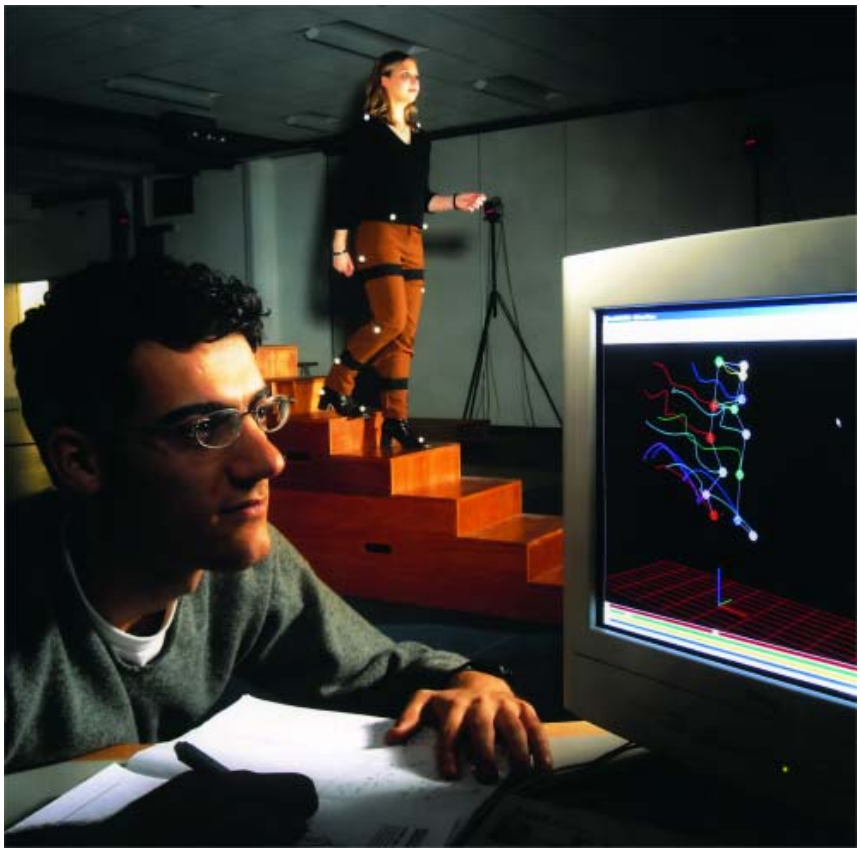
University of Surrey



Movement Analysis in the Gait Laboratory

MSc in Biomedical Engineering

Centre for Biomedical Engineering
Duke of Kent Building
University of Surrey
Guildford
Surrey, UK
GU2 7TE

MSc in Biomedical Engineering
COURSE PROGRAMME

COURSE STATUS AND QUALITY

The Surrey MSc in Biomedical Engineering is an internationally recognised MSc Course. Founded in 1964, it was awarded the highest "Excellent" rating for its last UK Teaching Quality Assessment conducted by the Higher Education Funding Council. It is fully accredited by the UK Institute of Physics and Engineering in Medicine (IPEM) for its National Health Service (NHS) professional training scheme. The course aims to:-

- Educate engineering, physical science, life science, medical and paramedical graduates in the broad base of knowledge required for a Biomedical Engineering career in Industry, Healthcare or Research in the United Kingdom, Europe, and the Rest of the World.

- In the UK it will provide the complete knowledge base appropriate to Clinical Engineering elements of the Clinical Scientist Training Scheme organised by the Institute of Physics and Engineering in Medicine (IPEM) and recognised and supported by the NHS.

DURATION, PROGRAMME DATES AND COST

The Course is offered on a full time or part time basis. Full time attendance is for approximately 1 year. Part time is normally over 2 years. In 2005, the course will start on Wednesday, 5th October 2005, and will end on Wednesday, 20th September 2006.

Tuition fees for full time students for 2005/2006 will be £3,760 for UK/EU students and £10,500 for overseas students.

Fees are normally paid as one payment at the start of the course for full time attendance. For part time students, the course fee is normally divided into equal annual proportions over their selected attendance period based on the annual fee applying in each year of attendance.

FUNDING

Schemes to assist students exist, but scholarships are highly competitive. Examples of these include:

a. The Cerebra Foundation has kindly awarded scholarships for partial support of tuition fees for home students.

b. The University will offer scholarships to home or overseas students with a UK 2:1 or better from their first degree (or equivalent).

Students should contact the Course Secretary to express an interest in the competition for (a) or (b).

c. The NHS, through our links with St George's Hospital, London, supports a 2 year appointment including studentship to our MSc, for UK students as part of the NHS, IPEM accredited, training scheme.

d. Overseas students are also advised to contact the British Council in their home country.

STRUCTURE

The course consists of a **taught period** which is presented mainly during the first half of the academic year, followed by an **individual Research Project**. Part time students undertake their Project over arranged periods suitable for their other employment and professional commitments.

MSc COURSE MODULES

Three Core Modules	
Musculoskeletal system	(3 weeks)
Fluids and soft tissue systems	(3 weeks)
Neurological and sensory systems	(3 weeks)
Eight Specialist Modules	
Safety	(1 week)
Physiological Measurement	(1 week)
Principles of Biomaterials	(1 week)
Microengineering in Medicine	(1 week)
Orthopaedic Biomechanics	(1 week)
Gait Analysis and Human Movement	(1 week)
Rehabilitation Engineering (physical)	(1 week)
Rehabilitation Engineering (sensory)	(1 week)

The taught phase of the MSc course is examined by coursework, assignment and formal examinations. These are held throughout the course, with the major examinations being held in late April/early May. Students successful in this part of the programme are entitled to be awarded the Postgraduate Diploma in Biomedical Engineering. By completing the individual research project, the Diploma students are able to advance their award to that of an MSc in Biomedical Engineering.

The taught course has 11 modules giving approximately 400 hours direct teaching time.

A particular feature is student class involvement with practising professionals in research and medical subjects, to gain direct experience of the opportunities and challenges open to them on successful completion of the programme. Examples of arranged visits include:

Blatchford Ltd (Basingstoke), The Oxford Centre for Enablement (Oxford), Papworth Hospital (Cambridge), Queen Mary's Hospital, (Roehampton), Royal College of Surgeons (London), Royal National Orthopaedic Hospital (Stanmore), Rutherford Appleton Laboratory (Didcot), Salisbury District Hospital (Salisbury) and St George's Hospital (London).

ATTENDANCE CHOICES

Full time students attend for a period of approximately 50 weeks. There are a number of routes available for part-time attendance. The staff are happy to offer advice on the best programme to suit a student's needs.

ENTRY QUALIFICATIONS

Students normally possess a UK 2:2 honours degree or equivalent in the Engineering or Physical Sciences; in Medicine; or in the Life or Medical /Paramedical Sciences. Students holding other, related paramedical, professional qualifications may also be eligible for entry.

Occasionally, students may be admitted to the Course with a lesser academic qualification if they can prove several years of relevant Industrial (or Health Service) experience.

HOW TO APPLY AND WHAT HAPPENS TO YOUR APPLICATION

Application forms for the Course are obtainable from, and submitted to, the MSc Course Secretary at the address given below.

CONTACT INFORMATION

MSc Course Secretary
Centre for Biomedical Engineering
Duke of Kent Building
University of Surrey
Guildford
Surrey, UK
GU2 7TE

Tel: +44 (0) 1483 689678
Fax: +44 (0) 1483 689395
email: e.roberts@surrey.ac.uk
web www.bmesurrey.org

Applications are acknowledged and academic referees reports are then requested. Dependent on these reports, admission is then recommended to the University's Postgraduate Registry.

We normally inform applicants when their application has been recommended. A few weeks may elapse between our recommendation being made and the University Registry writing to applicants with a formal offer of a place.

Although students are normally asked to send final confirmation of funding support with their acceptance, **students should confirm their provisional acceptance of the offer of a place at the earliest opportunity and not wait for the final funding confirmation** to be available.

Application information/forms for accommodation will be issued with the formal offer letter from Postgraduate Registry; full time students are normally eligible for University accommodation.

SUMMARY OF THE TIMETABLE AND SYLLABUS

The indicative timetable plan is perhaps best understood through examining the attached **Taught Programmes** sheet (page 5) and looking at, for example, the second *core module*, the Fluids module.

Mondays are reserved, throughout the core modules, for Anatomy and Physiology. In the Fluids module, topics such as the structure and function of the cardiovascular and respiratory systems will be covered.

On the ***Tuesdays,*** reserved for Electronic Instrumentation, fundamentals relating to equipment used in, for example, blood flow measurement or ECG will be given.

Wednesdays are normally used for foundation work such as mathematics and mechanics.

Thursdays are reserved for (bio)mechanics, so in the Fluids module, topics such as blood rheology or the compatibility of blood and artificial vessels will be covered.

Fridays are normally reserved for private study and project work, however, foundation and applied lectures, e.g. management of fractures, are given on this day

The course may be divided into three components; **core modules; specialist modules;** and **individual project.**

A. CORE MODULES

1. Musculoskeletal Systems

This module provides knowledge pertinent to movement by reviewing the structural interrelation of the main components of the musculoskeletal system and describing the influence of mechanical and biological factors on the form and function of bone. On successful completion, the student should know the general anatomy of the human (the skeleton, muscle, tendon and ligaments) and the physiology of bone and muscle. They will be able to demonstrate an understanding of the biomechanical principles from which to quantify the load, strength, failure and equilibrium performance of articulated skeletal structures and have knowledge of skeletal repair processes.

2. Fluid Systems
This module provides knowledge of cardiovascular, respiratory and urinary system function. Students will be taught the anatomy and physiology of the normal cardiovascular and respiratory system, of the urinary system and of skin and superficial soft tissues. On successful completion, students will be able to demonstrate understanding of the biomechanical and instrumentation principles from which to quantify the flow, pressure, and rheological behaviour of these systems. They will also be able to define and assess physiological conditions, identify possible modes of failure and risk, and have knowledge of safe measurement technologies for monitoring the status of these systems.

3. Neurological Systems
This provides knowledge pertinent to advanced applications of technology and engineering to neurological function. On successful completion, students will know the general anatomy and physiology of the nervous system and the senses. They will also be able to demonstrate understanding of the measurement techniques and the control principles from which to quantify the performance and limits of the various components of the nervous system.

B. SPECIALIST MODULES
These modules are designed to build upon basic subjects from the core modules to give a more advanced clinical and research knowledge base. They are re-enforced by lectures from clinicians and outside experts in their specific fields and visits to clinical and industrial sites.

1. Safety
The aim of this module is to provide students with a solid grounding in safety. It will cover mechanical, chemical, electrical and fire safety in the workplace, principles of first aid, health and safety legislation and risk assessment, reporting and warning. This module will be reinforced by additional specific material in the other specialist modules.

2. Physiological Measurement
The aim of this module is to provide knowledge for the safe and effective use and management of electronic measurement equipment in clinical, healthcare and related units. On completion, students should be able to demonstrate the correct application of instrumentation theory to clinical instruments, specifying the sources of errors generated, the standards and requirements for managing medical instrumentation and the role of the medical engineer, the medical physicist and the radiation safety officer. They should also be able describe and explain the placement and use of surface electrodes for measurement of bioelectric signals for such techniques as blood pressure measurements, EMG, EEG, ECG, and nerve conduction measurement.

3. Principles of Biomaterials
This specialist module provides knowledge on the basics of biocompatibility and the response of human tissue to materials that form key constituents of prosthetic, orthotic and implanted devices used in medicine and healthcare. On completion of this module students should be able to describe and critique the behaviour of the human system when exposed to "biomaterials". They should be able to identify and specify preferred materials from a wide range available to the bioengineer. They should be able to advise on the relative merits of different approaches to solutions for replacement tissues or repair.

4. Microengineering in Medicine
The module introduces the principles and practice of microengineering applied to implantable and body worn (bio)sensors. It will explain the design and production of these devices together with the theory of biosensors and on-chip sensing. Applications in, for example, cochlear implants, neural stimulation, biological cell manipulation, and the future potential in clinical engineering will be explored. In addition to the devices themselves, the lecture material will also give students an opportunity to learn and experience the challenge of integrating the sensors with their signal acquisition and handling circuitry. A brief exploration of nanotechnology and fabrication advances will be included.

5. Orthopaedic Biomechanics and Biomaterials
This module will provide a knowledge base on the biomechanical, functional and production requirements relevant to orthopaedic surgical components and implants. The module covers the static and dynamic load requirements; standards for production and testing; current approaches to biocompatibility and constraints in respect of implants. On completion students should be able to evaluate the functionality and appropriateness of the latest implant designs, noting the occurrence and causes of failure.

6. Gait Analysis and Human Movement
The aims of this module are to provide a knowledge base on the biomechanics of human movement, its modelling, measurement and application to clinical and performance management. The module also covers control of voluntary movement, ranges of movement, and the functional strength of limbs and hands. On completion, students should be able to demonstrate understanding of methods for measurement of human size and shape, and the general aspects of the influence of disease and injury. They should also be able to specify motion analysis systems, quantify the limitations and capabilities of such systems and demonstrate ability to use movement analysis equipment.

7. Rehabilitation Engineering (Physical)
This module aims to provide the knowledge base on the theory and professional practice of clinical engineering applied to the rehabilitation of people with physical disability. Students will be informed about the methods of assessment of patient residual function and its relationship to the underlying physical disability, together with methods and technology for the analysis, treatment and amelioration of disability. The latter will have particular reference to orthotic and prosthetic devices, mobility aids, seating systems and Aids to Daily Living. On completion, students should be able to demonstrate awareness of the range of functional movement relevant to postural and functional control, spinal injury, and lower limb disorders. They should also be able to describe the mechanisms and probable dysfunction inherent in different physically disabling conditions, and outline the key elements of their management, with particular reference to the technical supplementation of function.

8. Rehabilitation Engineering (Sensory)
This module will provide the knowledge base on the theory and professional practice of clinical engineering applied to the rehabilitation of people with sensory or communication disability. The material covered will include the methods of assessment of patient residual function and its relationship to the underlying disability, and methods for analysis, treatment and amelioration of the disability. This will include material covering communication devices, environmental controls, sensory and neurological implants. On completion, students should be able to describe the mechanisms and probable dysfunction inherent in different sensory and neurological disabling conditions, and outline the key elements of their management, with particular reference to the technical supplementation of function and the challenges associated with use of technology in patient daily living.

C. INDIVIDUAL RESEARCH PROJECT
Students aiming for an MSc by taught course are required to complete a personal research project. This equates to around 800 hours of personal study, investigation, experimental work and data analysis. Students write a dissertation for their project and this is discussed in a viva voce examination.

For full-time students, the project material is chosen early in the teaching programme and initial work is concomitant with the taught parts of the course. After the main examinations, the project work is the student's main activity. For part-time students the timing of the project is discussed at an early stage to ensure that the topic and depth of material are appropriate.

Projects for full-time students are normally related to the research areas already active in the Centre for Biomedical Engineering or one of its outside collaborators. Care is taken to find projects that match each student's strengths and interests.

RECENT MSc PROJECTS

- *Finite Element Analysis of the Human Skull*
- *Development of an Electronic Assistive (EA) Technology Assessment Tool*
- *Review of Soft Tissue Interface to Titanium*
- *Enhanced Video Vector Generator (VVG) for Clinical Gait Analysis*
- *Micromachined Microprobe Electrode-site Impedance Measurements*
- *The Development and Validation of a Novel Technique for Assessing Pulmonary Blood Flow in Children*
- *Experimental Study of the Effects of Electric Fields on Cell Behaviour*
- *Development of an Overload Protection Device for the Osseointegrated Trans-femoral Implant*
- *Comparison of Sitting Position on Propelling Efficiencies of Wheelchairs*

During the project period, students are provided with opportunities to learn about the challenges of research through seminars on research methods, planning, publication writing and project management techniques. Students will also have many opportunities to practise presentational skills in seminars.

CENTRE FOR BIOMEDICAL ENGINEERING
The MSc course is organised and directed by the **Centre for Biomedical Engineering,** and supported by staff throughout the University, in particular the School of Engineering and the European Institute of Health and Medical Sciences.

The Centre was one of the first in Britain to offer advanced level education in Biomedical Engineering. Our activities remain focused on postgraduate research and teaching involving over 30 people, including its postgraduate students and visiting researchers.

For further information on the Centre and its research and taught programme activities, please use the **CONTACT INFORMATION** box on page 2 of this brochure.

Outline of Postgraduate Taught Programmes in Biomedical Engineering

MSc/Postgraduate Diploma
and
modules available for Continuing Professional Development (CPD)

Autumn Semester
(Three, 3 week core modules)

	Musculoskeletal Systems 3 weeks
Monday	Anatomy & Physiology
Tuesday	Instrumentation
Wednesday	Foundation Topics
Thursday	Biomechanics
Friday	Private Study
	Fluids and Soft Tissue Systems 3 weeks
Monday	Anatomy & Physiology
Tuesday	Instrumentation
Wednesday	Foundation Topics
Thursday	Biomechanics
Friday	Private Study/Project
Reading / Reflective Learning Week	
	Neurological and Sensory Systems 3 weeks
Monday	Anatomy & Physiology
Tuesday	Instrumentation
Wednesday	Foundation Topics
Thursday	Biomechanics
Friday	Private Study/Project

Spring Semester
(Eight, 1 week Specialist Modules)

Safety
Specialist Topic (1)

Physiological Measurement
Specialist Topic (2)

Principles of Biomaterials
Specialist Topic (3)
CPD

Microengineering in Medicine
Specialist Topic (4)
CPD

Reading and Reflective Learning Week

Orthopaedic Biomechanics
Specialist Topic (5)

Gait Analysis and Human Movement
Specialist Topic (6)
CPD

Rehabilitation Engineering (Physical)
Specialist Topic (7)

Rehabilitation Engineering (Sensory)
Specialist Topic (8)

Summer Period

MSc PROJECT

Every effort has been made to ensure the accuracy of the information contained in this brochure. However, the University reserves the right to introduce changes to the information given. Admission to the University is subject to the requirement that the student will comply with the University's registration procedure and will duly observe the Charter, Statutes, Ordinances and Regulations of the University.

October 10th 2004