doppler, elastography, harmonic, contrast enhanced imaging. The concepts of image processing used to enhance the ultrasound image and customisation to diagnostic challenge will be also introduced. Importantly, the understanding of safety, to include knowledge of high intensity (therapeutic) applications of ultrasound.
The module will then provide a working knowledge of the advances being made in ultrasound imaging improve function, e.g. plane wave imaging, multimodal (MRgFUS), super resolution – how they work, what they offer before

finishing with an appreciation of the opportunities and challenges that remain in diagnostic ultrasound imaging and how researchers are working to solve these (if applicable).

Assessment of Learning Outcomes

Criteria

For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

LO1
C1 Be able to describe the physical principles of each of the dominant diagnostic imaging modalities: X-Ray CT, MR, nuclear medicine, ultrasound
C2 Be able to appraise the suitability of a modality for a specific imaging need.

LO2
C3 Demonstrate an in depth and technical understanding of the physical principles of ultrasound imaging
C4 Be able to describe how the interaction of an ultrasound wave and the resulting backscattered signal is used to generate a clinical useful image
C5 Demonstrate an understanding of the applications where ultrasound imaging can offer diagnostically relevant information

LO3
C6 research and present (group) a scientific overview of the cutting-edge advances being made in ultrasound imaging
C7 Appraise the merits, challenges and opportunities presented by such cutting-edge ultrasound imaging advances

LO4
C8 Discuss where ultrasound imaging sits in the clinical diagnostic pathway, and evaluate when other imaging modalities or interventions may be required or can be used in complement

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

Principles of Assessment and Feedback
(within Assessment and Feedback Policy at: https://www.strath.ac.uk/staff/policies/academic/)

Please state briefly how these are incorporated in this module.

Students should have a strong understanding of the need, application and limitation of diagnostic imaging in the treatment pathway.
Ultrasound imaging, providing the focus of this course due to its ubiquitous nature throughout medicine, will allow students to develop an in-depth understanding of one modality, but also serve as a working example from which parallels to other imaging modalities may be drawn.
The main form of assessment will be a formal exam (70%), supported by a groupwork assignment which will be used to assess student ability to effectively communicate their technical understanding and reasoning, critical analysis and discussion and communication back to their peers.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

	Examinations				Courseworks		Projects	
	Number	Month(s)	Duration	***Weighting***	Number	***Weighting***	Number	***Weighting***
	1		2 hrs	70%	1	30%		
L/Outcomes	LO1-4				LO3			

Indicate which learning outcomes (L01, L02 etc) are to be assessed by exam/coursework/project as required.

Coursework / Submissions deadlines (*academic weeks*):
Group work will take place in weeks 5-7, presentations in week 8
Resit Assessment Procedures: 2-hr examination in August.

PLEASE NOTE:
Students must gain a summative mark of 40% to pass the module. Students who fail the module at the first attempt will be re-examined during the August diet. This re-examination will consist entirely of exam. No marks from any previous attempts will be transferred to a new re-sit attempt.

Recommended Reading

Journal-based literature will form a significant component to the class which will be student-generated during their own group research.

Additional Student Feedback
(Please specify details of when additional feedback will be provided)

Date	Time	Room No

Session:

Approved:

Course Director Signature: Craig Childs
Date of Last Modifications: 8/2/23

FACULTY OF ENGINEERING
MODULE DESCRIPTION FORM

EE312 - INSTRUMENTATION AND MICROCONTROLLERS

Module Code: EE312	**Module Title:** Instrumentation and Microcontrollers	
Module Registrar: M. Zagnoni		
Other Lecturers Involved: G. Dobie, C. MacLeod	**Credit Weighting** 20	**Semester:** 1 2
Compulsory/optional/elective class: C	**Academic Level:** 3	

Pre-requisites:

MODULE FORMAT AND DELIVERY (HOURS):

Lectures	Tutorial	Assignments	Laboratories	Private Study	Total
34	34	44	0	88	200

EDUCATIONAL AIM *THIS MODULE AIMS TO:*

INSTRUMENTATION

Aims

To introduce students to instrumentation and measurement as an interdisciplinary engineering activity.

To develop theoretical and practical understading of techniques for system modelling based on block diagrams and transfer functions and to use such techniques in the context of analysis and design of sensor systems and networks. To explain the basic principles of feedback, control systems and electronic instrumentation for measurement applications.

Context

To enable understanding of the dependence of measurement and control on a wide variety of scientific and engineering disciplines; to provide appreciation of the universal application of measurement and control within the same range of disciplines.

To demonstrate engineering design as applied to instrumentation systems and control engineering; in particular, to explain the important contribution of electrical, mechanical and software engineering to this process.

MICROCONTROLLERS

To allow students to gain practical design, implementation and test experience of the techniques required to create combined hardware/software systems using microcontrollers with an emphasis on measurement.

LEARNING OUTCOMES *ON COMPLETION OF THE MODULE, THE STUDENT IS EXPECTED TO BE ABLE TO;*

LO 1: Understand basic concepts of measurement systems (input output behaviour, linearity, offsets, noise) applied to analog and digital components of instrumentation systems.

LO 2: Understand the concept and importance of feedback, particularly for control systems.

LO 3: Recognise the importance of physical constraints on measurement processes; understand physical constraints of transducer selection for specific applications.

LO 4: Learn to use microprocessors, analyse specifications, consider trade-offs, generate designs, acquire competence in interfacing to peripheral sensors and actuation devices.

(UK SPEC suggests no more than 4 learning outcomes per module. Statements must be broad and be syllabus free and link in with the intended learning outcomes on the programme specifications.)

SYLLABUS *THE MODULE WILL TEACH THE FOLLOWING:*

INSTRUMENTATION

Systematic procedures are developed to model behaviour of engineering systems, with particular reference to those employed for measurement and control. Initial treatment concentrates on the principles and limitations of transducers which convert the measurand of interest (a physical or mechanical quantity) into a useful analogue signal (usually electrical). A wide variety of specific instrumentation systems are discussed including those for the measurement of liquid level, displacement, strain and temperature. Static and dynamic behaviour, measurement errors, electronic signal processing and feedback systems are considered as general topics relevant to all applications. There are extended case studies spanning a variety of engineering disciplines (mechanical, electronic, bioengineering and industry related) delivered throughout the course. Electrical bridge circuits are considered as an example of signal conditioning which can compensate for environmental influences such as temperature. Feedback is explored as a technique for both design of electronic circuits and control of engineering processes. Opamp theory, both in time and frequency domain, instrumentation amplifiers and lock-in amplifiers opeartion are described and their use related to engineering applications.

MICROCONTROLLERS

Overview of the product design cycle for dedicated systems. Development of a system specification, using illustrative case studies. Practical C language based tutorial sessions on microcontroller programming. Details on programming structure and implementation of hardware based operations on platform. Overview and design detail of the electronic building blocks. Overview and design detail to allow interfacing to sensors and motors.

ASSESSMENT OF LEARNING OUTCOMES - CRITERIA

For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

[Note: Criteria break the LO down into 'teachable' elements but do not become syllabus orientated i.e. no mention of CAD package names, components etc.]

LO1

C 1: Ability to understand the practical constraints of a generalised measurement system, tested during class test and final examination

LO2

C 1: Demonstate understanding of simple feedback systems, tested at final examination

LO3

C 1: Practical understanding of constraints on a real measurement problem tested at final examination.

LO4

C 1: Demonstrate basic programming of microcontroller systems and subsystems, tested through quizzes and final examination

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

12 PRINCIPLES OF ASSESSMENT FEEDBACK

Please state briefly how these are incorporated in this module.

Feedback to students is through a combination of formal tutorials (in person or online), online resource through MyPlace, and continuous assessment of coursework. Some non-assessed work is provided in S1 and S2 to promote course engagement - feedback is provided through MyPlace and tutorials.

The module is assessed by examination and coursework. The microcontroller coursework is carried out as a series of virtual laboratory sessions where the students are mentored by members of staff. Feedback on what students do and how they could improve their designs and efficiency is given during these sessions. It is an interactive approach. Three quizzes on C programming and microcontroller operations take place in S1 that are graded to assess performance. A class test in week7 of S2 provides a structured exam condition test that is part of the formal assessment process. Additionally, this class test is treated fully in subsequent tutorials so that students gain feedback on formal examination style questions.

Final examination in May includes aspects of taught materials from both semesters.

(on Learning & Teaching web pages: *www.strath.ac.uk/learnteach/teaching/staff/assessfeedback/12principles/*)

ASSESSMENT METHOD(S) INCLUDING PERCENTAGE BREAKDOWN AND DURATION OF EXAMS

To Pass the module, students need to gain a summative mark of;					40%	
Examination	Duration	2h	Weighting %	75	Learning Outcomes	1,2,3,4
Coursework	Number	4	Weighting %	25	Learning Outcomes	1,2,3,4
Project	Number		Weighting %		Learning Outcomes	

COURSEWORK / SUBMISSIONS DEADLINES:

C programming and microcontroller Quiz (week 5, 8, 10, S1)

Class Test (week 7, S2)

RESIT ASSESSMENT PROCEDURES: Submission of reworking of 1st diet examination

ADDITIONAL INFORMATION RELEVANT TO COURSE DELIVERY AND ASSESSMENT

None

RECOMMENDED READING

1) Bentley J P, Principles of measurement systems, Pearson (4th edition, 2005), ISBN-10: 0-13-043028-5

2) John H. Davies, MSP430 Microcontroller Add to dictionary; 2 edition (10 Oct. 2008), ISBN-10: 0750682760, ISBN-13: 978-0750682763

Supplementary Books

- Horowitz P, Hill W, The Art of Electronics, Cambridge University Press (2nd Edition 1989), ISBN-10: 0521370957
- Valvano J.W, Embedded Microcomputer Systems – Real Time Interfacing, Cengage Learning/Global Engineering, 3rd Edition 2012, ISBN10: 1-111-42626-0
- Transducer Interfacing Handbook, Editor: Daniel H Sheingold, Analog Devices Inc. 1980. ISBN 0-916550-05-2
- Kernighan BW and Ritchie DM, The C programming Language, Prentice-Hall 1988, ISBN 0-13-110362-8
- Stuart R. Ball Embedded Microprocessor Systems, Newnes 2002 (3rd Ed), ISBN 0 7506 7534 9
- Steve Heath Embedded Systems Design, Newnes 2002 (2nd Ed), ISBN 0 7506 5546 1

ADDITIONAL STUDENT FEEDBACK; SPECIFY DETAILS OF WHEN ADDITIONAL FEEDBACK WILL BE PROVIDED.

Semester	S1	Week	5	Nature	Feedback from coursework
Semester	S1	Week	8	Nature	Feedback from coursework
Semester	S1	Week	10	Nature	Feedback from coursework
Semester	S2	Week	8	Nature	Feedback from class test
Semester	S2	Week	11	Nature	Feedback from coursework
Semester		Week		Nature	
Further comments about feedback					

SIGNATURE (MODULE REGISTRAR):

DATE OF LAST MODIFICATIONS: 16/09/2020

Year 4

The following pages contain class descriptors for the different classes in year 1. Since different departments teach different classes, the class descriptors may differ slightly in format.

MODULE DESCRIPTION FORM

BE401 Biomedical Electronics

Module Registrar: Dr Mario Ettore Giardini	**Taught To:** BEng/MEng Biomedical Engineering	
Other Lecturers Involved: none	**Credit Weighting:** 10	**Semester:** 1
Compulsory/optional/elective class: Compulsory	**Academic Level:** SCQF10	

Prerequisites:

Module Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Project	Assignments	Private Study	Total
22	6	5		26	41	100

Educational Aim

This module aims to give the student a thorough introduction to the use of electronic circuits for the pre-conditioning, acquisition and display of biomedical signals and to provide an understanding of the components required in a basic biomedical measurement device.

Learning Outcomes

On completion of the module the student is expected to be able to:

LO1 understand the basis of biomedical signals that might be monitored by an electronic device or system

LO2 recognise the basic mathematical models for such systems

LO3 understand the important electronic components in a modern biomedical measurement system

LO4 be able to specify a basic biomedical measurement system

(UK SPEC suggests no more than 4 learning outcomes per module. Statements must be broad and be syllabus free and link in with the intended learning outcomes on the programme specifications.)

Syllabus

The module will teach the following:
Specification of biomedical sensors and instrumentation. Sensor/transducer characteristics and mathematical models. Effects of the conditioning circuit on biomedical measurement. Noise and errors.
Introduction to operational amplifiers. Theory of positive and negative feedback around amplifiers.
Signal preconditioning. Instrumentation amplifier. Differential voltage amplification with frequency limits.
A/D conversion. Specifications, sampling, aliasing,
Use of microcontrollers in Biomedical Engineering.
Individual project specifying a biomedical device for signal monitoring.

Assessment of Learning Outcomes

Criteria
For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

[Note: Criteria break the LO down into 'teachable' elements but do not become syllabus orientated i.e. no mention of CAD package names, components etc.]

LO1 understand the basis of biomedical signals that might be monitored by an electronic device or system
C1 describe the physiological processes that generate biomedical signals and the mathematical or electrical characteristics of such signals
C2 explain how various sensors pick up the biomedical signals and convert them to a useful electronic signal within the measurement device

LO2 recognise the basic mathematical models for such systems
C1 Write down and analyse the mathematical equations for the components of biomedical electronics circuits
C2 apply the appropriate equations to solve Biomedical Engineering-oriented problems

LO3 understand the important electronic components in a modern biomedical measurement system
C1 for a given biomedical measurement system, describe the electronic components involved
C2 for a given biomedical measurement system, explain the purpose and the operation of the electronic components involved

LO4 be able to specify a basic biomedical measurement system
C1 demonstrate a holistic view of biomedical measurement systems
C2 predict and select the necessary components of a biomedical measurement system for a specific hitherto unseen application

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

Principles of Assessment and Feedback

The University's Assessment and Feedback Policy can be found at: www.strath.ac.uk/staff/policies/academic/

Specific details relating to this class are as follows:

Discussions around lecture topics, at tutorials and during the individual project work are used to assess student feedback on the course and also to guide students in their own work. A written individual report from each student is marked and there is a separate lab report to be written by each student as part of their assessment. A closed book exam completes the assessment.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

Examination			Coursework		Project	
Number	Duration	Weighting	Number	Weighting	Number	Weighting
1	2 hours	70%	1	30%		
LO1-LO4			LO2, LO3			

Indicate which learning outcomes (L01, L02 etc) are to be assessed by exam/coursework/project as required.

Coursework / Submissions deadlines:

Midway through the academic session

Resit Examination Procedures:

One 2-hour examination at the August diet.

PLEASE NOTE:
Students need to gain a summative mark of 40% to pass the module. Students who fail the module at the first attempt will be re-examined during the August diet. This re-examination will consist entirely of a closed-book exam.

Recommended Reading:

Reading material will be supplied as part of the module.

Additional Student Feedback:

(Please specify details of when additional feedback will be provided)

MODULE DESCRIPTION FORM

BE404 Biomedical Instrumentation

Module Registrar: Dr David Li	**Taught To:** BEng/MEng Biomedical Engineering	
Other Lecturers Involved: Some lectures will be delivered as invited seminars	**Credit Weighting:** 10	**Semester:** 1
Compulsory/optional/elective class: Compulsory	**Academic Level:** SCQF10	
Prerequisites:		

Module Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Project	Assignments	Private Study	Total
28				22	50	100

Educational Aim

This module aims to
Give a detailed description of the principles and applications of a number of the most widely used biomedical instrumentation systems and devices found in the modern hospital environment. This course will enable students to understand the diagnostic and research applications of the various instrumentation-related techniques currently available and to appreciate their limitations.

Learning Outcomes

On completion of the module the student is expected to be able to:

LO1 Describe the function and makeup of basic transducer and biosensor systems.

LO2 Understand the principles underlying basic physiological monitoring techniques and technologies.

LO3 Demonstrate knowledge of imaging technologies from a theoretical and practical standpoint: ultrasound imaging, scanning and nuclear imaging including CT, MRI and PET.

LO4 Understand the recent evolutions in digital and mobile health.

(UK SPEC suggests no more than 4 learning outcomes per module. Statements must be broad and be syllabus free and link in with the intended learning outcomes on the programme specifications.)

Syllabus

The module will teach the following:

- Basic transducers, electrodes, biosensors and their applications
- CT scanning and nuclear imaging
- Medical ultrasound and blood flow measurement
- Modern radiotherapy and associated instrumentation
- Cardiology instrumentation
- Digital and mobile health applications

Assessment of Learning Outcomes

Criteria
For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning: [Note: Criteria break the LO down into 'teachable' elements but do not become syllabus orientated i.e. no mention of CAD package names, components etc.]

LO1 Describe the function and makeup of basic transducer and biosensor systems.
C1 Understand the principles of the signal sensing chain.
C2 Describe resistance, capacitance, inductive and piezoelectric transducers.
C3 Understand the electrode theory, the Nernst equation and the Ag-AgCl electrode.

LO2 Understand the principles underlying basic physiological monitoring techniques and technologies.
C1 Understand basic concepts of biosignals and noise.
C2 Describe the basic function of the ECG machine.
C3 Understand the source and diagnostic importance of different ECG leads.

LO3 Demonstrate knowledge of imaging technologies from a theoretical and practical standpoint: ultrasound imaging, scanning and nuclear imaging including CT, MRI and PET.
C1 Understand the use of radio-isotopes in cancer care, including safety issues involved in radiotherapy.

C2 Describe the importance of the “care plan” in patients undergoing radiotherapy.
C3 Describe the properties and technologies of ultrasound as a diagnostic and blood flow measurement tool.

LO4 Understand the recent evolutions in digital and mobile health.
C1 Describe the remit and scope of digital and mobile healthcare technology.
C2 Describe recent advances in digital and mobile healthcare.
C3 Understand limitations and barriers to introduction of digital and mobile healthcare technologies.

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

Principles of Assessment and Feedback

The University’s Assessment and Feedback Policy can be found at: www.strath.ac.uk/staff/policies/academic/

Specific details relating to this class are as follows:

Student feedback will be obtained through interaction during tutorial sessions associated with the coursework. Examination will be by closed book examination, but further assessment will be undertaken through assessment of assignments and reports.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

Examination			Coursework		Project	
Number	Duration	Weighting	Number	Weighting	Number	Weighting
1		70%	1	30%		
LO1-LO4			LO1-LO4			

Indicate which learning outcomes (L01, L02 etc) are to be assessed by exam/coursework/project as required.

Coursework / Submissions deadlines:

Coursework submission will be midway in the 6 week module.

Resit Examination Procedures:

One 2 hour examination at the August diet.

PLEASE NOTE:
Students need to gain a summative mark of 40% to pass the module. Students who fail the module at the first attempt will be re-examined during the August diet.

Recommended Reading:

None –reading material will be supplied as part of the module.

Additional Student Feedback:

(Please specify details of when additional feedback will be provided)

A feedback session will be organised between registrar and students at the end of the course.

MODULE DESCRIPTION FORM

BE405 Sports Injury and Rehabilitation

Module Registrar: Dr Lauren Forsyth	**Taught To:** BEng/MEng Sports Engineering BA Sport and Physical Activity	
Other Lecturers Involved: Guest Lecturers	**Credit Weighting:** 20	**Semester:** 2
Compulsory/optional/elective class:	**Academic Level:** 4	
Prerequisites: 65201, 65202, 65303		

Module Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Project	Assignments	Private Study	Total
20	10		20		150	200

Educational Aim

This module aims to provide students with an understanding of the injury mechanisms of the different tissues of the body, an ability to assess protective equipment, and be able to evaluate current rehabilitation practice.

Learning Outcomes

On completion of the module the student is expected to be able to:

LO1 qualitatively describe the response of musculoskeletal tissues to different loading regimens

LO2 describe the injury mechanisms of different body tissues

LO3 appraise the effect of protective equipment on injury prevention

LO4 describe rehabilitation protocols associated with sports injury

(UK SPEC suggests no more than 4 learning outcomes per module. Statements must be broad and be syllabus free and link in with the intended learning outcomes on the programme specifications.)

Syllabus

Tissue structure and mechanics
Bone, ligament, tendons, muscles

Injuries to musculoskeletal tissues
Bone, ligaments, tendons, muscles

Injuries to the upper limbs

Injuries to the lower limbs

Injuries to the ankle and foot

Injuries to the head and trunk

Rehabilitation of musculoskeletal injuries

Protective equipment
Helmets, taping, shin guards etc.

Assessment of Learning Outcomes

Criteria
For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning
[Note: Criteria break the LO down into 'teachable' elements but do not become syllabus orientated i.e. no mention of CAD package names, components etc.]

LO1 qualitatively describe the response of musculoskeletal tissues to different loading regimens
C1 describe the detailed anatomy of body tissues
C2 discuss the structure-function relationship of body tissue
C3 qualitatively describe the mechanical behaviour of body tissue to physiological loading

LO2 describe the injury mechanisms of different body tissues
C1 discuss the effect of over-loading on body tissue

LO3 appraise the effect of protective equipment on injury prevention
C1 use literature evidence to assess the effectiveness of sports protection equipment
C2 be able to design and conduct an experiment to assess the effectiveness of equipment

LO4 describe rehabilitation protocols associated with sports injury
C1 understand the physiological basis for rehabilitation protocols

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

Principles of Assessment and Feedback

The University's Assessment and Feedback Policy can be found at: www.strath.ac.uk/staff/policies/academic/

Please state briefly how these are incorporated in this module.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

Examination			Coursework		Oral Presentation	
Number	Duration	Weighting	Number	Weighting	Number	Weighting
			1	5-%	1	50%
			LO1-LO4		LO2-LO3	

Indicate which learning outcomes (L01, L02 etc) are to be assessed by exam/coursework/project as required.

Coursework / Submissions deadlines:

Coursework will consist of a 1500-word essay detailing a special a population at higher risk of a sports injury from participation in a specific sport and then describing changes (e.g. rules and use of protective equipment) to ameliorate risk. Submission will be during the May exam period.

The oral examination will consist of a group activity with students providing the evidence for a specific piece of sports protective equipment and then either provision a proposal for more robust testing or a reasoned argument for design changes. The oral presentation will occur in weeks 5/6 and will include submission of an 800-word individual report (25% weighting).

Resit Examination Procedures:

PLEASE NOTE:
Students need to gain a summative mark of 40% to pass the module. Students who fail the module at the first attempt will be re-examined during the August diet. This re-examination will consist entirely of coursework.

Recommended Reading:

Sports injury assessment and rehabilitation, David C. Reid, New York : Churchill Livingstone 1992
Sports injury : prevention & rehabilitation., Eric Shamus Jennifer Shamus, New York : McGraw-Hill 2001
Biomechanics of the musculo-skeletal system, Nigg, Herzog 2nd ed. Chichester ; New York : Wiley c1999
Sports Biomechanics; Reducing Injury risk and Improving Performance Roger Bartlett and Melanie Bussey, 2nd Ed. Routledge. 2011
An introduction to human movement and biomechanics (2019), Kerr & Rowe. Elsevier, ISBN-10 - 0702062367*
Essentials of Anatomy and Physiology Scanlon and Sanders,, F A Davis Company., 2011*
*electronic books available from Library

Additional Student Feedback:

(Please specify details of when additional feedback will be provided)

Feedback will be provided to students after the oral exam (week 7)
Feedback on coursework will be posted on myplace after the May exam period.

MODULE DESCRIPTION FORM

BE406 Biomedical Engineering Project

Module Registrar: Dr Mario E Giardini	**Taught To:** BEng/MEng Biomedical Engineering	
Other Lecturers Involved: All BME Staff	**Credit Weighting:** 40	**Semester:** 1&2
Compulsory/optional/elective class: Compulsory	**Academic Level:** SCQF10	

Prerequisites: None

Module Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Project	Assignments	Private Study	Total
			400			400

Educational Aim

This module aims to provide an opportunity for students to experience the challenges and rewards of sustained, independent study in a topic of their own choice in the general field of Biomedical Engineering. It will involve students in a number of processes which include justification of the selected topic; selecting, devising and applying appropriate methods and techniques; anticipating and solving problems which arise; displaying knowledge of background literature; and evaluating and reporting the conclusions of the study. The project may take the form of an extended literature review or involve experimental work. This project work will have been supported by a compulsory research methods module and specialist knowledge classes throughout the year designed to assist with technical aspects of methodology and analysis.

Learning Outcomes

On completion of the module the student is expected to be able to:

LO1 demonstrate a critical understanding of the principal theories, principles and concepts of their chosen topic field

LO2 show autonomy in planning and executing a significant project of research, investigation or development

LO3 apply critical analysis, evaluation and interpretation to their own experimental data and/or that of other published work

LO4 effectively communicate with peers, more senior colleagues and specialists in their chosen field

(UK SPEC suggests no more than 4 learning outcomes per module. Statements must be broad and be syllabus free and link in with the intended learning outcomes on the programme specifications.)

Syllabus

The module will teach the following:

There is no formal syllabus to this module. Supervisors will guide students through an appropriate research process.

Assessment of Learning Outcomes

Criteria
For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

[Note: Criteria break the LO down into 'teachable' elements but do not become syllabus orientated i.e. no mention of CAD package names, components etc.]

LO1 demonstrate a critical understanding of the principal theories, principles and concepts of their chosen topic field.
C1 describe the appropriate theoretical background for their project, including any underlying assumptions.
C2 describe alternative theories/methodologies where appropriate and discuss the differences between approaches.
C3 provide a fully-informed justifiable rationale for their research.

LO2 show autonomy in planning and executing a significant project of research, investigation or development
C1 develop an appropriate methodology to examine the research question.
C2 execute the developed methodology.
C3 critically appraise the execution of the methodology.

LO3 Apply critical analysis, evaluation and interpretation to their own experimental data and/or that of other published work.

C1 handle, present and discuss numerical data in an accurate and appropriate manner.
C2 discuss their analysis in the light of the theoretical framework.

LO4 effectively communicate specialist knowledge in their chosen field to technically adept non-specialists.
C1 use a good standard of technical English.
C2 explain complex concepts with clarity of expression.

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

Principles of Assessment and Feedback

The University's Assessment and Feedback Policy can be found at: www.strath.ac.uk/staff/policies/academic/

Specific details relating to this class are as follows:

Regular student-supervisor meetings will deliver regular high quality feedback on progress (2) providing ample opportunity for students to understand and to attain the expected level of achievement (3). Students will be working within a project area of their choice (8) maintaining motivation and interest in their work. Whilst independent, a healthy research community within the Department of Biomedical Engineering provides a motivational learning environment (10) with peer-peer encouragement and support in addition to that from the supervisor.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

Examination			Coursework		Project	
Number	Duration	Weighting	Number	Weighting	Number	Weighting
			1	30% (poster)	1	70%
			LO1-LO4		LO1-LO4	

Indicate which learning outcomes (L01, L02 etc) are to be assessed by exam/coursework/project as required.

Coursework / Submissions deadlines:

A poster presentation is required at the end of semester 2. Students will have staff discuss their work with them, and staff will agree a mark for each student.

Resit Examination Procedures:

Students who fail to provide a satisfactory project report at the first attempt will have one further attempt to submit a satisfactory report. Submission will be prior to the August exam diet.

PLEASE NOTE:
Students need to gain a summative mark of 40% to pass the module. Students who fail the module at the first attempt will be re-examined during the August diet. This re-examination will consist entirely of report resubmission.

Recommended Reading:

Individual supervisors will recommend initial reading. It is then up to the student to direct themselves in collating the appropriate literature.

Additional Student Feedback:

(Please specify details of when additional feedback will be provided)

Feedback will occur during the regular meetings between student and supervisor.

MODULE DESCRIPTION FORM

BE424 Practical Biomechanics 2

Module Registrar: Dr Phil Rowe		**Taught To:** BEng/MEng Biomechanical Engineering	
Other Lecturers Involved: Dr Phil Riches and Dr Andy Kerr		**Credit Weighting:** 20	**Semester:** 2
Compulsory/optional/elective class: Optional		**Academic Level:** SHE 4	
Prerequisites: BE302 Practical Biomechanics			
Module Format and Delivery (hours):			

Lecture	Tutorial	Laboratory	Project	Assignments	Private Study	Total
	12	6	15		176	200

Educational Aim

Building on BE302 Practical Biomechanics, this module aims to provide an opportunity for students to experience the challenges and rewards of independent group project work study in the general field of Biomechanics (human movement analysis). It will involve students in a number of processes which include selecting, devising and applying appropriate methods and techniques; anticipating and solving problems which arise; displaying knowledge of background literature; and evaluating and reporting the conclusions of the study. Project work will be supported by expert tutorials to assist with technical aspects of experimental methodology and analysis.

Learning Outcomes

On completion of the module the student is expected to be able to:

LO1 Demonstrate a critical understanding of the principal theories, principles and concepts of their chosen biomechanics topic.

LO2 Show autonomy in planning and executing a significant project of research, investigation or development.

LO3 Apply critical analysis, evaluation and interpretation to biomechanical experimental data.

LO4 Effectively communicate and discuss their project.

(UK SPEC suggests no more than 4 learning outcomes per module. Statements must be broad and be syllabus free and link in with the intended learning outcomes on the programme specifications.)

Syllabus

The module will teach the following:

There is no formal syllabus to this module. Class tutors will guide students through an appropriate research/ project process using tutorials.

The class will be divided into groups of between 3 and 5 students. Each group will be allocated a single tutor with expertise in conducting biomechanics experiments. The biomechanics topic will be provided and will be within the remit of a generic ethics application, if necessary. It is expected that the group will meet their tutor once a week for tutorial sessions. Students will design, conduct and analyse their experiment and data under the guidance of their tutor.

The project will be assessed by an oral presentation and submitted coursework in the style of a journal paper.

Assessment of Learning Outcomes

Criteria

For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:
[Note: Criteria break the LO down into 'teachable' elements but do not become syllabus orientated i.e. no mention of CAD package names, components etc.]

LO1 Demonstrate a critical understanding of the principal theories, principles and concepts of their chosen topic field.
C1 Describe the appropriate theoretical background for their project, including any underlying assumptions.
C3 Provide a fully-informed justifiable rationale for their research.

LO2 Show autonomy in planning and executing a significant project of research, investigation or development.
C1 Develop an appropriate methodology to examine the research question.
C2 Execute the developed methodology.
C3 Critically appraise the execution of the methodology.

LO3 Apply critical analysis, evaluation and interpretation to their own experimental data and/or that of other published work
C2 Correctly analyse 3D biomechanical data, writing bespoke software and algorithms to do so.
C2 Present and discuss numerical data in an accurate and appropriate manner

LO4 effectively communicate and discuss their project
C1 Summarise, using a good standard of written and verbal technical English, the project work in a journal paper format

C2 Orally present complex technological and scientific concepts with clarity of expression

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

Principles of Assessment and Feedback

The University's Assessment and Feedback Policy can be found at: www.strath.ac.uk/staff/policies/academic/
Specific details relating to this class are as follows:

Regular student-tutor meetings will deliver regular high quality feedback on progress (2) providing ample opportunity for students to understand and to attain the expected level of achievement (3). Students will be working within a project area of their choice (8) maintaining motivation and interest in their work.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

Examination			Coursework		Project	
Number	Duration	Weighting	Number	Weighting	Number	Weighting
					1	100%
					LO1-4	

Indicate which learning outcomes (L01, L02 etc) are to be assessed by exam/coursework/project as required.

Coursework / Submissions deadlines:

Paper submission and oral presentations will occur in week 11 of the semester.

Resit Examination Procedures:

Students who fail to provide a satisfactory project at the first attempt will be asked to do corrections and to resubmit within an agreed timescale.

PLEASE NOTE:
Students need to gain a summative mark of 40% to pass the module. Students who fail the module at the first attempt will be re-examined during the August diet. This re-examination will consist entirely of coursework.

Recommended Reading:

As part of the project a small literature will be necessary. The necessary prior theory has been given in class BE302.

Additional Student Feedback:

(Please specify details of when additional feedback will be provided)

Feedback will be ongoing at weekly tutorials.
Feedback will occur during the regular meetings of the student and supervisor.

MODULE DESCRIPTION FORM

BE425 The Medical Device Regulatory Process

Module Registrar: Dr Craig Robertson		**Taught To:** BEng/MEng Biomedical Engineering	
Other Lecturers Involved: Edwin Lindsay and Professor Terence Gourlay		**Credit Weighting:** 10	**Semester:** 2
Compulsory/optional/elective class: Optional		**Academic Level:** 4	
Prerequisites: None			

Module Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Project	Assignments	Private Study	Total
20	5			45	30	100

Educational Aim

This module aims to give students an understanding of the regulatory pathway and requirements to deliver a new medical device to the marketplace from concept to clinical use. The student should understand the complexity of the regulatory requirements internationally, the importance of the maintenance of technical files and pre and post-certification vigilance.

Learning Outcomes

On completion of the module the student is expected to be able to:

LO1 Understand the need for regulatory approval.

LO2 Have a clear understanding of device classifications.

LO3 Be aware of the need for the construction and maintenance of the technical file.

LO4 Have an understanding of the different regulatory requirements across international sectors.

(UK SPEC suggests no more than 4 learning outcomes per module. Statements must be broad and be syllabus free and link in with the intended learning outcomes on the programme specifications.)

Syllabus

The module will teach the following:

The background to the regulatory approval system together with the underlying need and benefits.
Device classification and its impact on device testing requirements.
How to construct a device technical file and the importance of its maintenance.
The role of the academic in the regulatory process.
The different regional approval processes the levels of approval and international reciprocation.
The cost of the regulatory process.

Assessment of Learning Outcomes

Criteria
For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:
[Note: Criteria break the LO down into 'teachable' elements but do not become syllabus orientated i.e. no mention of CAD package names, components etc.]

LO1 Understand the need for regulatory approval.
C1 Review the history of the regulatory process
C2 Discuss the need for a regulatory process for medical devices and the clinical and commercial drivers.

LO2 Have a clear understanding of device classifications.
C1 Examine the different classifications of devices and how these impact on the regulatory process.
C2 Discuss the complexity of the investigative process for each classification

LO3 Be aware of the need for the construction and maintenance of the technical file.
C1 Review the process of constructing a technical file.
C2 Discuss the role of the technical file in the regulatory process, where it begins and where it ends.
C3 Review examples of technical files and critically discuss good practice

LO4 Have an understanding of the different regulatory requirements across international sectors.
C1 Demonstrate a full understanding of the requirements for CE approval and FDA submission.

C2 Compare and contrast the processes for adverse event reporting internationally.
C3 Critically discuss the level of reciprocation across international regulatory bodies.
C4 Appraise the regulatory audit process form the regulatory body's perspective and that of the manufacturer.

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

Principles of Assessment and Feedback

The University's Assessment and Feedback Policy can be found at: www.strath.ac.uk/staff/policies/academic/

Please state briefly how these are incorporated in this module.

Discussions around lecture topics, at tutorials and during the individual project work are used to assess student feedback on the course and also to guide students in their own work. There will also be individual written essays.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

Examination			Coursework		Project	
Number	Duration	Weighting	Number	Weighting	Number	Weighting
1	2 hrs	70%	1	30%		
			LO1-LO4			

Indicate which learning outcomes (L01, L02 etc) are to be assessed by exam/coursework/project as required.

Coursework / Submissions deadlines:

Coursework will be set in week 7 of semester 2, with submission in week 13.

Resit Examination Procedures:

Examination in August.

PLEASE NOTE:
Students need to gain a summative mark of 40% to pass the module. Students who fail the module at the first attempt will be re-examined during the August diet. This re-examination will consist entirely of exam.

Recommended Reading:

There are many textbooks available on the subject of regulatory affairs in the medical device domain. However, these will be reviewed as part of the course materials and if it becomes clear that a particular textbook covers all of the subject matter at the correct level it will become recommended reading for the start of the course

Additional Student Feedback:

(Please specify details of when additional feedback will be provided)

MODULE DESCRIPTION FORM

BE426 Medical Robotics

Module Registrar: Prof Will Shu				**Taught To:** BEng/MEng Biomedical Engineering		
Other Lecturers Involved:				**Credit Weighting:** 10		**Semester:** 2
Compulsory/optional/elective class: Optional				**Academic Level:** 4		
Prerequisites:						
Module Format and Delivery (hours):						
Lecture	Tutorial	Laboratory	Project	Assignments	Private Study	Total
20	10			24	46	100

Educational Aim

This module aims to introduce the concepts and the design of medical robotics and its applications in various medical disciplines including, interventions, surgery and rehabilitation. The course focuses on fundamental principles such as kinematics, dynamics, control and artificial intelligent combined with medical applications and examples.

Learning Outcomes

On completion of the module the student is expected to be able to:

LO1 Assess various design, kinematics, dynamics and control features of medical robotics systems.

LO2 Appraise the clinical applications of medical robotic systems, their operational concepts and their clinical environments.

LO3 Design medical robotic systems using mathematical and simulation models.

(UK SPEC suggests no more than 4 learning outcomes per module. Statements must be broad and be syllabus free and link in with the intended learning outcomes on the programme specifications.)

Syllabus

The module will teach the following:

1. An introduction to the various applications of medical robotics
2. The design rationale for medical robotics
3. Kinematics of medical robotics
4. Denavit-Hartenberg Convention
5. Basic dynamics and control
6. Mechatronic systems
7. Man-machine interfaces
8. Surgical planning, tracking and navigation
9. Clinical applications
10. Development of medical robotic product

Assessment of Learning Outcomes

Criteria
For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

[Note: Criteria break the LO down into 'teachable' elements but do not become syllabus orientated i.e. no mention of CAD package names, components etc.]

LO1 Assess various design, kinematics, dynamics and control of medical robotics systems.
C1 Describe the basic design methods for medical robotic systems.
C2 Be able to calculate the kinematics of robotic manipulators.
C3 Be able to build basic dynamic and control model for medical robotic manipulators.

LO2 Appraise the clinical applications of medical robotic systems, their operational concepts and their clinical environments.
C1 Defend the function and application of medical robotics in various medical fields.
C2 Analyse various clinical requirements and evaluate their influence on medical robotics design.

LO3 Recognise the basic mathematical and simulation models for these systems.
C1 Be able to build D-H model for medical robotic manipulators.
C2 Be able to build basic dynamic model using simulation and analysis software.

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

Principles of Assessment and Feedback

The University's Assessment and Feedback Policy can be found at: www.strath.ac.uk/staff/policies/academic/

Specific details relating to this class are as follows:

12 hours of tutorials are provided to work through problems where teacher feedback is available when students get stuck. This ensures the feedback is timely. In the lectures and tutorials, the teacher will model in class how they would think through and solve 'exemplar' problems paying specific attention to the concepts behind the problems and the different solution strategies including incorrect pathways. This will clarify what good performance is.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

Examination			Coursework		Project	
Number	Duration	Weighting	Number	Weighting	Number	Weighting
1	2 hrs	70%	2	30% (2x15%)		
			LO1-3			

Indicate which learning outcomes (L01, L02 etc) are to be assessed by exam/coursework/project as required.

Coursework / Submissions deadlines:

Week 5 and Week 10.

Resit Examination Procedures:

Exam only.

PLEASE NOTE:
Students need to gain a summative mark of 40% to pass the module. Students who fail the module at the first attempt will be re-examined during the August diet. This re-examination will consist entirely of exam.

Recommended Reading:

Being a developing field, no text books cover the entirety of the course, however, students will be directed to journal articles which will provide necessary information.

Additional Student Feedback:

(Please specify details of when additional feedback will be provided)

MODULE DESCRIPTION FORM

BE427 Numerical Modelling in Biomedical Engineering

Module Registrar: Dr Asimina Kazakidi		**Taught To:** BEng/MEng Biomedical Engineering	
Other Lecturers Involved: Case study tutors		**Credit Weighting:** 10	**Semester:** 2
Compulsory/optional/elective class: Optional		**Academic Level:** 4	

Prerequisites:

Some prior reading of programming basics will be provided in Semester 1 for those choosing this class

Module Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Project	Assignments	Private Study	Total
10		27			63	100

Educational Aim

This module aims to provide experience of using numerical modelling tools, in particular Matlab, in a Biomedical Engineering context. For those with no knowledge of matlab, some pre-class preparatory work will be required and expected.

Case studies will be presented from the departmental research portfolio that require the use of numerical modelling. These case studies will be explained in detail, together with a methodology of the required numerical modelling to answer the research question. Students will be expected to write their own code to answer the research question, to appropriately graphically present results and to interpret the results in context.

Learning Outcomes

On completion of the module the student is expected to be able to:

LO1 Design numerical modelling tools to solve research-related problems in the field of Biomedical Engineering.

LO2 Create appropriate methods of data presentation of structured data.

LO3 Interpret numerical solutions to address research question(s) in the context of the presented case studies.

(UK SPEC suggests no more than 4 learning outcomes per module. Statements must be broad and be syllabus free and link in with the intended learning outcomes on the programme specifications.)

Syllabus

The module will teach the following:

Structured and supported self-learning will develop numerical modelling tools and techniques. Case studies, which will vary on a year by year basis, based on current research, will introduce both generic and specific numerical skills abilities, in addition to introducing a knowledge based on the case study itself. It is expected that Matlab will be used to solve problems, or finite element analysis programs, such as ANSYS or FEBio, or even bespoke code written in high level program languages such as C++. Case studies will require different graphical presentation methods, which will be exemplified.

Assessment of Learning Outcomes

Criteria

For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

[Note: Criteria break the LO down into 'teachable' elements but do not become syllabus orientated i.e. no mention of CAD package names, components etc.]

LO1 Design numerical modelling tools to solve research-related problems in the field of Biomedical Engineering
C1 Production of numerical code that follows a given algorithm
C2 Appropriate using of programming structures (e.g. for loops, functions, while etc)

LO2 Create appropriate methods of data presentation of structured data
C1 Use of 2D and 3D data plotting appropriate to context

LO3 Interpret numerical solutions to address research question(s) in the context of the presented case studies.
C1 Concisely relate programming output to research question
C2 Critically assess findings with regards to literature evidence
C3 Comment of differences and suggest further improvements, if necessary

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

Principles of Assessment and Feedback

The University's Assessment and Feedback Policy can be found at: www.strath.ac.uk/staff/policies/academic/
Specific details relating to this class are as follows:

Two small short assignments should encourage students to spend time and effort on the class.

Computer laboratories will provide students the ability to self-learn through the use of online help documentation and a process of trial and error. Teacher feedback will be provided as and when the student needs it: good quality teacher feedback should ultimately be geared to helping students learn to trouble-shoot and self-regulate their own performance. It should be timely –ideally it should be available when students are 'stuck', when it will have maximum impact and in time to improve subsequent assignments.

Submitted short reports should enable staff turnaround in marking and feedback of submissions to enable students to close gap between desired and current performance.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

Examination			Coursework		Project	
Number	Duration	Weighting	Number	Weighting	Number	Weighting
			2	100% (50% each)		
			LO1-3			

Indicate which learning outcomes (L01, L02 etc) are to be assessed by exam/coursework/project as required.

Coursework / Submissions deadlines:

Submission in weeks 9 and 11.

Resit Examination Procedures:

Resubmission of failed coursework.

PLEASE NOTE:
Students need to gain a summative mark of 40% to pass the module. Students who fail the module at the first attempt will be re-examined during the August diet. This re-examination will consist entirely of coursework.

Recommended Reading:

MATLAB [internet resource] a practical introduction to programming and problem solving, Stormy Attaway Elsevier 3rd ed. Waltham, MA : Butterworth-Heinemann Ltd 2013

Essential MATLAB for engineers and scientists [internet resource] Brian D. Hahn author. Daniel T. Valentine 1946- author.; Elsevier Fifth edition. Waltham, MA : Academic Press 2013

Contextualised reading for case studies will be provided by the case study leader.

Additional Student Feedback:

(Please specify details of when additional feedback will be provided)

MODULE DESCRIPTION FORM

BE428 Professional Studies and Research Methods in Biomedical Engineering (BE402/BE403)

Module Registrar: Research Methods (BE403): Dr Michelle Maclean Professional Studies (BE402): Dr Craig Robertson	**Taught To:** BEng/MEng Biomedical Engineering	
Other Lecturers Involved: Professional Studies: Guest lecturers Research Methods: Dr Chris McCormick	**Credit Weighting:** 20	**Semester:** 1
Compulsory/optional/elective class: Compulsory	**Academic Level:** 4	
Prerequisites: None		

Module Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Project	Assignments	Private Study	Total
48	5	16			131	200

Educational Aim

Research Methods (Semester 1, weeks 1-11): This part of the module aims to:

- Equip you with the knowledge and skills necessary for undertaking a research project.
- Provide an understanding of experimental design, and training in aspects including the use of mathematics and statistics tools, including software, for data visualisation, analysis and interpretation.
- Provide you with knowledge of how to construct and write a scientific report, and allow you to apply the techniques learnt during the module to support you in writing a scientific report/project.

Professional Studies (Semester 1, weeks 1-11): The part of the module aims to:

- Provide introduction to the philosophy, ethics and methodology of research;
- Outline the role that the bioengineer plays in the solution of clinical problems;
- Provide training in the principles, assessment and application of safety procedures in areas relevant to medical physics and biomedical engineering; and
- Engender an awareness of the importance of regulatory issues in medical device design and manufacturing.

Learning Outcomes

Research Methods: On completion of the module the student is expected to be able to:

LO1 Demonstrate knowledge and understanding of good project planning, the various design possibilities for a research project, the different types of data that can be generated, and demonstrate knowledge of how to select a data sample.

LO2 Demonstrate knowledge and understanding of the most common methods for visualising and analysing data using descriptive and statistical methods, and understand how to interpret their results.

LO3 Demonstrate the ability to appropriately utilise the various methods of data presentation and statistical analysis when writing scientific reports.

Professional Studies: On completion of the module the student is expected to be able to:

LO1 Appreciate the role that professional bodies play in society, and the various pathways that exist to becoming a professionally qualified engineer; have knowledge of the standards of competence and integrity to which professional engineers in the UK are held (UK-SPEC), and the role that biomedical engineers, in particular, play in finding solutions to clinical problems.

LO2 Recognise and understand hazards, relevant safety procedures and legislation in a broad range of activities encountered in medical physics and biomedical engineering.

LO3 Compare and contrast the quality management systems in place in industry with the requirements of medical device manufacture; and to provide an overview of the regulatory framework in which these companies operate.

Syllabus

Research Methods:
This part of the module will cover the following:

- Project Planning: Setting aims and objectives, conducting literature reviews, project management tools, data management, planning experiments/data collection, working with supervisors
- Producing data: Sampling, designing studies
- Data Analysis: Examining distributions, examining relationships
- Probability: Introduction of probability, random variables
- Inference: Introduction to inference, estimation and hypothesis testing
- Scientific writing: Writing scientific abstracts and reports, presenting and reporting data and statistical analysis

Professional Studies:
This part of the module will cover the following:

- The healthcare science workforce: overview of career pathways for healthcare scientists and engineers in Universities and the NHS
- The research landscape: the scientific literature; good practice in research; research ethics: structure and conduct of clinical trials
- Management of Health & Safety in the work-place:
- Health & Safety Legislation
- Fire safety
- Chemical Safety: COSHH, hazards, storage, use & disposal
- Electrical Safety: fault conditions, leakage currents, circuit protection, body response to electrical shock
- Biological Safety: blood and other tissues, handling procedures, contamination and cross-contamination, cleaning; infection control
- Ionising Radiation: sources, units, physical and biological effects, measurement and instrumentation, dose limits, protection, legislation
- Non-ionising Radiation: UV, lasers, ultrasound, physical and biological effects, dose limits, legislation
- Quality Management Systems: comparison of industry-based and clinical design management systems;
- Manufacturing and quality control (ISO9001); good manufacturing practices
- Regulatory issues in medical device manufacture: device classification; registration and listing; declaration of conformity (the CE mark)

Assessment of Learning Outcomes

Criteria
For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

Research Methods:

LO1 Demonstrate knowledge and understanding of good project planning, the various design possibilities for a research project, the different types of data that can be generated, and demonstrate knowledge of how to select a data sample.

C1 Identify a range of tools and methods that can support good project planning and project management
C2 Identify a range of experimental design methods, and the levels of measurement
C3 Understand the important of selecting appropriate data samples, and validating data through use of controls for a particular research study
C4 Differentiate between different types of data generated in a particular research study

LO2 Demonstrate knowledge and understanding of the most common methods for visualising and analysing data using descriptive and statistical methods, and understand how to interpret their results.

C1 Describe and apply the main principles of visualising and analysing data generated in research studies
C2 Construct a research hypotheses and identify a claim
C3 Apply appropriate inference methods to test a research study hypothesis
C4 Interpret results from hypothesis testing

LO3 Demonstrate the ability to appropriately utilise the various methods of data presentation and statistical analysis when writing scientific papers/reports.

C1 Apply knowledge learnt to construct a scientific abstract and prepare a research paper/report
C2 Present, report and interpret data and statistical analysis within a research paper/report

Professional Studies:

LO1 Appreciate the complexity of the research landscape, its constraints and challenges, and the role that bioengineers in particular play in finding solutions to clinical problems.

C1 Articulate the importance ethical issues in scientific and clinical research;
C2 Identify the type of projects that require ethical review by a University or NHS Research Ethics Committee;
C3 Ability to identify the procedures in order to obtain ethical approval for research involving human subjects in both university and NHS settings; and the roles of the chief investigator, sponsor, etc.
C4 Outline the career paths open to scientists and engineers in biomedical research.

LO2 Recognise and understand hazards, relevant safety procedures and legislation in a broad range of activities encountered in medical physics and biomedical engineering.

C1 Ability to identify and weigh the risks and hazards associated with laboratory- and clinical-based activities;
C2 Outline the assessment and reporting procedures to be followed to ensure a safe working environment; and
C3 The relevant health and safety legislation and the executive bodies involved in enforcing those regulations.

LO3 Compare and contrast the quality management systems in place in industry with the requirements of medical device manufacture; and to provide an overview of the regulatory framework in which these companies operate.

C1 Ability to identify principles of Medical Device Design;
C2 Identify the requirements specific to medical device design and manufacture;
C3 Identify the relevant quality management systems, standards and regulations that apply; and
C4 The relevant medical device legislation and the executive bodies involved in enforcing those regulations.

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

Principles of Assessment and Feedback

The University's Assessment and Feedback Policy can be found at: www.strath.ac.uk/staff/policies/academic/

Please state briefly how these are incorporated in this module.

Research Methods:

Student outcomes will be assessed using tools provided by the University's Virtual Learning Environment 'MyPlace', and on campus (where possible). MyPlace will also be used to promote interaction between individual students and their tutors, and to tailor feedback on performance to individual students. Likewise student feedback will be sought to improve both content and delivery of the course.

Clear instructions will be given to students about assessment requirements and expectation through live interactive virtual sessions (and/or on-campus sessions where possible), and through notifications and information provided using MyPlace. Students will work on a regular basis on a series of tasks (tutor-led, self-led and interactive group activities) with regular interaction and dialogue around learning (with their peer group and teaching staff). Activities will be followed by feedback to encourage self-assessment and reflection on their learning progress. Informal communities of learning may emerge from these activities. Students will be given a choice of topic to explore for their mini-project assessment, thus enabling this aspect of assessment to be tailored to their interests and motivations

The class test results, together with conversations with students during tutorial/computer lab sessions, will provide information that will help that shape teaching in subsequent lectures. In particular, the revision lecture content will be shaped by such information.

Professional Studies:

The module is wholly formative, student outcomes being assessed using tools provided by the University's Virtual Learning Environment 'MyPlace'; the VLE will be used also to promote interaction between individual students and their tutors, and to tailor feedback on performance to individual students.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

Research Methods:

Examination			Coursework		Project	
Number	Duration	Weighting	Number	Weighting	Number	Weighting
-	-	-	1 x Class Test 1 x Project Plan Computer worksheets	40% Pass/Fail Pass/Fail	1 (mini-project)	60%
			LO1 - LO2		LO1 - LO3	

Professional Studies:

Examination			Coursework		Project	
Number	Duration	Weighting	Number	Weighting	Number	Weighting
-	-	-	3	100%	-	-
			LO1 – LO3			

Indicate which learning outcomes (L01, L02 etc) are to be assessed by exam/coursework/project as required.

Coursework / Submissions deadlines:

Research Methods:

A project plan will be set in week 1 (Semester 1), with a deadline of week 4 (Semester 1)

An online MCQ test will be set in week 8 (Semester 1)

A mini-project assignment will be set in week 4 (Semester 1), with a deadline of 16th December 2022.

Professional Studies:

An online MCQ test will be set in Week 11 of Semester 1.
A number of self-assessment exercises will be set in Week 6 with deadlines by Week 11 (Semester 1).

Resit Examination Procedures:

Research Methods:
Resubmission of failed elements as per 1st attempt.
PLEASE NOTE: Students must gain a summative mark of 40% to pass the module.

Professional Studies:
Resubmission of failed coursework as per 1st attempt.
PLEASE NOTE: Students need to gain a summative mark of 40% in the class test and complete all formative assessments in order to pass the module. Students who fail the module at the first attempt will be re-examined during the August diet. This re-examination will consist entirely of coursework.

Recommended Reading:

Research Methods:
Access to comprehensive lecture slides and notes will be provided during the class. Electronic resources including links to appropriate on-line learning resources will be provided on MyPlace. Students wishing to carry out additional reading to supplement their learning may wish to consult some of the following texts, which provide a broad range of approaches to the study and application of statistics within a biomedical context:

R. Ennos, *Statistical and Data Handling Skills in Biology*, Pearson Education Ltd

C. Dytham, *Choosing and using statistics - a biologists guide*, Wiley-Blackwell

D.G. Altman *Practical Statistics for Medical Research*, Chapman and Hall

J.M. Bland *An Introduction to Medical Statistics*, Oxford

B.R. Kirkwood and J.A. Sterne *Essential Medical Statistics*, Blackwell

Ryan, BF & Joiner, *MINITAB handbook*, Duxbury – Kent

Professional Studies:
Electronic resources: Links to appropriate on-line learning resources and exercises will be provided on MyPlace

Additional Student Feedback:

(Please specify details of when additional feedback will be provided)

Research Methods:
Feedback on activities will be provided regularly throughout the module (through scheduled virtual interactive sessions (and on campus sessions where possible), and posted on MyPlace) – details of these will be announced via MyPlace. Class feedback sessions will also be held in week 8, and mini-project feedback will be provided (within 3 weeks of submission deadline).

Professional Studies:
Beginning of second semester (via MyPlace).

MODULE DESCRIPTION FORM

BE431 Rehabilitation Technology

Module Registrar: Dr Andrew Kerr		**Taught To:** MSc Biomedical Engineering	
Other Lecturers Involved: Online resources		**Credit Weighting:** 10	**Semester:** 2
Compulsory/optional/elective class:		**Academic Level:** M	
Prerequisites: Nil			

Module Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Project	Assignments	Private Study	Total
11	22	7	20	20	120	200

Educational Aim

This module aims to:

Provide students with the evidence and rationale for embedding technology into rehabilitation practice considering the technological, design and cultural barriers to adoption.

Learning Outcomes

On completion of the module the student is expected to be able to:

LO1 Justify the use of rehabilitation technologies within a modern health service.

LO2 Apply understanding of rehabilitation principles to the design of technologies.

LO3 Analyse the design features of rehabilitation technologies.

LO4 Appraise currently technologies within a specific area of rehabilitation in terms of efficacy and usability.

(UK SPEC suggests no more than 4 learning outcomes per module. Statements must be broad and be syllabus free and link in with the intended learning outcomes on the programme specifications.)

Syllabus

The module will teach the following:

1) Broad principles of rehabilitation including strengthening, flexibility, neuroplasticity and motivation (3 weeks).
2) Application of design techniques (e.g. user centred design) to rehabilitation technology (1 week).
3) The gamification of rehabilitation activities, role of competition and fun (1 week).
4) Principles of motor learning (1 week).
5) Body worn sensors to provide movement feedback (0.5 weeks).
6) Virtual reality in rehabilitation (0.5 weeks).
7) Robotics in rehabilitation (0.5 weeks).
8) Brain Computer interface technology (0.5 weeks).
8) Barriers to adoption (1 week).
9) Case studies from neurological and musculoskeletal conditions. (2 weeks)

Assessment of Learning Outcomes

Criteria
For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

[Note: Criteria break the LO down into 'teachable' elements but do not become syllabus orientated i.e. no mention of CAD package names, components etc.]

LO1 Justify the use of rehabilitation technologies within a modern health service.
C1 Economic backdrop to health care and rehabilitation.
C2 Examples of technology already adopted in health care.
C3 Maturity of technologies such as body worn sensors and mobile devices (smart phones etc).

LO2 Apply understanding of rehabilitation principles to the design of technologies.
C1 Principles of musculoskeletal adaption to loading/movement.
C2 Principles of neuroplasticity with reference to motor (re)learning.
C3 Presentation of clinical case studies and discussion of literature.
C4 Appraising the use of therapy robots and virtual reality in rehabilitation.

LO3 Analyse the design features of rehabilitation technologies.

C1 Exposure to design techniques such as user centred design and controlled convergence.
C2 Student based learning through searching patents, reviews, research publications.
C3 Use of feedback and development of a gaming environment suitable for rehabilitation.

LO4 Appraise current technologies within a specific area of rehabilitation in terms of efficacy and usability.
C1 Barriers to adoption.
C2 Presentation of case studies.
C3 Planning and reading for assessments.

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

Principles of Assessment and Feedback

The University's Assessment and Feedback Policy can be found at: www.strath.ac.uk/staff/policies/academic/

Please state briefly how these are incorporated in this module.

Online forums will be set up for each weekly topic to encourage engagement across the study group. Student will have an opportunity to have a one to one discussion regarding their assessment (project proposal) plans with the teaching. Each student will be provided with a detailed feedback on their assessment based on assessment criteria provided in week 1.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

Examination			Coursework		Project	
Number	Duration	Weighting	Number	Weighting	Number	Weighting
			2	100		
			Coursework 1 assesses LO3 and LO4 Coursework 2 assesses LO1 and LO2.			

Indicate which learning outcomes (L01, L02 etc) are to be assessed by exam/coursework/project as required.

Coursework / Submissions deadlines:

1) Coursework 1: Submission of a pre-recorded, 10 minute video, of a presentation summarising the literature for a rehabilitation technology. This will be accompanied by a 350-word abstract short. (LO3 and LO4)
2) Coursework 2: A 1500 word proposal for developing a rehabilitation technology or enhancement of a current one (LO1 and LO2)

Resit Examination Procedures:

Resits will be resubmissions of the original work following feedback.

PLEASE NOTE:
Students need to gain a summative mark of 50% to pass the module. Students who fail the module at the first attempt will be re-examined during the August diet. This re-examination will consist entirely of coursework.

Recommended Reading:

There are few core textbooks in this area so the reading will be predominantly journal based.

The first 3 weeks will consider principles of rehabilitation supported by:

1) Physical Management in Neurological Rehabilitation, Stokes and Stack (2011). Churchill Livingstone
2) Motor learning: concepts and applications. Magil (2003). McGraw-Hill

The use of technology in neurological conditions will be covered by:

Neurorehabilitation technology. (2012) Dietz et al. Springer-Verlag, London.

Additional Student Feedback:

(Please specify details of when additional feedback will be provided)

Year 5

The following pages contain class descriptors for the different core classes in year 1. Since different departments teach different classes, the class descriptors may differ slightly in format.

Class descriptors of all potential optional classes will be given closer to the time.

Department of Design, Manufacture and Engineering Management

MODULE DESCRIPTION FORM

EF931 Project Management

Module Registrar: Dr David Butler	**Taught To (Course):** Faculty wide	
Other Lecturers Involved: Dr. Vassili Vorontsov	**Credit Weighting:** 10	**Semester:** 1
Assumed Prerequisites: None	**Compulsory/Optional/ Elective class:** Optional	**Academic Level:** 5

Module Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Project	Private Study	**Total**
22	0	0	50	28	100

Educational Aim

This module aims to provide students with skills and knowledge relating to the use of engineering practices in Project Management with particular respect to the project triple constraint: time, cost and quality.

Learning Outcomes

On completion of the module the student is expected to be able to:
LO1 Demonstrate a good understanding of project management practices and practical skills to manage project scope
LO2 Gain intellectual skills to apply various project planning, scheduling and controlling methods with respect to the project triple constraints: time, cost and quality
LO3 Develop a good understanding of the inter-dependency between various project management knowledge areas
LO4 Understand the importance of project stakeholders and their impact on project management

Syllabus

- Introduction to project management principles, concepts and processes
- Project management and organisations: organisational influences, project stakeholders, project team, and project life cycle
- Project scoping: project definition, project objectives, project deliverables, and work breakdown structure
- Project planning and scheduling: definition of events, activities and nodes, network diagram, analysis of critical path, PERT method, and use of industry standard software packages
- Project controlling: cost estimate, budget setting, risk identification and assessment, and contingency planning
- Case studies/practical examples in project management

Assessment of Learning Outcomes

Criteria

For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning. These outcomes are based on the Engineering Council's Degree Accreditation programme and the references used are linked to the 3rd edition of 'Accreditation of HE Programmes' (AHEP), May 2014.

LO1 – Demonstrate a good understanding of project management practices and practical skills to manage project scope. AHEP assessment – SM7M, SM9M, D9M, D10M, P10m, G1
C1 – develop *critical* understanding of key project management principles, concepts and processes
C2 – understand project life cycle and its key characteristics
C3 – define and develop project specifications as well as deliverables
C4 – translate project specifications into *critical* work packages using work breakdown structure

LO2 – Gain intellectual skills to apply various project planning, scheduling and controlling methods with respect to the project triple constraints: time, cost and quality. AHEP assessment – EA6M, EA7M, D9M, D10M, P10m, G1.
C1 – define and schedule project activities using *analytical* tools such as critical path and PERT methods
C2 – estimate cost and determine budget using *analytical* tools such as analogous and three-point estimating methods
C3 – identify and control quality standards using *analytical* approaches such as cost of quality and seven basic quality tools

LO3 – Develop a good understanding of the inter-dependency between various project management knowledge areas. AHEP assessment – SM7M-SM9M, EA6M, D9M, D10M, EL13M, P10m.
C1 – understand the dynamics of managing projects under triple constraints

C2 – identify and assess risks associated with changing circumstances using *analytical* approaches such as fishbone diagram and SWOT analysis
C3 – develop contingency plans for correction and prevention purposes

LO4 Understand the importance of project stakeholders and their impact on project management. AHEP assessment – EL8M-EL10M, P11m, G1, G4.
C1 – address the link between organisations and project management
C2 – Know how to capture *critical* project requirements from various stakeholders
C3 – Know how to manage the relationship with *critical* stakeholders

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

12 Principles of Assessment and Feedback
(on Learning & Teaching web pages:http://www.strath.ac.uk/learnteach/informationforstaff/staff/assessfeedback/12principles/)

- The students will be encouraged to formulate learning groups based on the specialist stream they have chosen;
- In *Week 1*, constructed criteria-sheets and performance-level definitions will be explained, including discussion in class; Students may be asked to reformulate in their own words the documented criteria and submit it together with each *Assignment*;
- The assignment (if applicable) will be *marked by considering achievements* in the knowledge, skills and attitudes which are linked to future employment;
- For the coursework, students will be *given a choice* on the topic-focus which would target applications to a specific sector and/or a job targeted;
- The students are encouraged to submit a draft essay for *early feedback* (if applicable);
- Time and effort will be defined to students for each learning task/assignment;
- The feedback on the coursework will be provided in relation to the stated assessment criteria specifying the level of *criticality* in understanding a topic/area and its key elements, the level of *technicality* in collecting and analysing the relevant information leading to major observations, and the level of *criticality* in drawing major conclusions from the analysis.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

	Examinations			Courseworks		Projects	
	Number	Duration	***Max Marks***	Number	***Max Marks***	Number	***Max Marks***
				1	50	1	50
L/Outcomes				LO1-4		LO1-4	

Coursework / Submissions deadlines:
Group Report to be submitted by Week 9
Individual Essay to be submitted by Week 11

Resit Assessment Procedures:
Students need to gain a summative mark of 50% to pass the module. Students who fail the module at the first attempt will be if appropriate re-examined during the August diet. They will be required to submit an individual essay.

Recommended Reading

Textbooks:

- A guide to the project management body of knowledge (PMBOK Guide), Project Management Institute (PMI), USA.
- Dennis Lock (2013). Project management, Gower, England.
- Frederick Harrison and Dennis Lock (2004). Advanced project management: a structured approach, Routledge.
- M. Daud Alam and Uwe F. Guhl (2016). Project-management in practice: a guideline and toolbox for successful projects, Springer.
- Jack R. Meredith, Samuel J. Mantel, Jr., Scott M. Shafer, Margaret M. Sutton (2014). Project management in practice, Wiley.

Journals:
International Journal of Project Management
Other relevant journals

Additional Student Feedback

Date	Time	Room No
TBC	TBC	TBC

Session: 2017/2018

APPROVED

PG Leader:

Date of Last Modifications: 15 August, 2018

MODULE DESCRIPTION FORM

BE513 Biomedical Engineering Group Project

Module Registrar: Dr Philip Riches	**Taught To:** MEng Biomedical Engineering	
Other Lecturers Involved: All BME Staff	**Credit Weighting:** 40	**Semester:** 1&2
Compulsory/optional/elective class: Compulsory	**Academic Level:** SCQF11	
Prerequisites:		

Module Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Project	Assignments	Private Study	Total
			400			400

Educational Aim

This module aims to give students an authentic experience of managing and contributing to a complex group project. This will include an opportunity to demonstrate mastery of the technical aspects of the project, in addition to demonstrating competence in project management, technical risk management and safety risk assessment.

Learning Outcomes

On completion of the module the student is expected to be able to:

LO1 Appreciate the principles of project management and planning.

LO2 Be able to reflect on their role in a team and their interaction with team members.

LO3 Appreciate the importance of technical risk and health and safety management.

(UK SPEC suggests no more than 4 learning outcomes per module. Statements must be broad and be syllabus free and link in with the intended learning outcomes on the programme specifications.)

Syllabus

Students will form into groups and be allocated a project topic, supervised by a member of staff. All students will take part in intensive workshops on project management, technical risk management and safety risk assessment. Each group will then write a statement of purpose detailing the deliverables and schedule for the project. This will be agreed with the supervisor, who will take on the role of client. The statement of purpose will form a contract between the group and the client.

Students will carry out the project, and report to the assessment team in December (interim presentation/report) and at the conclusion of the project (time agreed in contract). Groups will be assessed on the extent to which they have met the deliverables set out in the contract, as well as on the quality of reflection on the group process and project management experience.

Assessment of Learning Outcomes

Criteria
For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:
[Note: Criteria break the LO down into 'teachable' elements but do not become syllabus orientated i.e. no mention of CAD package names, components etc.]

LO1 Appreciate the principles of project management and planning
C1 Show an ability to develop a detailed project plan
C2 Be able to analyse the critical path of a project
C3 Understand project estimating and project control

LO2 Be able to reflect on their role in a team and their interaction with team members
C1 Critically analyse their contribution to the project
C2 Consider the interaction between team members
C3 Reflect of the influence of team structure on team effectiveness

LO3 Appreciate the importance of technical risk and health and safety management
C1 Understand the need for technical risk management
C2 Appreciate the obligations of health and safety law
C3 Appreciate the obligations of regulatory and ethical frameworks for conducting project in Biomedical Engineering

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

Principles of Assessment and Feedback

The University's Assessment and Feedback Policy can be found at: www.strath.ac.uk/staff/policies/academic/
Specific details relating to this class are as follows:

The assessment is by oral presentations and dialogue, which provides instant feedback on group performance in a two-way communication process.

The summative assessment in through oral presentations, after which feedback/mark sheets are completed by each assessor. These are returned to each group within a week of the assessment. Groups are encouraged to discuss any issues with the assessors.

Project deliverables and deadlines will be defined by the group through a statement of purpose. Progress at each oral presentation is assessed against these criteria. Each group will define the detailed work on their project in negotiation with the supervisor (client).

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

Examination			Coursework		Project	
Number	Duration	Weighting	Number	Weighting	Number	Weighting
			1 (interim presentation)	20%	1	80%
			All		All	

Indicate which learning outcomes (L01, L02 etc) are to be assessed by exam/coursework/project as required.

Coursework / Submissions deadlines:

Statement of purpose, semester1 week4
Interim report/presentation, semester1 week10
Final report/presentation, as defined by group in statement of purpose.

Resit Examination Procedures:

A group that fails to meet the threshold level for a pass will be allowed to complete further work over the summer. This will be assessed for the September Board of Examiners.

PLEASE NOTE:
Students need to gain a summative mark of 50% to pass the module. Students who fail the module at the first attempt will be re-examined during the August diet. This re-examination will consist entirely of exam/coursework/viva *(please delete as appropriate).*

Recommended Reading:

Supervisors will provide initial guidance on reading, but groups should identify their own appropriate literature.

Additional Student Feedback:

(Please specify details of when additional feedback will be provided)

The Course – timetables

The timetabling and room booking team is part of Estates Management – this team are responsible for the publication of the University teaching timetables. Please note that all timetables are provisional and are subject to constant change. Please check daily for any changes to your timetable.

All timetables are electronic and you will find your timetable using here:

http://www.strath.ac.uk/timetables/

Please use the conversion table on Page 7 and 8) to convert between the academic calendar and the calendar on the University Timetabling system. For example, the first teaching week of the academic year in semester 1 is week 8 of the timetabling system. The first week of semester 2 is week 25 of the timetabling system.

You can get a personalized timetable through the Strath App.

Appendix 1

Access to University Premises -John Anderson Campus

Access_to_University_Premises_Policy_updated_-_13_September_2022.docx (live.com)

Appendix 2

Use of computing facilities & resources

Find and use IT or AV | University of Strathclyde

Library & IT help | University of Strathclyde

Notes