MRes BIOMEDICAL ENGINEERING

2014-2015

On behalf of all members of staff, I welcome you to the Department of Biomedical Engineering. We hope you will have an enjoyable and successful time with us. This handbook explains the organisation and regulations affecting the MRes course.

This handbook should be read in conjunction with the University Student Handbook

http://www.strath.ac.uk/media/ps/sees/informationandadviceteam/student_handbook.pdf

which provides information on the range of support and information services within the University.
Professor Helen Grant (m.h.@strath.ac.uk), as Course Director, will be your main point of contact and will help with any academic issues you may have.

Please note that the course begins on Tuesday, 30th September at 9.00 am. I look forward to meeting you at that time in the Conference Room, Room 2.13, Level 2, Wolfson Centre.

Professor T Gourlay
Head of Department

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THE DEPARTMENT OF BIOMEDICAL ENGINEERING

The Department of Biomedical Engineering, in the Faculty of Engineering, was formed in 2012 following the merger of the Bioengineering Unit and the National Centre for Prosthetics and Orthotics. The merger reconnects two complementary and key areas of health technology teaching and research within the University. The single department offers students unrivalled undergraduate and postgraduate opportunities for learning and knowledge exchange in prosthetics and orthotics and for advanced postgraduate study in a broad range of biomedical engineering disciplines.

The Bioengineering Unit was established 50 years ago and is an internationally-recognised centre of excellence for postgraduate education and research at the interface between engineering and the life sciences, with particular emphasis on clinically-related research. The goal of the Unit is to transform and improve future healthcare through innovations and advances in science in technology.

The MRes is predominantly taught by the Bioengineering Unit in the Department of Biomedical Engineering. The following Bioengineering Unit staff, with their contact details, have a significant role on the course. Other staff, including those from other departments, may also contribute to the course in a minor capacity, and their contact details will be given by them in due course.

HEAD OF DEPARTMENT	Email	Extension
Prof. Terry Gourlay	terence.gourlay@strath.ac.uk	2005
COURSE DIRECTOR		
Prof Helen Grant	m.h.grant@strath.ac.uk	3438
COURSE ADMINISTRATOR		
Ms Maureen Leonard	m.b.leonard@strath.ac.uk	5920
COURSE TEACHING STAFF		
Dr Richard Black	richard.black@strath.ac.uk	4568
Prof. Patricia Connolly	patricia.connolly@strath.ac.uk	3034
Prof. Bernard Conway	b.a.conway@strath.ac.uk	3316
Dr Mario Giardini	mario.giardini@strath.ac.uk	3042
Prof. Terry Gourlay	terence.gourlay@strath.ac.uk	2005
Prof. Helen Grant	m.h.grant@strath.ac.uk	3438
Dr Heba Lakany	heba.lakany@strath.ac.uk	3487
Dr Michelle MacLean	michelle.maclean@strath.ac.uk	2891
Dr Chris McCormick	christopher.mccormick@strath.ac.uk	2855
Dr Philip Riches	philip.riches@strath.ac.uk	5703
Prof. Philip Rowe	philip.rowe@strath.ac.uk	3032
Mr Stephanos Solomonidis	s.e.solomonidis@strath.ac.uk	3778
Dr Wei Yao	w.yao@strath.ac.uk	3030
COURSE COUNSELLORS		
Dr Philip Riches	philip.riches@strath.ac.uk	5703
Prof. Helen Grant	m.h.grant@strath.ac.uk	3438
DEPARTMENT DISABILITY CONTACT		
Dr Heba Lakany	heba.lakany@strath.ac.uk	3487

OVERVIEW OF THE MRES BIOMEDICAL ENGINEERING

MRes students are required to undertake instructional classes and complete a research project. For the degree, students must attain 60 credits from the instructional classes and obtain a further 120 credits on satisfactory completion of a thesis on a research project.

In the 1st week of the course, you will be interviewed by a member of senior staff who will advise you on the classes you should attend. The list of classes is given on page 5. The selection of classes in Block 1 will reflect your previous education. For example, physical science students will normally take the Medical Science conversion module, while life science students will normally take the Engineering Science conversion module. This interview will also discuss your optional class choices.

Early in Semester 1, a list of available research projects will be published. You should speak with potential supervisors about the projects that you are interested in and submit a form indicating your 1st,2nd and 3rd choices. Projects will be allocated shortly thereafter.

On return from the Winter break, there is one week of revision prior to two examination weeks. Semester 2 officially starts after the exams for a 12 week period (with two weeks vacation in spring). In this Semester

Prior to week 6 of Semester 2 you are required to submit an abstract of your project and in week 6 of Semester 2 you will be required to make an oral presentation of your project, outlining the programme of research you are undertaking and the work to date. Your project supervisor will advise you on the preparation of the abstract and oral presentation.

Second semester classes will be examined in May and another examination diet, if necessary, will be in August.

Following the completion of project work, MRes students are required to submit a thesis. The submission date for MRes students will be around the middle of August. The theses will be examined by an internal examiner and an external examiner appointed by the supervisor with approval from the HOD. In early September, MRes students may be required to attend an oral examination of their thesis.

Whilst every effort has been made to make this handbook correct at the time of printing, please be aware that some information may be subject to revision.

Classes in the MRes Biomedical Engineering

Code	Class Name	Semester	Credits	Organiser
Initial Classes (one of):				
BE915	Medical science for engineering	1	20	Bernie Conway
or				
BE911	Engineering science	1	20	Phil Riches
Compulsory classes:				
BE918	Professional studies in biomedical engineering	1	10	Richard Black
BE919	Research methodology	1	10	Chris McCormick
Optional Classes (2 to be taken for MRes):				
BE916	Introduction to biomechanics	2	10	Phil Rowe
BE902	Prosthetics and orthotics	2	10	Stephan Solomonidis
BE901	Regenerative medicine	2	10	Helen Grant
BE900	Tissue mechanics	2	10	Phil Riches
BE909	Biomedical electronics	1	10	Patricia Connolly
BE904	Clinical and sports biomechanics	2	10	Phil Rowe
BE905	Biosignal processing & analysis	2	10	Heba Lakany
BE906	Biomaterials and biocompatibility	2	10	Richard Black
BE903	Cardiovascular devices	2	10	Terry Gourlay
BE908	Biomedical instrumentation	1	10	Mario Giardini
Independent research class:				
BE913	MRes Project	1, 2 and 3	120	Helen Grant

A detailed description of each class is provided in the section on Module descriptor, starting on page 22.

GENERAL NOTES

Wolfson Building Access

The normal hours of access to Wolfson Building are:

Monday to Friday 0800 to 1800 hours

Every other time is considered out-with normal working hours. Saturdays, Sundays and public holidays are considered to be out-with normal hours of access. Out of hours IT provision is available in the library.

You are not allowed in the building at any other time, except with a valid out of hours access card. An out of hours access card (RED), issued by the Department Administrator, allows access to low hazard areas only. It must be signed by the Head of Department, or their deputy and the person being granted access. These RED cards are **not** normally provided to MRes students.

Health & Safety

University Health and Safety information may be found here:

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

Essential 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, room 4.02, extension 3283 or 0141 548 3283.

Communication

Students must notify the Department and University of any change in their in-term or out-of-term addresses. The University may use these addresses for official communications and cannot be held responsible for non-delivery where a change of address is not notified.

The Department of Biomedical Engineering and the University will predominantly communicate with students using their Strathclyde email account, i.e. name@strath.ac.uk. It is students' responsibility to check this email account daily for new Departmental and University messages.

The noticeboard in the communal area on level 2 of the Wolfson Centre will also be used for Departmental communication purposes.

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. This is available from:

http://www.strath.ac.uk/staff/policies/wellbeing/nosmokingpolicy/

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

Eating and drinking are permitted in the foyer, office areas and the tea area only. Eating and drinking are not permitted in any labs, prosthetic or mechanical/Electronic workshops.

Use of Computing Facilities

Your attention is drawn to the University Regulations regarding the use of computing facilities, which can be found at http://www.strath.ac.uk/staff/policies/hr/useofcomputingfacilities/. These regulations are reproduced on pages 82.

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 Policy, Disability Policy and 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/equalityinformationforstudents/

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
Telephone: 0141 548 2811
www.strath.ac.uk/equalitydiversity/

Athena SWAN

The University 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.

Students with disabilities

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/disabilityservice/

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/disabilityservice/ddc/

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: disabilityservice@strath.ac.uk
Telephone: 0141 548 3402
www.strath.ac.uk/disabilityservice

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.

Departmental Disability Contact (DDC)

The designated DDC in the Bioengineering Unit is Dr Heba Lakany (Room 5.00C, extension 3487, 0141 548 3487).

The role of the DDC is to discuss with students with a disability, any aspect of the courses and classes offered by the Department that might relate to their special needs with a view to ensuring, as far as possible, that any necessary adjustments are identified or sought. It is important that if you feel you require any adjustments that you discuss your needs with the DDC at the earliest opportunity.

The DDC acts as a two-way channel for communication between the University's Disability Service and academic and other staff of the agreed and disclosed needs of disabled students, with due regard to the students' rights to confidentiality.

Students with disabilities are also advised to contact the University Disability Service.

Departmental Counsellors

Professor Helen Grant (Room 4.14, Wolfson Centre) and Dr Phil Riches (Room 4.01, Wolfson Centre) are counsellors within the Bioengineering Unit. Please consult with either of them if you wish to discuss confidentially any personal problems that may be affecting your studies.

The University Student Handbook

The University Student Handbook 2012-2013 is available to download from

www.strath.ac.uk/media/ps/sees/informationandadviceteam/student_handbook.pdf

and it contains a wealth of useful information relating to facilities and services offered to students by the University, including

- Getting Started
- On Campus
- Living In Glasgow
- International Community
- The Students' Association
- Student Business
- Advice and Support
- Policies and Regulations

Within these pages you can find information on the

- Centre for Sport and Recreation
- Student Advice Centre
- Student Counselling
- ASK (Advice, Support, Knowledge) Service run by the Student's Union
- Disability Service
- Student Health Service
- Chaplaincy

COURSE INFORMATION

Class Requirements

At the start of each class, the organiser will specify the level of skills necessary (e.g. in mathematics). Voluntary maths tuition is offered in week 1, however further mathematical work may be required in particular classes.

Attendance

It is expected that you will attend the University during all normal working days, i.e.

Monday to Friday 0900 to 1700 hours

When you have a taught class timetabled, it is expected that you to attend that class. . The attendance requirements for PGT elements of the course are 75% of lectures, and 90% of laboratory classes, unless there is a valid reason for non-attendance. A student who does not satisfy the requirements as to attendance and performance will not be entitled to take the examinations in the class concerned.

Once a MRes project has been allocated to you, it is expected that the majority of time out with taught curriculum will be devoted to the project. Notwithstanding that requirement, project supervisors will understand the need for taught class independent study, coursework and revision.

Taught classes examination procedure

Class examination will usually be by written examination coupled with tutorial or homework assignments. Some classes require the submission of laboratory reports for assessment. The class organiser will give details of the examination procedure and dates for completion of assignments at the start of each class.

Project examination procedure

You will submit a thesis which normally will be orally examined by an external (i.e. out with the Univeristy) and an internal examiner. The quality of the thesis and your performance in an oral examination will determine whether you obtain the credits for the project.

Assessment and Award of Credits

Every class will be marked on a percentage scale, with the pass mark for each class set at 50%. On achieving a mark of 50% or more for a class, the student is awarded the class credits. The taught curriculum consists of 60 credits with the project adding a further 120 credits.

Resit Examinations

Students who fail any taught class (i.e. achieve a mark of less than 50%) shall be permitted one further attempt to pass the relevant class at the August diet of examinations.

If a student fails a class at the second attempt, they will be withdrawn and no award will be made.

The award of MRes

Where a candidate has accumulated 60 credits of taught classes from the curriculum, together with 120 credits for the project, they will be awarded the MRes Biomedical Engineering.

Submission of Class Assignments and coursework

Deadlines for class assignments must be strictly observed and these will be given at the start of each class. Most assignments should be submitted as hard copies and handed in to the Departmental Office (Room 2.05) using a cover sheet available in the photocopying room. A receipt of submission will be returned to you

and you must retain this as proof of submission in the unlikely event that the coursework goes missing. Coursework submission may be required using the University's virtual learning environment, MyPlace. Please follow class instructions regarding these submissions.

Penalties for late submission of coursework

Unless there are mitigating circumstances (e.g. ill-health) work submitted after the deadline will be penalised. The penalty scheme for the late submission of assignments is as follows:

1 day late deduct 5% of mark allocated
2 days late deduct 10% of mark allocated
3 days late deduct 20% of mark allocated
4 days late deduct 40% of mark allocated
5 days late deduct 80% of mark allocated
After 5 days deduct 100% of mark allocated

This applies to working days (Mon-Fri). An extension to course submission deadlines is not normally granted without mitigating circumstances.

Submission of the MRes Project

The MRes project thesis (two copies, soft bound) should be submitted to the Departmental Office. The submission date will be in the middle of August. Late submission will mean that the thesis will not be examined in time for November graduation.

Plagiarism and Collusion

Plagiarism is taking the work of others and presenting it as your own.

Collusion is using the work of a fellow student, with his or her knowledge, and presenting it as your own.

You could be accused of plagiarism if you:

- hand in (as your own) work that was written by someone else
- copy out someone else's work and hand it in
- copy out sections of someone else's work and include it in your own submitted work without acknowledging it
- use someone else's work in any of the above ways with a few words changed

That "someone else" might be the writer of a journal article, a textbook or an internet site. It could be a fellow student, though you might then be accused of collusion. The "work" could be a whole essay, paragraph or even sentence; i.e. copying (or altering in a minor way) a complete paragraph or sentence constitutes plagiarism.

You could be accused of collusion if:

- you and another student submit identical or almost identical work

Any work submitted for assessment, e.g. essays, laboratory reports, homework and tutorial assignments, must be solely the work of the individual student or group (if a group assignment is set). If there is evidence of plagiarism or collusion, penalties may be imposed ranging from a reduction in marks, to resubmission of work or, if particularly severe, to disciplinary action. Each case of plagiarism/collusion will be discussed by an adjudication panel who will recommend an appropriate course of action. The University's guidance on plagiarism can be found using the url below. If you are in any doubt as to what constitutes plagiarism, please read this document.

http://www.strath.ac.uk/media/ps/cs/gmap/academicaffairs/policies/student-guide-to-academic-practice-and-plagiarism.pdf

Absenteeism from Laboratory Sessions

Laboratory reports submitted by a student who was absent for the relevant session will normally result in a reduced mark. Consideration will be given if the student has a valid reason for being absent.

Absence & Mitigating Circumstances

Students have an obligation to inform the University Student Experience – Student Business at the first reasonable opportunity of any medical or other circumstances which might adversely affect their attendance, performance and/or ability to study.

For absences of seven days or less: Students who have been absent from the University for seven days or less should record a self-certification online via PEGASUS using the 'Personal Circumstances' link under the Services tab. You should also inform the Course Director.

For absences of more than seven days: Where sickness results in absence of more than seven days, the student is required to submit a medical certificate (signed by a U.K. medical practitioner who is not a member of the student's family) to Student Business. You should also inform the Course Director.

For absences from an examination : The self-certification convention does not apply and a student absent from an examination due to sickness must submit a formal medical certificate. All certificates that are submitted to Student Business are kept in the student's file, and details are recorded on computer. Student Business informs the relevant departments and Board of Examiners of certificates which are relevant to a diet of examinations or the corresponding period of study, including, where appropriate, the relevant details.

The University's policy on Mitigating Circumstances that have affected a students performance in assessments leading to the final mark for a class can be found on the following webpage:

http://www.strath.ac.uk/studentlifecycle/absencemitigatingcircumstances/

Student feedback

Feedback will be provided by staff during class time, and during specific weeks in the calendar which have been allocated for this. Feedback may be in the form of marks, written comments or verbal assessment. Please email the course lecturer to arrange a meeting should you need particular feedback in addition to this; whilst we like to operate a friendly “open door” policy, we can not guarantee an immediate response should you just knock on someone’s door.

Students also have the opportunity to feedback their comments to staff. At the start of the academic year, we will ask for course representatives (normally 2) to be chosen from amongst the student cohort. These representatives will sit on the student-staff liaison committee (SSLC), which will sit three times a year, and comments on the course will be formally minuted and action taken where necessary.

LEARNING RESOURCES

MyPlace

The University’s virtual learning environment (VLE) is called MyPlace. It is accessed using your DS credentials via the Strathclyde homepage, or directly from:

http://classes.myplace.strath.ac.uk/

Many class resources will be available from MyPlace, however individual class tutors will inform you regarding the level of class engagement with the VLE.

Student self-development

The University provides a range of handouts that guide you through some common tasks at university. For example, reading and writing tips, grammar and language help, time management, avoiding plagiarism, making presentations, critical thinking. These can be accessed here:

http://www.strath.ac.uk/caple/studentdevelopment/forpgistudents/

The Univerity also provides online IT training for common software packages including Microsoft Office (Word, Excel, Powerpoint) and for University systems (Pegasus, Nemo, webdrives, MyPlace etc).

The online tutorials can be accessed, using your DS username and password here:

http://www.strath.ac.uk/ittraining/postgraduateittrainingservices/

Staff will assume that all students are familiar with Microsoft Office to a basic level, and can engage with all University systems.

Printing and Photocopying

You will be issued with a printer and photocopying username from the Departmental Office. You will be allocated 100 A4 black and white prints/copies free. Further black and white prints can be bought in blocks of £5 using the online shop.

http://onlineshop.strath.ac.uk/

£5 buys you 125 A4 prints. Colour prints can be also bought at 10p per print and need to be acquired separately to black and white prints.

Once you have bought your print credits, you will be offered a receipt. Please bring this receipt to the departmental office and your print credits will be added.

Library

We expect students to use the library independently as part of their daily study routine. Independent study using books and journal articles will augment class notes and facilitate a deeper understanding. A guide on how to use the library is here:

http://www.strath.ac.uk/library/usingthelibrary/libraryusers/postgradguide/

UNIVERSITY ACADEMIC YEAR 2014/2015

Week beginning	Semester	Week definition
Mon 29/09/14	Semester 1	Week 1
Mon 06/10/14		Week 2
Mon 13/10/14		Week 3
Mon 20/10/14		Week 4
Mon 27/10/14		Week 5
Mon 03/11/14		Week 6
Mon 10/11/14		Week 7
Mon 17/11/14		Week 8
Mon 24/11/14		Week 9
Mon 01/12/14		Week 10
Mon 08/12/14		Week 11
Mon 15/12/14		Week 12*
Mon 22/12/14		Vacation
Mon 29/12/14		Vacation
Mon 05/01/15	Sem 1 Exams	Revision Week
Mon 12/01/15		Exam Week
Mon 19/01/15		Exam Week
Mon 26/01/15	Semester 2	Week 1. Start of MRes project research period
Mon 02/02/15		Week 2
Mon 09/02/15		Week 3
Mon 16/02/15		Week 4
Mon 23/02/15		Week 5
Mon 02/03/15		Week 6*
Mon 09/03/15		Week 7
Mon 16/03/15		Week 8
Mon 23/03/15		Week 9
Mon 30/03/15		Week 10
Mon 06/04/15		Vacation
Mon 13/04/15		Vacation
Mon 20/04/15		Week 11
Mon 27/04/15		Week 12*
Mon 04/05/15	Sem 2 Exams	Revision Week
Mon 11/05/15		Exam Week
Mon 18/05/15		Exam Week
Mon 25/05/15		Exam Week
Wed 05/08/15		Exam Week**
Mon 17/08/15		Exam Week**

* these weeks are project/class feedback weeks (see timetable section)

It is expected that MRes students engage with their project from the moment of allocation at the start of Semester 1.

**exam weeks for examining classes previously failed, or discounted due to mitigating circumstances.

KEY DATES

September	29	University Closed
	30	Welcome Address, 9am, Conference Room, Wolfson Building
October	01	Student interviews to determine class choices
	01	Student photographs
	02	Access cards issued
	03	Welcome Reception for new students (4pm).
	06	Start of teaching block 1 – medical and engineering science
November	07	End of teaching block 1
	10	Start of teaching for block 2 - compulsory classes
	12	Student project choices submitted
	07	Student interviews to determine semester 2 classes
December	12	End of teaching for block 2.
	15-18	Feedback and project week
	14	End of semester party (tbc)
	22	Christmas vacation starts
	24	University Closes (to 5th January)
January	05	University Opens - revision period starts
	07	Staff Student Liaison Committee (tbc)
	05	Exam period starts
	26	Start of teaching block 3 - optional classes. Start of project period for MRes students
February	04	Internal Exam Board (tbc)
	tbc	Post exam board progress interview
	20	Deadline for submission of project abstract MRes
March	02	Feedback and project week
	06 (TBC)	Student presentations of research projects(MSc & MRes)
	09	Restart of teaching for block 3
April	03	University closed
	06	Start of Spring Vacation, University closed
	20	Restart of teaching for block 3
	24	End of teaching for block 3
	27-01	Feedback and project week, University closed 6-17 April, Easter
May	01	Deadline for hand-in of research project chapters (lit review + methodology etc)
	04	Revision week
	04	University closed
	06	Staff Student Liaison Committee (tbc)
	11	Start of exam period
	25	University closed
June	01	Start of full-time work on all Masters and PgDip research projects
	tbc	External Exam Board
	tbc	Post exam board progress interview
July	18	University closed
	21	University closed
August	05	Staff Student Liaison Committee (tbc)
	05	Start of resit examinations
	tbc	Deadline for hand-in of Masters theses (tbc)
	14	Start of oral examinations
September	tbc	External exam board
	28	University closed
	29	Start of teaching block 1 - medical and engineering science
	25	Deadline for enrolment with Registry for graduation in November (tbc)
October	02	Final date for approval of postgraduate awards (tbc)

TIMETABLE

Please find your timetable on the following pages. The timetable may be subject to change.

There is a separate timetable for the first week of the first semester. It is important you attend on Tuesday morning at 9am. This week contains revision mathematics classes which are open to all, however those from a Life Science background are particularly encouraged to attend. These classes are not examined, but should provide you with the minimum mathematical content required for the taught classes.

Weeks 2 to 6 consist of either Engineering Science (for those with a life science background) or Medical Science (for those with a Engineering or Physical Science background). A brief discussion will be had in week 1 with a member of staff as to which class you should attend.

Weeks 7 to 11 of semester 1 contain the two remaining compulsory classes for the MRes Biomedical Engineering and Biomedical Electronics and Biomedical Instrumentation. Week 12 is set aside for project work and class feedback and revision sessions. In addition to class-specific coursework, these classes will be examined in the January exam diet starting 5 January 2015.

Semester 2 contains all the optional classes. These will be chosen at some point during semester 1. Class feedback weeks occur in weeks 6 and 12.

The following pages detail the individual class timetables within these weeks. Further breakdown of classes will be given in class where appropriate.

Semester 1

Week 1

	9-10	10-11	11-12	12-1	1-2	2-3	3-4	4-5
Monday								
Tuesday	Welcome Talk		Departmental & Campus Tour (student led)			Maths class (exps and logs)		
Wednesday	Maths class (trigonometry)		Departmental Research overview + project list			Student Interviews	Photos	
Thursday	Maths class (differentiation)		Library visit		Access cards	Maths class (integration)		
Friday	Maths class (vector algebra)			Maths class (matrices)				Welcome Party

Weeks 2 to 6

	9-10	10-11	11-12	12-1	1-2	2-3	3-4	4-5
Monday	Engineering Science		Medical Science		Engineering Science		Medical Science	
Tuesday	Medical Science		Engineering Science		Medical Science		Engineering Science	
Wednesday	Engineering Science		Medical Science					
Thursday	Engineering Science		Medical Science		Engineering Science		Medical Science	
Friday	Medical Science		Engineering Science					

Please note that Monday 29th September is a public holiday (in week 1)

Semester 1 continued

Weeks 7 to 11

	9-10	10-11	11-12	12-1	1-2	2-3	3-4	4-5
Monday	Res. Meth. (GH542)		Introduction to Bio Mechanics			Professional Studies in Biomedical Engineering		
Tuesday		Biomedical Electronics			Biomedical Instrumentation		Res. Meth. (LT501)	
Wednesday	P. S. Biomedical Engineering		Biomedical Instrumentation			Res. Meth. (JA502)		
Thursday	Biomedical Electronics		P.S.B.E.			Introduction to Biomechanics		
Friday	Biomedical Instrumentation		Biomedical Electronics					

Week 12

	9-10	10-11	11-12	12-1	1-2	2-3	3-4	4-5
Monday	Project work							
Tuesday	Project work		Research Methods feedback session			Project work		
Wednesday	Project work		Biomedical Electronics feedback session					
Thursday	Project work		Biomedical Instrumentation feedback session			Introduction to Biomechanics feedback session		
Friday	Project work		P. S. Biomedical Engineering feedback			Project work		End of semester party (tbc)

Semester 2

Semester 2

Weeks 1 to 5 and 7 to 11

	9-10	10-11	11-12	12-1	1-2	2-3	3-4	4-5
Monday		R. Med. & Tiss. Eng.			Prosthetics & Orthotics		Cardiovascular devices	
Tuesday	Biosignal Processing & Analysis					Clinical and Sports Biomechanics		
Wednesday	Tissue Mechanics		Biomaterials & Biocompatibility					
Thursday		Regen. Med. & Tiss. Eng.				Tiss. Mech.	Seminars	
Friday	Cardio. Dev.	P & O			Biomat & Biocomp.			

Weeks 6 and 12

	9-10	10-11	11-12	12-1	1-2	2-3	3-4	4-5
Monday	Project work							
Tuesday	Biosignal Processing feedback session					Project work		
Wednesday	Tissue Mechanics feedback session		Biomaterials feedback session					
Thursday	Regen. Med. feedback session		P & O feedback			Project work		
Friday	Clinical & Sports Biomechanics feedback		Cardiovascular devices feedback			Project work		

Biomedical Engineering

MRes in Biomedical Engineering

[These regulations are to be read in conjunction with Regulations 20 and 20.4]

Admission

20.42.1 Regulations 20.4.1 and 20.4.2 shall apply.

Duration of Study

20.42.2 Regulations 20.4.5 and 20.4.6 shall apply.

Mode of Study

20.42.3 The course is available by full-time and part-time study.

Credit Transfer and Recognition of Prior Learning

20.42.4 At the discretion of the Head of Department, **or Course Director** credit transfer and RPL may be granted for up to 34% of the course.

Curriculum

20.42.5 All students shall undertake an approved curriculum as follows:

Compulsory Classes Level Credits
BE918 Professional Studies in Biomedical Engineering 5, 10
BE919 Research Methodology 5, 10
MRes Project 5, 120
Either
BE911 Engineering Science 5, 20
or
BE915 Medical Science for Engineering 5, 20
dependent on the academic background of the student and chosen after consultation with the Course Director.
Optional Classes
No fewer than 20 credits chosen from:
BE916 Introduction to Biomechanics 5, 10
BE902 Prosthetics and Orthotics 5, 10
BE901 Regenerative Medicine & Tissue Engineering 5, 10
BE900 Tissue Mechanics 5, 10
BE909 Biomedical Electronics 5, 10
Be904 Clinical and Sports Biomechanics 5, 10
BE905 Bio-signal Processing and Analysis 5, 10
BE906 Biomaterials and biocompatibility 5, 10
BE903 Cardiovascular Devices 5, 10
BE908 Biomedical Instrumentation 5, 10

Examination, Progress and Final Assessment

20.42.6 Candidates are required to pass written examinations and to perform to the satisfaction of the Board of Examiners in the course work and in the project.

20.42.7 Candidates will normally be expected to perform to the satisfaction of the Board of Examiners in the **compulsory** taught components of the course before being permitted to proceed to the project.

20.42.8 Candidates who fail to satisfy the Board of Examiners in any taught class shall be permitted one further attempt to pass the relevant class(es) normally in the same academic year.

Award

20.42.9 **Degree of MRes**: In order to qualify for the award of the degree of MRes in Biomedical Engineering, a candidate must have performed to the satisfaction of the Board of Examiners and must have accumulated no fewer than 180 credits, of which 120 must have been awarded in respect of the project.

Transfer

20.42.10 A candidate who fails to satisfy the progress or award requirements for the degree of MRes in Biomedical Engineering may be transferred to the Postgraduate Certificate in Biomedical Engineering provided the appropriate progress regulations are satisfied.

MODULE DESCRIPTORS

The following pages detail the individual classes (modules) that may be taken as part of the MRes Biomedical Engineering.

They are in numerical order, according to their class code (beginning BE…)

BE900	Tissue mechanics
BE901	Regenerative medicine
BE902	Prosthetics and orthotics
BE903	Cardiovascular devices
BE904	Clinical and sports biomechanics
BE905	Biosignal processing & analysis
BE906	Biomaterials and biocompatibility
BE907	Project
BE908	Biomedical instrumentation
BE909	Biomedical electronics
BE911	Engineering science
BE912	Anatomy and physiology
BE914	PgDip biomedical engineering dissertation
BE915	Medical science for engineering
BE916	Introduction to biomechanics
BE918	Professional studies in biomedical engineering
BE919	Research methodology

MODULE DESCRIPTION FORM

BE900 Tissue Mechanics

Module Registrar: Philip Riches	**Taught To (Course):** MSc Biomedical Engineering, MRes Biomedical Engineering, EngD Medical Devices, MSc Medical Devices	
Other Lecturers Involved:	**Credit Weighting:** 10	**Semester:** 2
Assumed Prerequisites: None	**optional**	**Academic Level:** 5

Module Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Project	Assignments	Private Study	**Total**
12	12	12		12	52	100

Educational Aim

This module aims to provide an introduction to the mechanical properties of human tissue using a PBL approach. With the aid of an existing finite element (FE) model of the knee, students will virtually dissect the knee joint indentify the different tissue types in the knee. Discussion will take place to determine how to incorporate the material properties of the different tissues into the model. A Journal "club" will be used to discuss recent literature, informing and directing students in perform appropriate experimental methods to determine the mechanical properties, which can then be incorporated into the FE model. A fully working FE knee joint will be the objective of the class.

Learning Outcomes

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

LO1 describe the relationship between the mechanical functioning and the microstructure of the main tissues of the knee

LO2 understand the legal, ethical and methodological issues involved of mechanical testing tissue

LO3 search, collate and digest current literature on the mechanical properties of tissue

LO3 critically appraise current experimental and modelling approaches to the above tissues

(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:

Law, Ethics and Safety associated with handling tissue

Bone

Cartilage

ligaments

Linear viscoelasticity theory as applied to biological tissue

Linear biphasic (poroelasticity) theory as applied to biological tissue

The laboratories will be student led. Students will devise the precise nature of the tests, supported and advised by staff, but it is envisaged that tension testing of bone and ligaments will occur, compression testing of articular cartilage; indentation testing and permeation tests may also occur.

Journal clubs will be facilitated by require individual presentations on a research synthesis of appropriate literature and subsequent discussion.

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 relationship between the mechanical functioning and the microstructure of the main tissues of the knee.

C1 Describe the relationship between the mechanical functioning and the microstructure of compact and trabecular bone.

C2 describe the relationship between the mechanical functioning and the microstructure of articular cartilage

C3 Describe the relationship between the mechanical functioning and the microstructure of ligaments.

LO2 Understand the legal, ethical and methodological issues involved of mechanical testing tissue.

C1 Be cognisant of the legal framework in Scotland and in the UK regarding tissue testing.

C2 Be aware of the ethical issues regarding the collection of human tissue.

C3 Have working experience of the methodological difficulties of testing such tissue.

LO3 Search, collate and digest current literature on the mechanical properties of tissue.

C1 Be able to identify pertinent research literature regarding a specific question in this field.

C2 Understand and contextualise the literature within the development of understanding in this area.

LO4 Critically appraise current experimental and modelling approaches to the above tissues.

C1 Semonstrate a critical knowledge in this area through journal club.

C2 Apply this knowledge in the development of methodologies to test tissue.

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/)

Please state briefly how these are incorporated in this module.

One exam, one piece of coursework (laboratory write up) and one presentation (research synthesis and critique) will be used for assessment purposes. The weighting of each assessment will be between 20% and 60% and chosen by each student, adding up to 100%. Thus the assessment will be completely individualised and shaped by each student. The use of a journal discussion will foster a sense of learning community.

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

Examinations			**Courseworks**		**Projects**	
Number	Duration	Weighting	Number	Weighting	Number	Weighting
1	1 hr	20-60	2	20-60		
LO1, LO2			LO1, LO2, LO3, LO4			

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

Coursework / Submissions deadlines:
Lab report week 9. Presentation week 11 (semester 2)

Resit Assessment Procedures: students will reattempt/resubmit failed assessments in August

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 of exam and coursework.

Recommended Reading

Nigg B., Herzog W. Eds. (1999) Biomechanics of the musculoskeletal system. John Wiley & Sons

Cowin SC, Doty SB (2007) Tissue Mechanics, Springer

Some up to date research articles will be provided for class discussions and students will be expected to find many more.

Additional Student Feedback

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

Date	Time	Room No.
Wednesday, weeks 6 and 12, Semester 2	9-11	WC/213

MODULE DESCRIPTION FORM

BE901 Regenerative Medicine & Tissue Engineering

Module Registrar: Professor Helen Grant	**Taught To (Course):** MSc/PgDip/PgCert Biomedical Engineering; EngD Medical Devices	
Other Lecturers Involved: Dr RA Black plus invited guest lecturers	**Credit Weighting:** 10	**Semester:** 2
Assumed Prerequisites: BE915 Medical Science or a Life Sciences Degree	**Optional class**	**Academic Level:** SHE 5

Module Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Project	Assignments	Private Study	Total
24	4			22	50	100

Educational Aim

To describe the developments and advances in regenerative/repair medicine in terms of

- Source of cells
- Cell expansion/seeding and bioreactor technology
- Tissue scaffolds: design criteria, fabrication and characterisation
- Clinical status of replacement tissues and organs

Learning Outcomes

On completion of the module the student is expected to:

LO1 Appreciate the difficulties in sourcing a suitable supply of cells to produce artificial organs and tissues.

LO2 Understand the importance of mass transfer and membrane transport in relation to cell expansion and the design of bioreactors in general.

LO3 Know the characteristics required of materials used for scaffolds in tissue engineering, and how their physical properties can be measured.

LO4 Have discovered the most recent advances in regeneration and repair of cartilage; skin; pancreas; liver; neural tissue and retina

(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:

- Sources of cells for tissue replacement and repair – primary and immortalised cells and stem cells.
- Differentiation of stem cells into functional tissue cells in vitro and in vivo.
- Bioreactor technology and design, including principles of mass transfer, oxygenation and the supply of nutrients and removal of waste products; membrane transport.
- Scaffolds for 2-D and 3-D tissue engineering- effects of surface chemistry and physical properties on adhesion; porosity and its effect on cell distribution and vascularisation.
- Mechanical characterisation of engineered tissues.
- Advances in the replacement of organs and tissues including– cartilage; skin; pancreas; liver; neural tissues and retina.

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 difficulties in sourcing a suitable supply of cells to produce artificial organs and tissues.

C1 Know the different options for supply of cells and their advantages and limitations.

C2 Understand the sources for stem cells and their advantages and limitations.

LO2 Understand the importance of mass transfer, oxygen and nutrition supply, and membrane transport in the design of bioreactors.

C1 Understand the process of mass transfer and how it is affected by diffusion and convection.

C2 Be aware of how oxygen and nutrients are supplied to bioreactor environments.

C3 Understand basic membrane transport processes.

LO3 Know the characteristics required of materials used as scaffolds in tissue engineering, and how their physical properties can be measured.

C1 Appreciate how cell adhesion to materials can be influenced by chemical and physical properties of materials, and the conditions under which cells/materials are cultured *in vitro.*

C2 Know how the mechanical properties of engineered tissues can be measured, and manipulated.

C3 Understand the importance of porosity and interconnectivity in scaffolds.

LO4 Have discovered the most recent advances in replacement/repair of cartilage; skin; pancreas; liver; neural tissue and retina.

C1 Know the anatomy, physiology and function of the tissues which are being repaired.

C2 Learn about the source of cells to be used and the options for scaffolds available for each tissue/organ.

C3 Appreciate the stage of development of the engineered tissues aiming towards clinical therapy.

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/)

Please state briefly how these are incorporated in this module.

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.

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

Examinations			**Courseworks**		**Projects**	
Number	Duration	Weighting	Number	Weighting	Number	Weighting
1	2 hrs	70	1	30		
LO1, LO2, LO3, LO4			LO1, LO2, LO3, 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 and submitted in week 10.

Resit Assessment Procedures:

Failed coursework shall be submitted prior to a resit at the next available exam diet. Failed examinations will be attempted again at the August resit diet.

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 and coursework as required.

Recommended Reading:

Journal papers will be used to illustrate the most recent advances in regeneration and repair of tissues in animals and humans. The most recent literature review articles will be used to provide state-of –the- art information on the topics.

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

Date	Time	Room No.
Thursday, weeks 6 and 12, semester 2	9-11	CW/213

MODULE DESCRIPTION FORM

BE902 Prosthetics and Orthotics

Module Registrar: Prof. P. Rowe	**Taught To (Course):** MSc Biomedical Engineering; MRes Biomedical Engineering; MSc/EngD Medical Devices	
Lecturers Involved: S. Solomonidis; various members of NCPO	**Credit Weighting:** 10	**Semester:** 2
Assumed Prerequisites: BE916 Introduction to Biomechanics, or equivalent as deemed suitable by the Course Director	**Optional**	**Academic Level:** SHE 5

Module Format and Delivery (hours):

Lectures	Tutorial	Laboratory	Project	Assignments	Private Study	Total
30	7	5	0	12	46	100

Educational Aim

This module aims to demonstrate to students how biomechanical principles can be applied to the design, manufacture, fitting procedures and evaluation of prostheses, orthoses and other devices externally applied to the body of patients in need of rehabilitation. It is hoped that students taking this module should be able to join manufacturing companies, research groups or clinical teams responsible for the delivery of such systems.

Learning Outcomes

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

LO1 Demonstrate knowledge and understanding of the biomechanical principles as applied to the design of prosthetic/orthotic (P&0) devices and other rehabilitation aids.

LO2 Demonstrate knowledge and understanding of device selection criteria to suit various pathologies presented, manufacturing and fitting processes, and clinical practice.

LO3 Demonstrate knowledge and understanding of the experimental and analytical procedures used to determine relevant kinematic and kinetic parameters which allow the function, strength and safety in use of the devices to be evaluated.

LO4 Discuss design aspects and improvements of prosthetic and orthotic 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.)

The module will teach the following:

Lower limb prosthetics: Study of conventional and modern types of prostheses. This will cover prosthetic sockets, feet, ankle/ knee/ hip joints, alignment devices, cosmetic restoration and suspension systems. Biomechanical analyses related to function, comfort and strength aspects will be discussed. Socket design, alignment, fitting procedures and techniques, gait analysis.. Analysis of swing and stance mechanisms.

Lower limb and spinal orthotics: Indications, principles, biomechanics and construction, patient matching, load analysis will be discussed.

Upper limb prosthetics: Body and externally powered.

Upper limb orthotics: Indications and discussion of basic types.

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 the biomechanical principles as applied to the design of prosthetic/orthotic (P&0) devices and other rehabilitation aids.
C1 Describe the mathematical principles of static and dynamic mechanical analysis as appropriate to P&O.
C2 Use the mathematical principles to solve problems in P&O.

LO2 Demonstrate knowledge and understanding of device selection criteria to suit various pathologies presented, manufacturing and fitting processes, and clinical practice.
C1 Describe pathologies requiring P&O intervention.
C2 Describe the types of P&O required to address the clinical treatment of each pathology.
C3 Describe the manufacturing and fitting process of each P&O.

LO3 Demonstrate knowledge and understanding of the experimental and analytical procedures used to determine relevant kinematic and kinetic parameters which allow the function, strength and safety in use of the devices to be evaluated.
C1 Describe mechanical testing of P&Os.
C2 Describe modelling of P&Os.
C3 Describe how the obtained P&O parameters assess the function of the P&O.

LO4 Discuss design aspects and improvements of prosthetic and orthotic devices.
C1 Synthesise the above knowledge to demonstrate a holistic understanding of P&O.
C2 Utilise overall understanding to knowledgeably discuss P&O designs.
C3 Utilise overall understanding to knowledgeably suggest P&O design improvement.

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/)

Please state briefly how these are incorporated in this module.

Assessment is carried out by means of an examination paper and 2 assignments which are to be handed in. See below for details. 7 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 Feedback will be obtained through a structured questionnaire form and voluntary group discussion at the conclusion of the course.

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

Examinations			**Coursework**		**Projects**	
Number	Duration	Weighting	Number	Weighting	Number	Weighting
1	2 hrs	70%	2	30%	0	0
LO1, LO2, LO3			LO1, LO2, LO3, LO4			
Indicate which learning outcomes (L01, L02 etc) are to be assessed by exam/coursework/project as required.						

Coursework / Submissions deadlines:
First assignment should be handed in week 7 and the second one in week 12. Assignments will have been set 3 week prior.

Resit Assessment Procedures:
A resit examination paper will be set for the August diet.

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.

Recommended Reading:
There are no recommended text books for this class. Handouts will be given throughout the course and students will be directed to appropriate supplementary reading material.

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

Date	Time	Room No.
Thursday weeks 6 and 12, semester 2	11-1	WC/213

MODULE DESCRIPTION FORM

BE903 Cardiovascular Devices

Module Registrar: Professor T. Gourlay	**Taught To (Course):** MSc Biomedical Engineering; MRes Biomedical Engineering; MSc/EngD Medical Devices	
Other Lecturers Involved: Dr. Laurie Shedden (Vascutek), Mr Mark Danton (Yorkhill Hospital), Mr. Fraser Sutherland (Golden Jubilee Hospital), Professor David Wheatley, Mr Douglas McIvor (MHRA)	**Credit Weighting:** 10	**Semester:** 2
Assumed Prerequisites:	**optional**	**Academic Level:** SHE 5

Module Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Project	Assignments	Private Study	Total
20	5	5	20	20	30	100

Educational Aim

This module aims to:

- Give students a broad overview of cardiovascular devices used in the clinical setting for the treatment of a range of clinical conditions.
- Demonstrate and develop an understanding of the clinical, design and regulatory challenges involved in developing devices for this clinical sector.
- Offer some insight into the pathologies underlying the need for cardiovascular device technologies.

Learning Outcomes

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

LO1 Understand the important elements of cardiopulmonary bypass and support systems.
LO2 Recognise the challenges, in terms of biocompatibility, associated with implantable and extracorporeal cardiovascular devices.
LO3 Understand the different and emerging valve replacement options available to clinicians.
LO4 Understand the different types and applications of VAD technologies.

Syllabus

The module will teach the following:

- The history and principals of Cardiopulmonary Bypass (CPB)
- The design, development and clinical applications of Extracorporeal Membrane Oxygenation (ECMO).
- The history and design of conventional artificial heart valves.
- The challenges and advantages of the percutaneous approach to heart valve replacement.
- The history, current status and clinical challenges associated with the use of ventricular assist devices (VADs)
- History, current status and future of cardiovascular stents.
- The regulatory process governing the clinical deployment of cardiovascular devices and materials.
- Aspects of safety related to the clinical use of cardiovascular devices.
- An individual project around the design of a safety enhanced system for extracorporeal life support.

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 important elements of cardiopulmonary bypass and support systems

C1 Describe the main components of a CPB system and the equations used to calculate heat and oxygen transfer in a counter-current device.

C2 Explain the difference between CPB and ECMO with reference to the technologies employed.

C3 Describe the devices and techniques employed to ensure safe use of CPB and ECMO technologies.

LO2 Recognise the challenges, in terms of biocompatibility, associated with implantable and extracorporeal cardiovascular devices.

C1 Explain the in terms of blood/tissue/biomaterial contact, the inflammatory response to cardiovascular devices.

C2 Describe the techniques employed to enhance biocompatibility of cardiovascular devices.

C3 Explain the major clinical effects of bio-incompatibility in patients undergoing ECMO procedures.

LO3 Understand the different valve replacement options available to clinicians.

C1 Describe the different types of conventional artificial heart valves.

C2 Describe the different types of percutaneous artificial heart valves.

C3 Describe the limitations, advantages and drivers associated with the development and deployment of percutaneous heart valves.

LO4 Understand the different types and applications of VAD technologies.

C1 Describe the different types of VAD devices.

C2 Explain the different techniques used to deploy VAD devices and how these effect patient mobility and the treatment cycle.

C3 For a given clinical condition, select the appropriate VAD device and mode of use.

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/)

Student feedback will be obtained through interaction during tutorial sessions associated with the project work. Examination will be by closed book examination, but further assessment will be undertaken through assessment of assignments and individual project reports.

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

Examinations			Courseworks		Projects	
Number	Duration	Weighting	Number	Weighting	Number	Weighting
1	2 hrs	60%	3	15% (3x5%)	1	25%
LO1, LO2, LO3, LO4			LO1, LO2, LO3		LO1, LO2, LO3, LO4	
Indicate which learning outcomes (L01, L02 etc) are to be assessed by exam/coursework/project as required.						

Coursework / Submissions deadlines:

Three coursework assignments will be set in weeks 3, 7, 9 with submission in two weeks. A project will be set in week 5, with submission in week 12.

Resit Assessment Procedures:

Examination only

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. For details of this re-examination see above.

Recommended Reading:

Materials and Devices of the Cardiovascular System.(Gourlay and Black eds). Woodhead Publishing Ltd, Cambridge, UK

Minimized Cardiopulmonary Bypass: Technologies and Applications (Gourlay and Gunaydin eds). Woodhead Publishing Ltd, Cambridge, UK

Additional Student Feedback

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

Date	Time	Room No.
Friday week 6 and 12	11-1	WC/213

MODULE DESCRIPTION FORM

BE904 Clinical and Sports Biomechanics

Module Registrar: Prof Philip Rowe	**Taught To (Course):** MSc Biomedical Engineering; MRes Biomedical Engineering; MSc/EngD Medical Devices	
Other Lecturers Involved: Dr Philip Riches Dr Andy Kerr & Visiting Lecturers	**Credit Weighting:** 10	**Semester:** 2
Assumed Prerequisites: BE916 Introduction to Biomechanics	**optional**	**Academic Level:** SHE 5

Module Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Project	Assignment	Private Study	Total
16		8		20	56	100

Educational Aim

This module aims to provide the student with the ability to appraise the role of biomechanics and biomechanical measurement techniques in the development and evaluation of clinical practice in rehabilitation and in the production and management of sports injuries. The module will also allow the student to assess the role of biomechanics and biomechanical measurement in the improvement of human function and the optimising of sports performance. The module will focus on orthopaedic and neurological issues.

Learning Outcomes

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

LO1 Employ biomechanical principles to assess qualitatively clinical and sports related performance

LO2 To appraise different biomechanical measurement technologies and to compare their strengths and weeknesses in different measurement settings

LO3 To evaluate the role of biomechanics in the management of hard and soft tissue injury and the development of orthopaedic practice in clinical and sports arenas

LO4 Evaluate the role of biomechanics in understanding clinical and sports practice and judge its likely impact on the design of medical, rehabilitation, and sports technology and on the design, implementation and evaluation of rehabilitation technology services.

(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:

Revision of newtons laws, kinematics and kinetics

Nine things to measure in relation to movement

Measurement equipment deployed in biomechanics

Bone material properties

Fractures

Fracture fixation

Hip Arthroplasty

Knee arthroplasty

Knee and ankle ligament repair

Arthroscopy and meniscus repair

Imaging for surgery

Computer assisted surgery

Navigation in surgery

Robotic Surgery in orthopaedics

Functional outcome in Arthroplasy and aging

Neurological control of movement

3D biomechanics and surgery in cerebral palsy

Casting for stroke

Robotic rehabilitation in stroke

Sports performance and enhancement

Sports injury

Sports injury prevention

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 Employ biomechanical principles to assess qualitatively clinical and sports related performance.

C1 Comprehend and apply the concepts of forces, moments, displacement, velocity & acceleration in both linear and angular contexts and how they are related by Newtons laws

C2 Create suitable qualitative analyses of clinical and sports related tasks.

C3 Construct suitable analytical solutions for these problems using words and pictures.

LO2 To appraise different biomechanical measurement technologies and to compare their strengths and weeknesses in different measurement settings.

C1 To comprehend the different types and complexities of biomechanical measurement technologies and what ther record.

C2 To deploy suitable biomechanical measurement techniques in an efficient manner to relevant movement issues using judgement as to the best tool for the job.

C3 To evaluate the results of these measurement techniques and interpret their implications for human movement and health.

LO3 To evaluate the role of biomechanics in the management of hard and soft tissue injury and the development of orthopaedic practice in clinical and sports arenas.

C1 To comprehend the biomechanical consequences of loading on the musculo-skeletal system.

C2 To appraise biomechanical orthopaedic technologies for the repair of the boney deficits caused.

C3 To appraise biomechanical orthopaedic technologies for the repair of soft tissue deficits caused.

LO4 Evaluate the role of biomechanics in understanding clinical and sports practice and judge its likely impact on the design of medical, rehabilitation, and sports technology and on the design, implementation and evaluation of rehabilitation technology services.

C1 To appraise the role biomechanics has played in the understanding of clinical practice and sport performance.

C2 To appraise the role biomechanics has played in advancing clinical practice and sports.

C3 To estimate its likely future impact on clinical practice and sports.

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

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

Please state briefly how these are incorporated in this module.

An e-learning moodle website will be used to facilitate learning , assessment and feedback . The website will include all teaching material, powerpoint copies of lectures, examples and solutions, a previous exam paper with answers and suggested links to other learning resources. The website will also included pre module revision information and suggestions for further reading. (p2, p3, p4,p6,p7,p10, p11). Assignments will be directly relevant to current material (p1, p2,p5) and a feedback sheet giving the marks will be used to return performance to students(P1, p4,p5). Interaction between staff and students and dialogue relating to delivered material will be encouraged in lectures and laboratories (P6) and an online chat facility will be included in the web package (P6,p7,p10) Clear instructions will be given to students regarding the assignments in both written and verbal format, (p5).

1. Help clarify what good performance is.
2. Encourage 'time and effort' on challenging learning tasks.
3. Deliver high quality feedback information that helps learners self-correct.
4. Provide opportunities to close any gap between current and desired performance.
5. Ensure that summative assessment has a positive impact on learning.
6. Encourage interaction and dialogue around learning (peer and teacher-student)
7. Facilitate the development of self-assessment and reflection in training
8. Give choice in the topic, method, criteria, weighting or timing of assessments
9. Involve students in decision-making about assessment policy and practice
10. Support the development of learning communities
11. Encourage positive motivational beliefs and self-esteem
12. Provide information to teachers that can be used to shape teaching.

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

Examinations			Courseworks		Projects	
Number	Duration	Weighting	Number	Weighting	Number	Weighting
0	0	0	2	1005	0	0
			LO1, LO2, LO3, LO4			

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

Coursework / Submissions deadlines:

The class will be taught over 12 weeks of semester 2.
Assignment 1 submitted at end of week 6 of module
Assignment 2 submitted at end of week 12 of module

Resit Assessment Procedures:

Coursework resubmission prior to August exam Diet

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 prior to and during the August diet. This re-examination will consist entirely of coursework resubmission and resit exam.

Recommended Reading:

Research methods in biomechanics

D. Gordon E. Robertson 1950-

Champaign, IL : Human Kinetics c2004

Main Library 6 Week Loan (D 591.1852 RES)

Functional human movement : measurement and analysis

Brian R Durward; Gillian D Baer; Philip J Rowe

Oxford ; Boston, Mass : Butterworth-Heinemann 1999

Main Library 6 Week Loan (D 612.76 FUN)

Biomechanics of the musculo-skeletal system

Benno Maurus Nigg; W Herzog (Walter), 1955-

2nd ed. Chichester ; New York : Wiley c1999

Available at ML Main Library 6 Week Loan (D 612.76 BIO)

Basic biomechanics of the musculoskeletal system

Margareta Nordin; Victor H Frankel (Victor Hirsch), 1925-

3rd ed. Philadelphia : Lippincott Williams & Wilkins c2001

Main Library 6 Week Loan (D 612.76 NOR)

Biomechanics and motor control of human movement

David A. Winter 1930-

3rd ed. New Jersey : John Wiley & Sons 2004

ML Main Library 1 Week Loan (D 612.76 WIN)

Fundamentals of biomechanics : equilibrium, motion, and deformation

Nihat Özkaya 1956- Margareta Nordin

2nd ed. New York : Springer c1999

ML Main Library 6 Week Loan (D 612.76 OZK)

Biomechanical basis of human movement

Joseph Hamill 1946- Kathleen Knutzen

2nd ed. Philadelphia : Lippincott Williams & Wilkins c2003

Main Library 1 Week Loan (D 612.76 HAM)

Additional Student Feedback:

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

Date	Time	Room No.
Friday, weeks 6 and 12, semester 2	9-11	WC/213

Session: Feedback will also be given electronically through the module moodle e-learning package following the relevant exam board

MODULE DESCRIPTION FORM

BE905 Biosignal Processing & Analysis

Module Registrar: Dr Heba Lakany	**Taught To (Course):** M.Sc. Biomedical Engineering, MSc/Eng.D. Medical Devices, MRes Biomedical Engineering	
Other Lecturers Involved:	**Credit Weighting:** 10	**Semester:** 2
Assumed Prerequisites: Mathematics (Higher)	**Optional**	**Academic Level:** SHE 5

Module Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Project	Assignments	Private Study	Total
30 hrs	12 hrs	Non-Compulsory			58 hrs	100 hrs

Educational Aim

This module aims to familiarise students with the fundamentals and concepts of signals and systems (both continuous-time and discrete-time), and to develop a framework for processing and analysing a variety of biomedical signals and images (biosignals), including electrocardiograms (ECGs) and magnetic resonance images. Students will also develop valuable Mathcad and MATLAB signal/image processing skills, through non-compulsory self-study laboratory exercises.

Learning Outcomes

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

LO1 Understand the origin and nature of biosignals.
LO2 Have the necessary theoretical background to comprehend many important biosignal processing concepts.
LO3 Relate to important advanced biosignal processing techniques.
LO4 Have the necessary practical experience to implement a large variety of algorithms and techniques (non-compulsory self-study laboratory exercises).

(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. Signals and Systems: Background, Fourier Analysis, Laplace Transform, Data Conversion , *Z*-Transform, Examples.
2. Digital Filters: Introduction, Finite impulse response (FIR) and infinite impulse response (IIR) filters, Realisations, Frequency response, Generic design procedure, Frequency domain representations, Discrete Fourier series and discrete-time Fourier transform (DTFT), FIR digital filter design, Linear phase, Window design method, Examples.
3. Discrete Fourier Transform (DFT): Motivation, Derivation, Properties, Fast Fourier transform (FFT), Decimation-in-time algorithm, Bit reversal, Decimation-in-frequency algorithm, Examples.
4. Image Processing: Basics of medical imaging including MRI, CT, SPECT, PET and ultrasound, Image transforms, Image enhancement, Low-pass and high-pass 2-D filters, Histogram equalisation, Image segmentation, Examples.
5. Introduction to Advanced Techniques: Adaptive filtering, Artificial Neural Networks (ANNs), Time-frequency analysis, Non-linear processing, Telemedicine, Data compression, Biosignal applications.
6. Biosignal Processing: Electrocardiograms (ECGs), Seismocardiograms, Electroencephalograms (EEGs), Event-related potentials (ERPs), Sleep apnea, Diabetes, Medical ultrasound, Radiotherapy treatment planning.

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 origin and nature of biosignals.
C1 Describe the physiological basis for the main biosignals.
C2 qualitatively describe the expected "normal" biosignal.
C3 qualitatively describe the effect of health status on the biosignal.

LO2 Have the necessary theoretical background to comprehend many important biosignal processing concepts.
C1 Be able to name and describe the purpose of various biosignal processing techniques.
C2 Know when it is appropriate to apply each technique.

LO3 Relate to important advanced biosignal processing techniques.
C1 Describe qualitatively some advanced examples of biosignal processing.
C2 Qualitatively discuss the importance and role of advanced biosignal processing in their field.

LO4 Have the necessary practical experience to implement a large variety of algorithms and techniques.
C1 Describe the effect on the biosignal, using pre-written numerical routines.

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/)

Please state briefly how these are incorporated in this module.

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

Examinations			Courseworks		Projects	
Number	Duration	Weighting	Number	Weighting	Number	Weighting
2	1hr & 2 hrs	30% & 70%				
LO1, LO2, LO3, LO4						

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

Coursework / Submissions deadlines: N/A

Resit Assessment Procedures: Exam in August.

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.

Recommended Reading:

1. Ambardar, A., 1999, Analog and Digital Signal Processing (2nd Ed.), *Brooks/Cole*.
2. Denbigh, P.N., 1998, System Analysis and Signal Processing, *Addison-Wesley*.
3. Ifeachor, E.C. & B.W. Jervis, Digital Signal Processing: A Practical Approach (2nd Ed.), *Pearson Prentice Hall*.
4. Ludeman, L.C., 1987, Fundamentals of Digital Signal Processing, *Wiley*.

5. Lynn, P.A. & W. Fuerst, 1994, Introductory Digital Signal Processing with Computer Applications (2nd Ed), *Wiley*.
6. McClellan, J.H., R.W. Schafer & M.A. Yoder, 2003, Signal Processing First, *Pearson Prentice Hall*.

Additional Student Feedback:

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

Date	Time	Room No.
Tuesday, week 6 and 12, semester 2	9-11	WC/213

MODULE DESCRIPTION FORM

BE906 Biomaterials & Biocompatibility

Module Registrar: Dr Richard Black	**Taught To (Course):** MSc/PgDip/PgCert Biomedical Engineering EngD/MSc Medical Devices	
Other Lecturers Involved: Prof. MH Grant, Prof.M Stack, Drs A MacLaren & A. Galloway (MechEng)	**Credit Weighting:** 10	**Semester:** 2
Assumed Prerequisites: None	**Optional**	**Academic Level:** SHE 5

Module Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Project	Assignments	Private Study	Total
31	9			12	48	100

Educational Aim

This module aims to:

- provide fundamental information on the properties of synthetic biomaterials, and how these are evaluated experimentally and from the literature.
- outline how material properties are influenced by methods of processing.
- explore with the aid of appropriate examples what is meant by biocompatibility; provide an overview of the host responses to and interactions with biomaterials, and how these interactions are assessed and influenced by surface properties.
- introduce the principles of toxicology, identify the major toxic interactions with foreign chemicals and the protective mechanisms which enable us to survive most toxic insults. Assessment of the safety of materials according to the International Standards will be discussed.

Learning Outcomes

On completion of the module the student is expected to:

LO1 Understand the relationship between structure of metals & ceramics and their behaviour as a basis for materials selection in biomedical applications.

LO2 Have a good understanding of the concept of biocompatibility as it relates to materials for implantation into different systems of the body; and of the interactions of tissues and body fluids with materials.

LO3 Be able to identify appropriate methods to assess biocompatibility, and to understand the relevance and limitations of those assessment procedures to clinical outcomes.

LO4 Understand how to assess and quantify toxic responses to foreign chemicals.

Syllabus

The approach to metal, ceramic, composite and polymer engineering will be to integrate the description of materials in terms of their basic behaviour (brittle, ductile, plastic, elastic, viscoelastic) applied to Biomedical Engineering applications. The basic understanding will be established through examples with back-up software which will cover materials science in an interactive programme.

Manufacture of artefacts will be described in terms of basic materials behaviour governing the methods of fabrication and the consequences for use of those processing routes. Links between the properties of the materials considered, their selection, and processing will be made with reference to examples and demonstrations taken from Biomedical Engineering applications. Corrosion behaviour and the relationship between functional and structural materials will be covered in the same way.

The concept of biocompatibility will be introduced with reference to the historical uses of materials in medicine, and the many successes and failures in clinical practice. The view that biocompatibility is akin to inertness will be challenged by citing examples of materials that illicit specific responses that are appropriate for their intended application, and the specific requirements of materials for use in cardiovascular applications, Tissue Engineering and Regenerative Medicine.

Toxicology: Quantification of toxic responses; in vitro and in vivo testing for toxicity; safety evaluation of materials according to the International Standards; mechanisms of toxicity and protective mechanisms of the body; inflammation; carcinogenesis; effect of the tissues and body fluids on materials.

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 Good understanding of the concept of biocompatibility as it relates to materials for implantation into different systems of the body; and of the interactions of tissues and body fluids with materials.
C1 Ability to explain the nature of the interactions between tissues and body fluids (e.g. blood) on materials, both acute and chronic; and
C2 The manner in which surfaces properties in particular influence protein-cell-biomaterial interactions at the tissue interface.

LO3 Identify appropriate methods to assess biocompatibility, and to understand the relevance and limitations of those assessment procedures to clinical outcomes.
C1 Describe methods used to assess blood-biomaterial biocompatibility: in vitro, ex vivo, in vivo; and
C2 Explain the relevance and limitations of these assessment procedures in predicting device performance.

LO4 Understand how to assess and quantify toxic responses to foreign chemicals.
C1 Ability to describe mechanisms of toxicity and protective mechanisms of the body.
C2 Detail *in vitro* and *in vivo* testing for toxicity.
C3 Cite the relevant International Standards that apply.

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/)

Please state briefly how these are incorporated in this module.

The module comprises a combination of summative and formative assessments, making full use of the University's Virtual Learning Environment 'MyPlace'; the software 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

Examinations			Courseworks		Projects	
Number	Duration	Weighting	Number	Weighting	Number	Weighting
1	2	70%	1	30%		
LO1-4			LO1-4			

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

Coursework / Submissions deadlines:
Coursework set in week 5 and submitted in week 11 (semester 2)

Resit Assessment Procedures:
Examination

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 of an exam.

Recommended Reading:

Callister WD “Materials Science & Engineering” (Wiley: New York)

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

Dee KC, Puleo DA, Bizios R ‘An introduction to tissue-biomaterial interactions’ John Wiley & Sons

JA Timbrell 'Introduction to Toxicology' Taylor & Francis

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

Date	Time	Room No.
Wednesday Weeks 6 and 12, semester 2	11-1	WC/213

MODULE DESCRIPTION FORM

BE908 Biomedical Instrumentation

Module Registrar: Dr Mario E Giardini	**Taught To (Course):** MSc Biomedical Engineering; MRes Biomedical Engineering; EngD/MSc Medical Devices	
Other Lecturers Involved: Prof. G Corner (Ninewells Hospital, Dundee), Dr C. McCormick, Prof. P. Connolly, Mr S Solomonidis, Mr. J. McLean (Southern General Hospital), Dr M McJury (Beatson Cancer Centre	**Credit Weighting:** 10	**Semester:** 1
Assumed Prerequisites: BE915 Medical Science or BE911 Engineering Science	**Compulsory**	**Academic Level:** SHE 5

Module Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Project	Assignments	Private Study	Total
30				20	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 Understand the principles underlying basic physiological monitoring techniques and technologies.

LO2 Describe the function and makeup of basic transducer, strain gauge and biosensor systems.

LO3 Demonstrate knowledge of CT scanning and nuclear imaging including MRI, SPECT and PET from a theoretical and practical standpoint.

LO4 Describe the properties of ultrasound used as a diagnostic and blood flow measurement tool.

(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
- Basic ophthalmology equipment
- 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 Understand the principles underlying basic physiological monitoring techniques and technologies
C1 Describe the basic function of the ECG machine
C2 Describe the components of an ambulatory ECG system.
C3 Understand the source and diagnostic importance of different ECG "leads".

LO2 Describe the function and makeup of basic transducer, strain gauge and biosensor systems.
C1 Understand the principles of the Wheatstone Bridge and strain gauge measurement
C2 Describe resistance, capacitance, inductive and piezoelectric transducers.
C3 Understand the electrode theory, the Nernst equation and the Ag-AgCl electrode.

LO3 Demonstrate knowledge of CT scanning and nuclear imaging including MRI, SPECT and PET from a theoretical and practical standpoint.
C1 Understand the use of radio-isotopes in cancer care.
C2 Describe the importance of the "care plan" in patients undergoing radiotherapy.
C3 Understand the safety issues involved in radiotherapy.

LO4 Describe the properties of ultrasound used as a diagnostic and blood flow measurement tool.
C1 Understand ultrasound imaging (A,M and B modes).
C2 Describe the principles of ultrasound blood flow measurement.
C3 Describe the various transducers employed in diagnostic ultrasound.

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/)

Student feedback will be obtained through interactions 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

Examinations			**Courseworks**		**Projects**	
Number	Duration	Weighting	Number	Weighting	Number	Weighting
1		30%	6	70%		
LO1, LO2, LO3, LO4			LO1, LO2, LO3, 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 equally spaced throughout the 6 week module.

Resit Assessment Procedures: Resubmission of failed coursework and/or exam.

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. For details of this re-examination see above.

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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)*		
Date	Time	Room No.
Thursday, week 12, semester 1	11-1	WC/213

MODULE DESCRIPTION FORM

BE909 Biomedical Electronics

Module Registrar: Patricia Connolly	**Taught To (Course): MSc Biomedical Engineering, MRes Biomedical Engineering, MSc/EngD Medical Devices**	
Other Lecturers Involved: Drs Heath, O'Leary and Windmill	**Credit Weighting: 10**	**Semester: 1**
Assumed Prerequisites: BE911 Engineering Science or equivalent	**Compulsory class**	**Academic Level: 5**

Module Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Project	Assignments	Private Study	**Total**
20	5	5	20	20	30	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 mathematica 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.

12 Principles of Assessment and Feedback

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

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. 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

	Examinations			**Courseworks**		**Projects**	
	Number	Duration	***Weighting***	Number	***Weighting***	Number	***Weighting***
	1	2 hours	70%	1	5%	1	25%
L/O	LO1, LO2, LO3, LO4			LO1, LO2, LO3		LO1, LO2, LO3, LO4	

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

Coursework / Submissions deadlines:
January of the academic session
Resit Assessment Procedures: students will reattempt failed assessments for the August assessment diet

PLEASE NOTE: Students need to gain a summative mark of 40% / 50% *(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

The interdisciplinary nature of this course would require purchase of several textbooks. Thus extensive printed hand outs are supplied with detailed course notes.

Additional Student Feedback

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

Date	Time	Room No
Wednesday, Week 12, semester 1	11-1	WC/213

MODULE DESCRIPTION FORM

BE911 Engineering Science

Module Registrar: Philip Riches	**Taught To (Course): MSc Biomedical Engineering**	
Other Lecturers Involved:; S Solomonidis; M Giardini; C McCormick	**Credit Weighting: 20**	**Semester: 1**
Assumed Prerequisites: None	**Compulsory for students without an Engineering background**	**Academic Level: 5**

Module Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Project	Assignments	Private Study	**Total**
24	24	12		12	128	200

Educational Aim

This module aims to provide instruction in the areas of fundamental engineering (mechanics of rigid bodies, mechanics of deformable bodies, mechanics of fluids and electronics) for life scientists who have no formal education in the engineering sciences.

Learning Outcomes

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

LO1 Demonstrate knowledge and understanding of rigid body mechanics

LO2 Demonstrate knowledge and understanding of the mechanics of materials

LO3 Demonstrate knowledge and understanding of fluid mechanics

LO4 Demonstrate knowledge and understanding of electronics

(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:

Section 1 Mechanics of Rigid Bodies

Basic concepts – Force, moment, equilibrium

Free body diagrams, force components, acceleration

Friction, 3-D moments

Angular motion, centrifugal force, moment of inertia

Momentum, impulse, work done

Differentiation/integration. Work, energy, power

Jump laboratory – demonstration/data collection. Analysis of jump forces and impulse

Section 2 Mechanics of Deformable Bodies

Tension and Compression

Stress, strain; stress-strain relationships; elastic and plastic deformations; Young's modulus.

Yield stress, proof stress, ultimate tensile stress. Poisson's ratio. Analysis of compound bars. Tensile test laboratory.

Shear loading and torsion

Shear stress and strain; modulus of rigidity, shear strength.

Torsion of circular bars, angle of twist; polar moment of area, Analysis of compound shafts.

Bending of Beams

Bending moment and shear force distribution in beams. Calculation of bending stresses and strains, centroids and second moment of areas. Deflection of beams.

Design considerations

Failure and safety. Modes of failure. Ductile and brittle materials. Metal fatigue.

Section 3 Mechanics of Fluids

Fluids and their properties

Definitions, shear stress in a moving fluid, Newtonian and non-Newtonian fluids, viscosity.

Fluid properties – density, temperature effect on viscosity, surface tension, contact angle.

Fluid Statics

Pressure – Pascal's law for pressure at a point, variation in pressure within a static fluid.

Pressure and head. Pressure measurement techniques.

Fluid Dynamics

Basic concepts – uniform and steady flow, streamlines and stream tubes, laminar and turbulent flow, Reynolds number

Conservation of mass and energy in flow systems. Force-momentum equation. Bernoulli's equation. Analysis of flow in tubes – Poiseuille equation. Measurement of viscosity

Rheology of Blood

Factors affecting blood viscosity. Blood flow in capillaries, the Fahraeus-Lindqvist effect.

Section 4 Electronics

The Nature of Electricity

Charge, current and voltage. Voltage/current relationship across a resistive load. Ohm's Law.

Resistors in series and parallel.

Types of voltage signal: the function generator and the Cathode Ray Oscilloscope.

Capacitors and Inductors

Capacitance. Capacitors in series and parallel. Time constant.

Electromagnetic induction. Inductance and inductors.

AC Circuits

Concept of average and RMS representation of electrical power.

AC across resistive, capacitative and inductive loads. Power supplies.

Semiconductors

Semiconductors materials. Diodes and transistors. Transistor as an amplifier and as a switch.

Digital circuits.

An introduction to OP amps

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 rigid body mechanics

C1 Describe the main principles (i.e. Newton's laws) of rigid body mechanics

C2 Apply the appropriate equations to solve Biomedical Engineering-oriented problems

LO2 Demonstrate knowledge and understanding of the mechanics of materials

C1 Describe the main principles of the mechanics of materials

C2 Apply the appropriate equations to solve Biomedical Engineering-oriented problems

LO3 Demonstrate knowledge and understanding of fluid mechanics

C1 Describe the main principles of fluid mechanics

C2 Apply the appropriate equations to solve Biomedical Engineering-oriented problems

LO4 Demonstrate knowledge and understanding of electronics

C1 Describe the main principles electronics

C2 Apply the appropriate.methods to solve Biomedical Engineering-oriented 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 and Feedback

*(on Learning & Teaching web pages: www.strath.ac.uk/learnteach/informationforstaff/staff/assessfeedback/12principles/)*Please state briefly how these are incorporated in this module.

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

	Examinations			**Courseworks**		**Projects**	
	Number	Duration	***Weighting***	Number	***Weighting***	Number	***Weighting***
				8	100% (8x12.5%)		
L/O				LO1, LO2, LO3, LO4			

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

Coursework / Submissions deadlines: 8 numerical coursework questions will be set (2 fluids, 2 electronics, 2 deformable bodies, 2 rigid bodies). Each question will be required to be submitted within 2 days of setting (e.g. Monday-Wednesday, or Wednesday to Friday), so two courseworks can be completed in one week. Coursework questions shall not overlap.
Resit Assessment Procedures: exam only in August

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.

Recommended Reading

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

Additional Student Feedback

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

Tutorials will be arranged as required.

MODULE DESCRIPTION FORM

BE912 Anatomy & Physiology

Module Registrar: B. Conway	**Taught To (Course): MSc Biomedical Engineering**	
Other Lecturers Involved: A group of Research Fellows will lead the class.	**Credit Weighting: 10**	**Semester: 1 and/or 2**
Assumed Prerequisites: none	**Compulsory for students from a life science background, but without strong anatomy and physiology**	**Academic Level: 5**

Module Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Project	Assignments	Private Study	**Total**
	10				90	100

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 Identify the differences between tissues, organs and systems

LO2 Describe the basic structure and function of the skeleton, joints, muscle and nervous tissue

LO3 Describe the structure and function of the respiratory, cardiovascular, muscular and nervous systems and the co-ordination between these systems

Syllabus

The module will teach the following:

Cells, tissues, organs and systems

Anatomy

Skeleton

Joints

Muscles

Nervous system

Physiology

The cell

Energy systems

Nervous system

Muscular system

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:

[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 Identify the differences between tissues, organs and systems

C1 Name, locate and describe the anatomy and function of the main organs of the body

C2 Name, locate and describe the anatomy function of the main tissues of the body

C3 describe the operation of multiple organs in a physiological system

LO2 Describe the basic structure and function of the skeleton, joints, muscle and nervous tissue

C1 Describe the basic structure and function of the musculo-skeletal system

C2 Describe the basic structure and function of the diarthroidal joints

C3 Describe the basic structure and function of nervous tissue

LO3 Describe the structure and function of the respiratory, cardiovascular, muscular and nervous systems and the co-ordination between these systems

C1 Describe the physiology of the respiratory system

C2 Describe the physiology of the cardiovascular system

C3 Describe the physiology of the nervous system

C4 Describe the physiology of muscles

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/)*

Please state briefly how these are incorporated in this module.

It is expected that this class will only be taught when necessary, and consequently it will only be to a small number of students (< 3) each year. Thus small group teaching methods will be used with much directed learning at a pace dictated predominantly by the student, and subsequent discussion encouraging interaction and dialogue around the learning. These tutorials will provide instant feedback, ensuring the student knows what good performance is, and where they are situated in regards to this performance

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

	Examinations			**Courseworks**		**Projects**	
	Number	Duration	***Weighting***	Number	***Weighting***	Number	***Weighting***
	1	2 hr	100				
L/O	LO1, LO2, LO3, LO4						

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

Coursework / Submissions deadlines: N/A

Resit Assessment Procedures: Exam in August

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.

Recommended Reading

Marieb, E.N. Human Anatomy and Physiology. Benjamin/Cummings Pub. Co, Redwood City, 1989.

McArdle, W.D., Katch, F.I., Katch, V.L. (2001). Exercise Physiology: exercise , nutrition and human performance, (5th ed.). Baltimore Williams & Wilkins.

Norkin, C.C. & Levangie, P.K. Joint Structure and Function: a Comprehensive Analysis. F.A. Davis, Philadelphia, 1992.

Roberg, Roberts O (1997). Exercise Physiology (1st ed.). Mosby.

Scanlon, V.C., Sanders, T. (1995). Essentials of anatomy and physiology. (2nd ed.). F.A. Davis ed. Philadelphia (USA).

Sherwood, L. (2004). Human Physiology: from cells to Systems (5th ed.). USA Brooks/Cole, Thomson learning.

Vander, A.J., Sherman, J.H., Luciano, D.S. (2001). Human Physiology: The Mechanism of Body Function, (8th ed.). New York: Mcgraw-Hill.

Watkins, J. Structure and function of the musculoskeletal system. Human Kinetics: Champaign, Ill., 1999.

Wilmore J.H., Costill D.L. (2004). Physiology of Sports and Exercise, (3rd ed.) Champaign, IL, Human Kinetics.

MODULE DESCRIPTION FORM

BE913 MRes Project

Module Registrar: Helen Grant	**Taught To (Course): MRes Biomedical Engineering**	
Other Lecturers Involved: All Biomedical Engineering academic/research staff	**Credit Weighting: 120**	**Semester: 1,2 and3**
Assumed Prerequisites: None	**Compulsory**	**Academic Level: SHE 5**

Module Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Project	Assignments	Private Study	**Total**
0	0	0	600	0	0	600

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

Syllabus

The module will teach the following:

There is no formal syllabus to this module. Supervisors will guide students through an appropriate research process.

A**ssessment 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.

12 Principles of Assessment and Feedback *(on Learning & Teaching web pages: www.strath.ac.uk/learnteach/informationforstaff/staff/assessfeedback/12principles/).* Please state briefly how these are incorporated in this module

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 buzz within the Bioengineering Unit provides a motivational learning community (10) with peer-peer encouragement and support in addition to that from the supervisor.

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

	Examinations			**Courseworks**		**Projects**	
	Number	Duration	***Weighting***	Number	***Weighting***	Number	***Weighting***
	1		30%			1	70%
L/O	LO1, LO4					LO1, LO2, LO3, LO4	

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

Coursework / Submissions deadlines: End of August. An oral examination will take place in early September
Resit Assessment Procedures: Students who fail to provide a satisfactory project at the first attempt will be asked to do corrections until the supervisor deems it of suitable standard

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

	Examinations			**Courseworks**		**Projects**	
	Number	Duration	***Weighting***	Number	***Weighting***	Number	***Weighting***
						1	100
L/Outcomes						LO1, LO2, LO3, LO4	

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

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 be provided by regular discussions between student and individual supervisors

MODULE DESCRIPTION FORM

BE915 Medical Science for Engineering

Module Registrar: Prof Bernard A Conway	**Taught To (Course):** **MSc/PgDip/PgCert Biomedical Engineering** **MSc Medical Devices** **MRes Biomedical Engineering** **EngD Medical Devices**	
Other Lecturers Involved: Prof Helen Grant	**Credit Weighting: 20**	**Semester:1**
Assumed Prerequisites: None	**Compulsory for students without a life science background**	**Academic Level: SHE 5**

Module Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Project	Assignments	Private Study	**Total**
57	9	13	0	0	121	200

Educational Aim

To provide students of Biomedical Engineering with instruction in key areas of human anatomy, physiology and cell biology relevant to the advanced study of bio and clinical engineering. We aim to provide understanding of normal biological function and control as derived from scientific and clinical evidence. The course will educate students to use knowledge of normal function to better understand pathology, disease diagnosis and treatment.

Learning Outcomes

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

LO1 Have knowledge and understanding of cellular organization, function and metabolism.

LO2 Have knowledge and understanding of human anatomy in relation to each major body system and the structural composition of the human body.

LO3 Have knowledge and understanding of the main physiological systems and the control processes than underpin normal function.

(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.)

The module will teach the following:

Main theme: Normal function supplemented with information of disease states and pathologies.

Cell Biology:

Lecture classes will examine the principal features of cellular organisation, differentiation, division, signaling and metabolism, the structure and functions of the extracellular matrix and basic molecular biology. Classes will also examine the constituents of blood, the process of blood cell formation and the body's defense mechanisms.

Anatomy:

Anatomy classes will examine the structural organisation of the tissues of the human body with emphasis on the musculoskeletal system, the divisions of the nervous system and the major organ systems. The course will be supplemented by laboratory sessions to be held at The Laboratory of Human Anatomy (The University of Glasgow) in order to provide opportunities for students to directly study cadaveric tissue and gain a full appreciation of the topography and complexity of the human body.

Physiology:

Instruction in integrative physiology will introduce students to the main physiological systems and teaching will be strongly linked to lessons in anatomy. With the emphasis on function the physiological component of the course will identify the major control mechanisms that operate to regulate body function. The course will examine physiological processes at multiple levels of organization ranging from the sub-cellular to the intact human. Modern concepts and theories on membrane biophysics, neural control, sensation and movement, the cardiovascular system, the respiratory system, fluid balance and digestion will be provided. Laboratory work will explore non-invasive methods used for studying the motor system, the cardiovascular system and the 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:

[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 Have knowledge and understanding of cellular organization, function and metabolism.

C1 Describe the basic biochemistry of the metabolic processes in cells.

C2 Describe the process of cell division, differentiation and their control through signalling pathways.

C3 Describe the composition/structure of epithelial and connective tissues of the body.

C4 Describe the composition and function of blood and of the immune system

LO2 Have knowledge and understanding of human anatomy in relation to each major body system and the structural composition of the human body.

C1 Describe the relationships that exist between biological structure and function and demonstrate knowledge of anatomical terminology, body and organ topography.

C2 Report on the variety of tissue types found in the human body.

C3 Describe at micro and macro levels the structures of the musculoskeletal system and their actions

C4 Provide descriptions of the organ systems their general organisation.

LO3 Have knowledge and understanding of the main physiological systems and the control processes than underpin normal function.

C1 Understand the concept of homeostasis and its importance in biological control systems.

C2 Describe the structure and biophysics of the cell membrane and the ionic basis of the electrical activity of excitable tissues (signal generation, propagation and communication)

C3 Detail the main sensory and motor pathways within the central nervous system and describe sensory and motor function in relation to voluntary and involuntary neuronal behaviour

C4 Describe the physiology of muscle function.

C5 Describe the regulation and co-ordination of the cardiac cycle and the maintenance of the circulation.

C6 Understand the principles of gas exchange across tissues, CO_2 and O_2 transport in the blood and the regulation of ventilation.

C7 Understand the role of the kidney in fluid balance regulation.

C8 Describe the major functions of the liver and the gastrointestinal system.

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/assessfeedback/12principles/).*Please state briefly how these are incorporated in this module.

At each stage in the curriculum student engagement is encouraged through interaction with the course tutors and on discussions on key biological principles presented to students for the first time. Tutorials aim to support learning and instant feedback is provided on understanding and comprehension of course content.

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

	Class Tests			**Courseworks**		**Projects**	
	Number	Duration	***Weighting***	Number	***Weighting***	Number	***Weighting***
	4	90 min	100%				
L/O				all			

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

Coursework / Submissions deadlines:

No coursework

Resit Assessment Procedures:

If first attempt average mark over all class tests is less than 50 student will resit failed individual component exams at the next exam diet.

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 an exam.

Recommended Reading:

Fundamentals of Anatomy and Physiology; 9th Edition, Frederic H Martini & Judi L Nath. Pearson

International Edition ISBN-10: 0321545982

Additional Student Feedback

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

Tutorials will be arranged if required with individual student groups.

MODULE DESCRIPTION FORM

BE916 Introduction to Biomechanics

Module Registrar: Prof Philip Rowe	**Taught To (Course): MSc Biomedical Engineering; MRes Biomedical Engineering; MSc/EngD Medical Devices**	
Other Lecturers Involved: Mr S Solomonidis	**Credit Weighting: 10**	**Semester: 1**
Assumed Prerequisites: Degree in Physical Science/Engineering or BE911 Engineering Science	**Optional class**	**Academic Level: SHE 5**

Module Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Project	Assignments	Private Study	**Total**
16	4	4		20	56	100

Educational Aim

This module aims to provide the student with a tool set of analytical skills to enable them to undertake valid biomechanical analyses of human movement, including the science, engineering and mathematical skill to produce kinematic and kinetic analyses of human movement and the external and internal load actions experienced by humans during activity. The module will provided generic analysis skills but examples will focus primarily on human gait.

Learning Outcomes

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

LO1 Employ biomechanical principles and numerical methods to solve biomechanical problems

LO2 To formulate biomechanical analyses and to appraise the results of such analyses

LO3 To appraise current biomechanical technology and methodology and estimate future advances in such methods and technology

LO4 Evaluate the role of biomechanics in understanding human movement and judge its likely impact on the design of medical and rehabilitation devices and the implementation and evaluation of rehabilitation technologies.

(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:

Newtons laws

Body segment parameters

Force and motion analysis

Kinematics and Kinetics

Numerical analysis of displacement data

Use of load transducers

Gait and intersegmental moments

Gait demonstration/data collection

Hip force analysis

Knee force analysis

Analysis of 3-D geometry

3-D motion analysis

3-D matrix mathematics

3-D definition of human joints

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 Employ biomechanical principles and numerical methods to solve biomechanical problems

C1 Comprehend and apply the concepts of forces, moments, displacement, velocity & acceleration in both linear and angular contexts and how they are related by Newtons laws

C2 Create suitable free body diagrams of forces and moments of typical biomechanical problems

C3 Construct suitable mathematical solutions for these diagrams

LO2 To formulate biomechanical analyses and to appraise the results of such analyses

C1 To design suitable strategies for the solution of these problems

C2 To deploy the learnt mathematical techniques to solve these problems

C3 To evaluate the results of these solutions and interpret there implications for human movement and health

LO3 To appraise current biomechanical technology and methodology and estimate future advances in such methods and technology

C1 To distinguish different types of biomechanical technology and methodology

C2 To compare and contrast such technology and methodology

C3 To assess its current and future abilities and potential

LO4 Evaluate the role of biomechanics in understanding human movement and judge its likely impact on the design of medical and rehabilitation devices and the implementation and evaluation of rehabilitation technologies.

C1 To appraise the role biomechanics has played in the understanding of human movement

C2 To appraise the role biomechanics has played in advancing healthcare

C3 To estimate its likely future impact on healthcare

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/).*Please state briefly how these are incorporated in this module.

An elearning moodle website will be used to facilitate learning , assessment and feedback . The website will include all teaching material, powerpoint copies of lectures, tutorial examples and worked answers, a previous exam paper with answers and suggested links to other learning resources. The website will also included pre module revision information and suggestions for further reading. (p2, p3, p4,p6,p7,p10, p11). Assignments will be directly relevant to current material (p1, p2,p5) and a feedback sheet giving the marks will be used to return performance to students(P1, p4,p5). Interaction between staff and students and dialogue relating to delivered material will be encouraged in lectures, tutorials and laboratories (P6) and an online chat facility will be included in the web package (P6,p7,p10) Clear instructions will be given to students regarding the assignments in both written and verbal format, (p5).

1. Help clarify what good performance is.
2. Encourage 'time and effort' on challenging learning tasks.
3. Deliver high quality feedback information that helps learners self-correct.
4. Provide opportunities to close any gap between current and desired performance.
5. Ensure that summative assessment has a positive impact on learning.
6. Encourage interaction and dialogue around learning (peer and teacher-student)
7. Facilitate the development of self-assessment and reflection in training
8. Give choice in the topic, method, criteria, weighting or timing of assessments
9. Involve students in decision-making about assessment policy and practice

10. Support the development of learning communities

11. Encourage positive motivational beliefs and self-esteem

12. Provide information to teachers that can be used to shape teaching.

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

	Examinations			**Courseworks**		**Projects**	
	Number	Duration	***Weighting***	Number	***Weighting***	Number	***Weighting***
	1	2h	70%	2	30%	0	0
L/O	LO1, LO2, LO3, LO4			LO1, LO2, LO3,			

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

Coursework / Submissions deadlines: To be announced
Resit Assessment Procedures: Coursework resubmission prior to August Diet and resit exam in August diet

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 prior to and during the August diet. This re-examination will consist entirely of coursework resubmission and resit exam.

Recommended Reading

Research methods in biomechanics

D. Gordon E. Robertson 1950-

Champaign, IL : Human Kinetics c2004

Main Library 6 Week Loan (D 591.1852 RES)

Functional human movement : measurement and analysis

Brian R Durward; Gillian D Baer; Philip J Rowe

Oxford ; Boston, Mass : Butterworth-Heinemann 1999

Main Library 6 Week Loan (D 612.76 FUN)

Biomechanics of the musculo-skeletal system

Benno Maurus Nigg; W Herzog (Walter), 1955-

2nd ed. Chichester ; New York : Wiley c1999

Available at ML Main Library 6 Week Loan (D 612.76 BIO)

Basic biomechanics of the musculoskeletal system

Margareta Nordin; Victor H Frankel (Victor Hirsch), 1925-

3rd ed. Philadelphia : Lippincott Williams & Wilkins c2001

Main Library 6 Week Loan (D 612.76 NOR)

Biomechanics and motor control of human movement

David A. Winter 1930-

3rd ed. New Jersey : John Wiley & Sons 2004

ML Main Library 1 Week Loan (D 612.76 WIN)

Fundamentals of biomechanics : equilibrium, motion, and deformation

Nihat Özkaya 1956- Margareta Nordin

2nd ed. New York : Springer c1999

ML Main Library 6 Week Loan (D 612.76 OZK)

Biomechanical basis of human movement

Joseph Hamill 1946- Kathleen Knutzen

2nd ed. Philadelphia : Lippincott Williams & Wilkins c2003

Main Library 1 Week Loan (D 612.76 HAM)

Additional Student Feedback

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

Date	Time	Room No
Thursdays, Weeks 6 and 12	11-1	WC/213

Session: Feedback will also be given electronically through the module moodle elearning package following the relevant exam board

MODULE DESCRIPTION FORM

BE918 Professional Studies in Biomedical Engineering

Module Registrar: Dr Richard Black	**Taught To (Course):** MSc Biomedical Engineering; MRes Biomedical Engineering; EngD/MSc Medical Devices	
Other Lecturers Involved: Dr H Lakany	**Credit Weighting:** 10	**Semester:** 1
Assumed Prerequisites: None	**Compulsory**	**Academic Level:** SHE 5

Module Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Project	Assignments	Private Study	**Total**
21				9	70	100

Educational Aim

This module aims to:

- provide an 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
- engender an awareness of the importance of regulatory issues in medical device design and manufacturing

Learning Outcomes

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

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

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

(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

What is research? The research landscape: the scientific literature; good practice in research; research ethics: structure and conduct of clinical trials

The healthcare science workforce: overview of career pathways for healthcare scientists and engineers

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

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:

[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 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.

12 Principles of Assessment and Feedback *(on Learning & Teaching web pages: www.strath.ac.uk/learnteach/informationforstaff/staff/assessfeedback/12principles/).* Please state briefly how these are incorporated in this module.

The module is wholly formative, student outcomes being assessed using tools provided by the University's Virtual Learning Environment 'MyPlace'; the software 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

	Examinations			**Courseworks**		**Projects**	
	Number	Duration	***Weighting***	Number	***Weighting***	Number	***Weighting***
				2	100 (2x50)		
L/O				LO 1-3			

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

Coursework / Submissions deadlines:
AN online MCQ will be set in week 11 of semester 1. An MHRA assignment will be set in week 9 and submitted in week 12
Resit Assessment Procedures:
Resubmission of failed coursework as per 1st attempt

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

Textbook:
Design of Biomedical Devices and Systems (second edition), PH King and Fries RC, CRC Press, 2009
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)*

Date	Time	Room No
Friday, week 12, semester 1	11-1	WC/213

MODULE DESCRIPTION FORM

BE919 Research Methodology

Module Registrar: Drs Chris McCormick and Michelle MacLean	**Taught To (Course): MSc Biomedical Engineering; MRes Biomedical Engineering; MSc/EngD Medical Devices**	
Other Lecturers Involved:	**Credit Weighting: 10**	**Semester: 1**
Assumed Prerequisites: none	**Compulsory**	**Academic Level: SHE 5**

Module Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Project	Assignments	Private Study	**Total**
16	8	8			68	100

Educational Aim

This module aims to equip the students with the skills necessary to use mathematics and statistics tools including software in experimental design and data visualisation and analysis needed to progress in their research in Biomedical Engineering

Learning Outcomes

On completion of the module the student is expected to

LO1 Demonstrate knowledge and understanding of the various design possibilities for a research project, and the important considerations for observational studies and randomised trials.

LO2 Describe the different types of data that can be generated in research studies and demonstrate knowledge of how to select a data sample.

LO3 Demonstrate knowledge and understanding of the most common methods for visualising and analysing categorical and continuous data, including regression. methods and probability

LO4 Demonstrate understanding of when particular estimation and inference methods are appropriate and how to interpret their results.

Syllabus

The module will teach the following:

Section 1: Exploratory Data Analysis

subsection 1.1: Examining Distributions

subsection 1.2: Examining Relationships

Section 2: Producing Data

subsection 2.1: Sampling

subsection 2.2: Designing Studies

Section 3: Probability

subsection 3.1: Introduction (Probability)

subsection 3.2: Random Variables

subsection 3.3: Sampling Distributions

Section 4: Inference

subsection 4.1: Introduction (Inference)

subsection 4.2: Estimation

subsection 4.3: Hypothesis Testing

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 the various design possibilities for a research project, and the important considerations for observational studies and randomised trials.

C1 Identify and use a range of experimental design methods

C2 Identify level of measurement in different research studies

C3 Recognise and compare important considerations for observational and randomised trials

LO2 Describe the different types of data that can be generated in research studies and demonstrate knowledge of how to select a data sample.

C1 Describe how to select a data sample

C2 Estimate the size of a sample required for a particular research study

C3 Differentiate between different types of data generated in a particular research study

LO3 Demonstrate knowledge and understanding of the most common methods for visualising and analysing categorical and continuous data, including regression methods and probability.

C1 Describe the main principles of visualising and analysing data generated in research studies

C2 Apply the appropriate methods to visualise and analyse data generated in research studies

C3 Interpret and assess results after analysing data.

LO4 Demonstrate understanding of when particular estimation and inference methods are appropriate and how to interpret their results.

C1 Construct a research hypotheses and identify a claim

C2 Apply appropriate inference methods to test a research study hypothesis

C3 Interpret results from hypothesis testing

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/).Please state briefly how these are incorporated in this module.

P1: Clear instructions will be given to students about assessment requirements and expectation through tutorial sessions and written notes

P2 &P5: Students will work on a regular basis on five summative tasks that carry minimal marks (5%) but each with regular feedback.

P6 Interaction and dialogue around learning will be encouraged during tutorials, laboratory sessions and at the end of each lecture

P7, P9 & P10 development of learning groups and communities will be supported through a group project/assessment task that will carry 25%. Part of the mark will be based on peer assessment. A reflective element will be built in the assessment

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

	Examinations			**Courseworks**		**Projects**	
	Number	Duration	***Weighting***	Number	***Weighting***	Number	***Weighting***
	one	2hrs	50	2	25 (2x12.5)	One	25
L/O	LO1, LO2, LO3 and LO4			LO1, LO2, LO3 and LO4		LO1, LO2, LO3 and LO4	

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

Coursework / Submissions deadlines:
Course work will consist of two assignments submitted on the end of 3rd week and end of final week of the module (running weeks 6-11 semester 1). On project will be submitted in week 13 of semester 1.
Resit Assessment Procedures: Examination

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.

Recommended Reading

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

Additional Student Feedback

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

Date	Time	Room No
Tuesday, week 12, sem 1	11-1	WC/213

USE OF COMPUTING FACILITIES & RESOURCES

1. Scope

This policy covers the use of all computing facilities and resources administered by the University of Strathclyde, including use by staff and students of the University and by any other person authorised to use these facilities, and use at the University's property and/or through any networked links to the University's computing facilities. Anyone using any kind of computer hardware or software, for any purpose, at the University, even if it is their own equipment and even if it is only connected to the institution through a network, is required to abide by the terms of this policy.

In this policy 'computing facilities and resources' includes central services such as those provided by Information Services through the Divisions of Information Systems and Networking and Computing Services, and through the Centre for Educational Systems and AV Media Services; the University Libraries; departmental computers; microcomputers and peripherals; personal computers, whether desktop or portable, when linked to facilities provided by the University; any associated software and data including data created by others, and the networking elements which link the facilities together.

2. Introduction

The University of Strathclyde provides a wide range of computing facilities and resources for use by staff and students in pursuit of teaching, learning, research and administration. Use of the facilities solely for the purposes of the University is encouraged as part of the University's strategy of ensuring that any use the University makes of information technologies will be for the improvement of our already high educational standards.

Use of computing facilities requires that individuals accept certain responsibilities as set out in this policy (see section 5 - Conditions for Use). The University recognises that new measures are required for managing information in electronic forms, much of which will represent the University as a first point of contact with the rest of the world. The underlying philosophy of this policy is that the University's computing facilities should be used in a manner which is ethical, legal, appropriate to the University's aims, and not to the detriment of others. The policy sets out the conditions for use of the University's network for the publication of all material and demands that the same sensitivity is applied to information in electronic format as is normally applied to the written work.

3. Access to Facilities

3.1 Computing facilities are provided by the Department of Information Services and others for the University as a whole, and by Faculties and Departments for their staff and students, solely for use by staff and students in connection with the aims and purposes of the University (see section 4 - Definitions). Computing facilities should not be used for personal or recreational purposes.

3.2 On special application being made, the University may authorise the use of its computing facilities for work outside the scope of normal University purposes, including consultancy and use by external users. Any charges for provision of such facilities will be determined by the Director of Information Services. Other use may be allowed, by agreement with the Director of Information Services, as a privilege not a right and if abused may be deemed to be a breach of this policy.

3.3 In order to use the computing facilities of the University of Strathclyde a person must first register with the Department of Information Services as an authorised user in the manner prescribed in this policy. Registration grants authorisation to use some or all of the facilities of the University. Access to facilities is normally arranged by allocation of a unique user ID (sometimes called a login or user name) and will require the production of a University ID card or other form of identification. On most computer systems a password is required to gain access. Users should choose a password that is secure and not easily guessed, and should keep it secure at all times.

3.4 If a user suspects that the security of their computing facilities has been breached or compromised it should be reported to Information Services Help Desk or departmental computing staff as soon as possible.

3.5 Bona fide visitors to the University such as the staff of institutions connected to JANET (Joint Academic Network) and visiting scholars from overseas can request access to the University's computing facilities. Appropriate arrangements will be made by the Department of Information Services to register them as an authorised user in the normal way.

3.6 The Director of Information Services may permit other legal entities to connect to the University network under the terms and conditions laid down in the United Kingdom Education and Research Networks Association (UKERNA) document "Sponsored and Proxy Connections to JANET Guidelines for Hosting Organisations".

4. Definitions

In this policy the following definitions apply :

accessing means holding, storing, displaying, transmitting, or distributing information in electronic format, by whatever means, such that others may have access to it or use it; and such that the publisher or source of the information may be traced back the University of Strathclyde

authorised means a person who has been registered as a user by the Department of Information Services in accordance with the procedures set out in section 3 or a separate legal entity or bona fide visitor allowed connection under 3.5 and 3.6 above

computing facilities includes:

all local computing facilities, multi-user systems, server systems, work stations, personal computers, micro computers and networks and or other electronic information and communication systems whether provided by the University or otherwise and which are intended wholly or partly for use by employees of, researchers at or students of the University or wholly or partly for use for other University related or academic purposes

all remote facilities which are accessed through the computer, electronic information and communication facilities at or operated wholly or partly by the University

and anything else deemed computing equipment by the University

information includes words, pictures, data, graphics, visual images, video and sound clips and computer programs

solely for University purposes means use by staff in connection with their normal University duties of employment and by students in connection with their approved University study or research

unacceptable material includes material which, in the opinion of the University, is offensive, abusive, defamatory, discriminatory, obscene or otherwise illegal which brings or may bring the University into disrepute. The provision by a University user of explicit or cryptic links to such material stored elsewhere on the Internet is also unacceptable unless agreed with the Director of Information Services

personal information means any information which is not sanctioned by the University in accordance with section 7 of this policy

5. Conditions for Use - Rights and Responsibilities

5.1 All users will be required to sign an agreement to become a registered user of the University's computing facilities and resources and by so doing have understood and agreed to abide by the terms of this policy and other appropriate University regulations. Users must also comply with the provisions of any current UK or Scots law (see section 6 - Legal Framework) and will be held responsible for any and all activity on computing facilities which is initiated by their user ID. It is every user's responsibility to act in a manner which will not cause damage to computing facilities or adversely affect the performance of any service available on these facilities. Users should not allow any other person access to their user ID or password; use another person's user ID or password; or modify or interfere with information belonging to another user without their permission.

5.2 The University of Strathclyde will not permit the use of its computer facilities and resources for the access to or transmission of information which is considered by the University to be unacceptable; illegal; in breach of University policies, such as those on Equal Opportunities and Harassment; wasteful of resources; or not commensurate with the provision of facilities for legitimate educational purposes.

Examples of such unacceptable use may include -

accessing or displaying pornographic material; stating defamatory opinions or views concerning individuals or organisations; accessing or displaying discriminatory material or material which encourages discrimination; engaging in games or chain E-mail; publishing information which is intended to misinform and thereby cause anxiety or inconvenience in another; unauthorised use of University logos, titles etc.; spamming; corrupting or destroying other users' data; violating the privacy of other users; disrupting the work of others; using JANET in a way that denies service to others; misuse of networked resources such as the introduction of viruses.

5.3 The University may actively monitor usage of University computer facilities and resources which includes monitoring the access to, publication or receipt of, any Internet materials by any user and reserves the right to remove or require the immediate removal from the University systems of any material which, in the opinion of the Vice-Principal or a depute to whom authority has been delegated is unacceptable (see section 4 - Definitions). It is University policy to provide information obtained by monitoring, when required to do so to the UKERNA CERT team or other relevant agency.

5.4 No user will by wilful or deliberate act jeopardise the integrity of the computing equipment, communications network, system programs or other stored information. No user will connect to the University network any piece of equipment which by its function could adversely affect the performance of the network without the prior agreement of the Director of Information Services. Any user connecting their own equipment to the University network agrees that by doing so the Director of Information Services has the right to audit the equipment and data stored on it at any time.

5.5 Users may only use JANET for the purposes which meet the conditions agreed by the Secretary of State for Education for the operation of the network, and as set out in the UKERNA document "JANET Acceptable Use Policy". Users must also comply with the provisions of the Code of Conduct for the Use of Software and Datasets at Higher Education and Research Council Establishments. This Code does not constitute a licence and, in all cases, users of software should acquaint themselves with the provisions of the relevant licence when they obtain a copy and before putting the same into use. Further information about JANET and the Code of Conduct is available from the Information Services Help Desk in the first instance.

5.6 At the request of the Director of Information Services, any user holding or transmitting encrypted data must provide corresponding decrypting tools to the Director of Information Services for investigation purposes. Any dispute arising over material of a commercial or militarily sensitive nature will be referred to the Vice-Principal for decision.

6. Legal Framework

Users should be aware of UK legislation which relates to computer use. Much of the electronic information in use by staff and students is likely to also be available world-wide and care should be taken that the laws of other countries are not infringed by this availability. Brief details of the relevant legislation is outlined below but those seeking further information should contact the Director of Information Services in the first instance. Users should note carefully that much of the legislation prescribes criminal penalties including fines and custodial sentences where an offence is committed.

6.1 Data Protection Act 1984

The Act prohibits the holding, processing or disclosure of personal data about others on computer, unless the user is properly registered under the terms of the Act and observes the principles of data protection. Use of such information is subject to the University's Data Protection Registration and information about this can be obtained from the University's Data Protection Officer on ext 2416 (JA). All users are responsible for ensuring that they comply with the terms of the Act.

6.2 Telecommunications Act 1984

The Internet makes use of the "public telecommunication system" as defined by the Act. Under the Act it is a criminal offence to send a message or other matter that is grossly offensive, indecent, obscene or menacing in character via the public telecommunication system or to send a false message for the purpose of causing annoyance, inconvenience or needless anxiety to another, and those found guilty could face a substantial fine or a term of imprisonment.

6.3 The Copyright, Designs and Patents Act 1988

The Act requires that the permission of the owner of the intellectual property must be sought before any use is made of it. It is therefore unlawful to use or copy any material without proper authorisation and this includes computer software. Penalties include unlimited fines and up to two years imprisonment. It should be noted that the University titles and logos are the property of this University and may only be used for official University documents.

6.4 Computer Misuse Act 1990

The Act makes it a criminal offence to access, attempt to access or encourage others to access computer material without proper authority or to make unauthorised modification of computer material. This would include 'hacking', the introduction of viruses and knowingly receiving or using material from an unauthorised user who has gained access to computer material. Penalties for conviction include up to five years imprisonment and/or a fine.

6.5 Obscene Publications Act 1959

The publication, which includes transmission over a network, whether for gain or not, of material intended to be read, heard or looked at which is such as to tend to deprave and corrupt persons having access to it is a criminal offence under this Act. Penalties include up to three years in prison.

6.6 Criminal Justice and Public Order Act 1994

This legislation consolidates the protection of minors by making it a criminal offence to possess pornographic or obscene material of or involving minors, or material considered to be excessively violent. In the context of computer facilities it applies to the transmission, receipt and storage of text, audio, graphic and manipulated images.

(Note: The Acts referred to in 6.5 and 6.6 above apply in England and Wales but not in Scotland where prosecutions for similar offences are mounted on the basis of common law as opposed to Statute).

6.7 Sex Discrimination Act 1975

The Act makes it unlawful to discriminate against others on the grounds of sex, gender and marital status and any information published or received via the Internet which discriminates or encourages discrimination is illegal.

6.8 Race Relations Act 1976

The Act makes it unlawful to discriminate against others on the grounds of race, colour, nationality, ethnic or national origin and any information published or received via the Internet which discriminates or encourages discrimination is illegal.

6.9 Laws of Defamation

Any publication of a statement, comment or innuendo about another individual or organisation which cannot be justified at law may render the author liable to an action for defamation.

6.10 International and EC Law

Users should be aware that material they produce and transmit may be available world wide, and care should be taken to ensure that no international laws or treaties are contravened. Specific examples include importing specified materials from a country for which an embargo is in force, and exporting material legally obtained in the UK but which when accessed in another country may constitute an offence in that country. It also includes accessing material which though legally available in another country is illegal in the UK.

EC Law is constantly changing particularly in the areas of sex discrimination, harassment and unequal treatment. Increasingly EC Directives and regulations are being interpreted to afford protection to people who are discriminated against or harassed because of their sexuality. The information about the Sex Discrimination Act (see 6.7 above) should be read with this in mind.

6.11 Official Secrets Acts

Some work carried out under contract from the Government or its agencies may be subject to the provisions of this legislation. Any publication of material which contravenes obligations under this legislation is a criminal offence and punishable by imprisonment and/or a fine.

7. Publishing Information in Electronic Format

7.1 The Department of Information Services gives permission to staff and students to publish information on the University of Strathclyde World Wide Web information server under Regulation 6.11.13 (see University calendar). This Regulation allows the University to impose more stringent conditions than those usually applying to the use of computing facilities and the University has chosen to do so in the form of this policy.

7.2 Heads of Department have responsibility for ensuring that any information published electronically on behalf of their Department adheres to this policy. Any person who provides information for the Department must have the authority to do so from the Head of Department.

7.3 Staff or students may apply to the Department of Information Services to publish information on behalf of a University club, society or association but such an application must first have the approval of the Head of Department or Dean as appropriate, and the approval of the club, society or association.

7.4 Those who publish general University information, such as maps, events, descriptive or historical information about the University must obtain permission from the Office of Marketing and Communications. Guidelines to publishing in electronic format are available from that department and via the home page on the University's website. They make clear that University logos and titles are only to be used in conjunction with information on official institutional web pages approved by the University for publication.

7.5 Individuals are responsible for all information published through their personal computer account such as via WWW personal home page or Email contributions to discussion lists or bulletin boards. All the requirements outlined in this policy apply equally to publications on the World Wide Web (see particularly sections 5 and 6).

7.6 Information published by individuals must be declared as such and must not appear to be published on behalf of the University. To that end there must be a clear separation between University information and personal information and the latter should contain the following disclaimer: "The views and opinions expressed herein are strictly those of the author. The contents have not been reviewed or approved by the University of Strathclyde. They do not represent or reflect the views of the University of Strathclyde or anyone else associated with the institution and the University retains no liability for the content or layout". Anyone who registers in an external index an address for an electronic information system, such as a departmental server or personal home page, must ensure that it does not appear that their address is the principal access point for all University of Strathclyde systems. The home page of any externally registered WWW server, run on University of Strathclyde systems MUST contain a pointer to the University of Strathclyde home page. Information on or links to or from the University's official web pages must be authorised by the Communications Office.

7.7 Nothing must be published which might in any way bring discredit or harm to the University or its members or bring the University into disrepute. Personal opinions must not be published in any way which might make them seem to be those of the University.

7.8 Appropriate care must be taken in the presentation, content and management of information being published electronically. This includes :

care in writing, proofing and layout

following appropriate University presentational guidelines eg display of University crest/logo etc

attribution of the source of the information - include author, contact name and address

removal of out-of-date information

restricting access to sensitive information

editorial changes to documents in electronic format should only be made with the permission of the 'owner' of the document.

7.9 The University's computing facilities must not be used for the placing or distribution of commercial advertisements without the express written permission of the Vice-Principal. Any non-commercial advertisements which do appear must comply with the Code of Practice for Advertisers, issued by the Advertising Standards Authority, which requires that all advertisements should be 'legal, decent, truthful and honest'.

8. Misuse - Penalties and Sanctions

8.1 Breaches of this policy by staff or students will be dealt with under the appropriate disciplinary procedures. Where this involves students it will normally be dealt with under the University regulations for Student Discipline (see Regulation 5 in the University Calendar). The University will accept no responsibility for the effect disciplinary action might have on a student's academic progress and achievement. Where members of staff are involved breaches will be dealt with under the appropriate disciplinary procedures. Where an offence may have occurred under criminal law it will be reported to the police or other appropriate authority.

8.2 Where appropriate, staff or students at the University of Strathclyde or other authorised users may have their use of the University's computing facilities immediately suspended pending an investigation by an authorised person in the University.

8.3 In the event of loss being incurred by the University or members of the University as a result of a breach of these regulations by a user, that user may be held responsible for reimbursement of that loss.

9. Monitoring and Review

The effectiveness of this Policy will be monitored by the Department of Information Services and will be formally reviewed by the University Court within twelve months of its adoption.

KEY DATES 2014-2015

Semester 1:
Tuesday 30th September to Friday 19th December
Semester 2:
Monday 26th January to Friday 24th April

EXAM WEEKS

Monday 5th January to Friday 16th January
Monday 4th May to Friday 22nd May

UNIVERSITY HOLIDAYS

Monday September 29th (semester 1, week 1)
Christmas vacation: Monday December 22nd to 2 January 2015
Spring vacation: 6-17th April 2015
4, 25th May 2015
17, 20 July 2015