university of leeds

university of sheffield

M.Sc. in electronics and photonic components

engineering and manufacturing

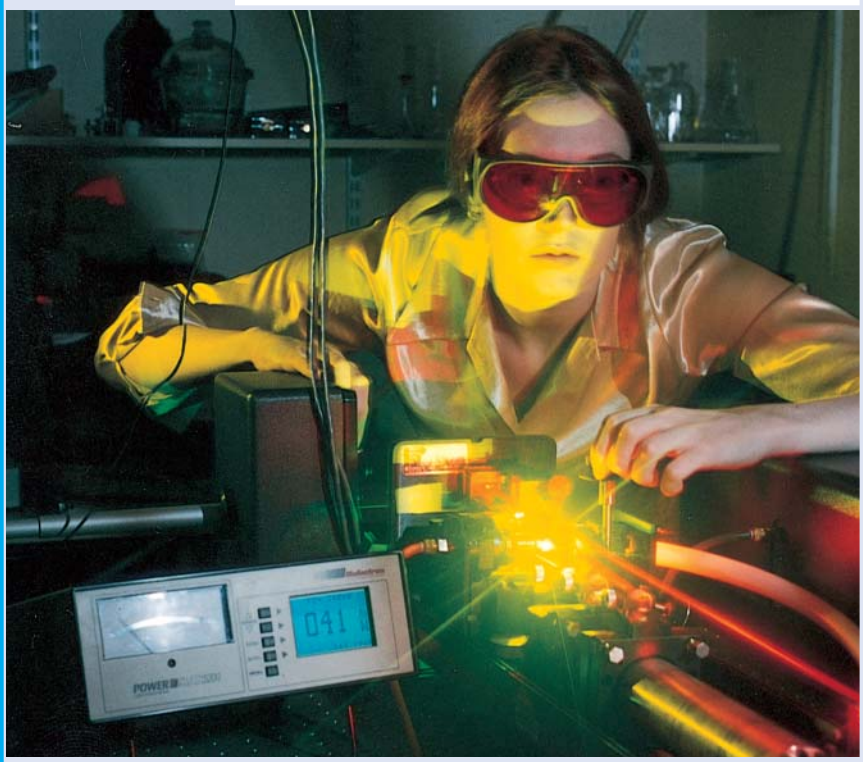
a first-class **reputation** in engineering

the institute for materials research (IMR)
university of leeds
department of electronic and electrical engineering (EE)
university of sheffield

M.Sc. in electronics and photonic components engineering and manufacturing

Laser Spectroscopy – indispensable tool for photonic and electronic device characterisation.

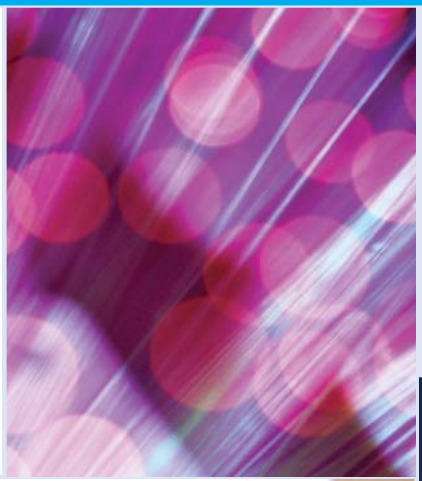
The IMR at Leeds and EE at Sheffield are world-renowned Seats of Learning for the last 50 years in the UK.
The taught engineering subjects at these two Seats of Learning and Scholarship have been rewarded by The Higher Education Funding Council (HEFCE) with a teaching grade of excellence; and we have maintained our international research rating (5/5*) in the last Research Assessment Excercise in 2001.



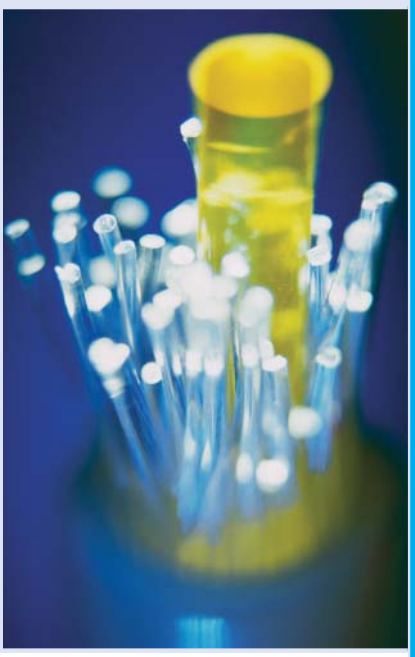
what are the aims of the course?

- To provide postgraduate training in advanced technology areas related to the engineering and manufacturing of photonic and optoelectronic components.
- To educate postgraduate students in the area of manufacturing business.

‘a grade of excellence’



An opportunity to achieve excellence in a cutting edge technology area.



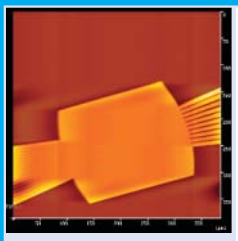
Pictures of J.J. Thompson (discovery of electron) and Sir Albert Einstein (discoveries of photo-electric effect and stimulated emission)

why study it?

a passage through time

The beginning of the twentieth-century saw the birth of modern physics via many discoveries and inventions, which were pioneered in Europe. The subject area of ‘Electronics’ was born with the discovery of electrons in 1899 by an English Nobel Laureate in Physics, Sir J.J. Thomson, and with it many properties of light and matter.
As well as the pioneering physicist, a major credit goes to Sir Albert Einstein and his Nobel Prize winning research on ‘Photo-electric Effect’, which is an Optoelectronic phenomenon. Einstein was also the first to propose the ‘Stimulated Emission of Photons’ – the origin for the operation of laser oscillators. Both photo-electric effect and stimulated emission helped in developing semiconductor diodes, solid-state lasers, solar cells, and many more that we, in modern society, take for granted in our day-to-day lives.
The pace for technological growth in the post World War II period saw a rapid rise in semiconductor devices, solid state lasers, computers and optoelectronic devices for a range of applications, including modern communication systems. Consequently, the electronics, photonics, optoelectronics and information technology industry, including the networks and services, contribute over 20% of the world’s GDP, which is likely to be sustained in the first half of the twenty-first-century.

The manufacturing of components, devices, systems and their applications in optical and mobile communications is an important part of the business, which needs to be sustained for enabling future development in the field of IT. This new M.Sc. course has been designed with the aim to support industry and future research in an important, expanding area. It focuses on advancing your understanding of Photonic and Optoelectronic Materials and their engineering, and processing techniques for components design. It also explores the strategies and elements of manufacturing required for a successful business.



course content

The following table shows the modules and their scheduled delivery during the academic year.

summary of modules and credits

No.	Name of the subject	Credits	Source	Semester
	1st Semester			
MATS 5310 EEE6390	Electronic and Optoelectronic properties of materials	15	Sheffield (EE)	1
MATS 5320	Dielectric properties	15	Leeds	1
MATS 5330 EEE6391	Semiconductor processing	15	Sheffield (EE)	1
BUEC5567	Change Management & Strategic Planning	15	Leeds University Business School	1
	2nd Semester			
MATS 5340	Optical properties of materials	15	Leeds	2
MATS 5350	Fibre and planar optical devices, fabrication techniques, components, and applications	15	Leeds/IMR	2
MATS 5360 EEE6392	Microsystems, Packaging, and Interconnects Technology	15	Leeds (IMR) Sheffield (EE)	2
BUEC5571	Continuous Process Improvement	15	Leeds University Business School	2
MATS5300 EEE6601	Literature Review Part of MATS-5300 with presentation skills**+ PROJECT including lab and field works**	60	Leeds/Sheffield	Summer
	Total	**180**		

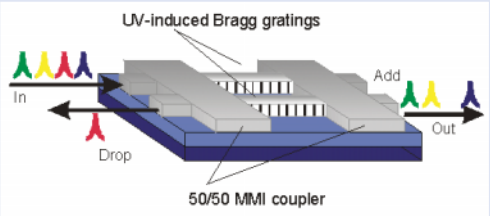
Optional modules from the M.Sc. in Nanotechnology are also available.

An opportunity for specialisation and career development via full and part-time education.

options:

- M.Sc. in Electronic and Photonic Components Engineering & Manufacturing (MAT-PE) with 180 credits.
- Diploma in Electronic and Photonic Components Engineering & Manufacturing (MAT-PE) with 120 credits.
- Certificate in Electronic and Photonic Components Engineering & Manufacturing Cert. (MAT-PE) with 60 credits.

OPTIONS	Full-time Duration	Part-time Duration	Credits Required	Courses
Certificate	1 semester	2 semesters	60	3 technology courses + 1 business course
Diploma	2 semesters	4 semesters	120	6 technology courses + 2 business courses
M.Sc	1 calender year	2 calendar years	180	6 technology courses + 2 business courses



syllabus:

project (MATS 5300/EEE6601):

This project may be based on any of the above subjects, industrial projects, or projects with business elements, e.g. quality control, process improvement. The project will be split into two activities – literature review and presentation skills (10 credits) to be completed by the middle of the second semester, with the experimental/field work (30 credits) beginning in the first week of June. The experimental/field work must be completed by 31 August in the form of a written report.

electronic and optoelectronic properties of materials (MATS 5310/EEE6390):

This module will develop an understanding of the properties of materials that depend upon the transport of charge. Of primary interest are the conduction mechanisms in metals and semiconductors, the latter being approached employing the formalism of the band structure. The properties of intrinsic and doped semiconductors will also be compared. Emphasis will be placed on junctions between dissimilar materials, including metal-metal, metal-insulator, metal-semiconductor, semiconductor-semiconductor and semiconductor-insulator junctions. The module will also address those properties of superconductors most relevant to their exploitation.

dielectric properties (MATS 5320):

The module will discuss charge displacement processes in insulators, focusing on the polarization mechanisms present in solids and how their temperature and frequency dependence are apparent in measurements of complex permittivity. The phenomenon of ferroelectricity will be introduced, including its corollaries of piezo- and pyroelectricity and their applications. An understanding of ferromagnetic and paramagnetic materials will be established, with a focus on the properties of interest in the electronics industry.
The module will focus on the principles of operation of fabrication various non-semiconductor devices, including capacitors, thermistors, varistors, gas sensors, piezoelectric actuators and sensors. A common aspect is that of ceramic processing, which will be covered in some detail from both the conceptual and practical viewpoints.

semiconductor processing (MATS 5330/EEE6391):

This module is designed to teach the aspects of semiconductor materials processing. It will include the main principles of single-crystal growth and thin film deposition (chemical and physical deposition). The fabrication of planar circuits will be covered in detail, including the various methodologies of lithography, together with methods for selective doping.

'a first class reputation'

The state-of-the-art laboratories and friendly learning environment.

optical properties of materials (MATS 5340):

This module will cover aspects of propagation of electromagnetic waves in dielectric media, intrinsic attenuation of power in waveguides (fibre/planar) due to scattering and absorption, Raman and Brillouin Scattering, dispersion effects, consideration for power penalty at high bit-rate data transmission, absorption and population inversion in 3- and 4-level systems. As well as spontaneous and stimulated emission, principles of solid-sate lasers based on RE- and TM-doped devices, gain and gain characterisation, Optical Non-linearity (second and third order susceptibilities in dielectric and ferro-electric media), Electro-optic effect and materials, Magneto-optic/Faraday effect, and the acousto-optic effect, and their applications.

change management & strategic planning (BUEC 5567):

The key learning objectives of this module include the understanding of strategic and operational planning in achieving organisational goals and managing change, and how changes may be planned and implemented to achieve business/organisational excellence. The role of business processes, structures, systems and the alignment of process teams in managing change will be explained through the use of case studies, with examples of how some obstacles to organisational excellence and resistance to change may be overcome.

fibre and planar optical device fabrication techniques, components, and applications (MATS 5350):

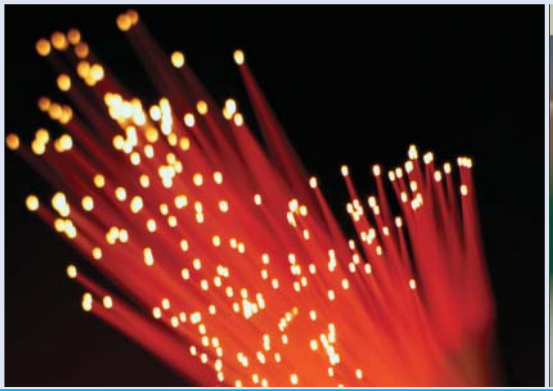
This module covers fibre and planar geometries, photonic band gap and photonic crystal fibres, fabrication methods using the glass fibre drawing (single, multimode, photonic crystal fibres) and thick/thin-film deposition techniques (PLD, CVD, Flame Hydrolysis, sol-gel). In addition to the characterisation of waveguides and fibres for attenuation, planar waveguide modelling, applications of fibres and planar devices (RE-doped and TM-doped lasers, RE-doped amplifiers, directional couplers, beam splitters and isolators), and a brief introduction on integrated optical and opto-electronic circuits.

microsystems, packaging, and interconnects technology (MATS 5360/EEE6392):

The concept of thick-and thin-film circuits as a means of realising robust circuits in planar form will be introduced. The majority of the module will focus on fabrication techniques including optical and optoelectronic interconnects, packaging issues, which will include screen-printing, vacuum deposition, electro-deposition, as applied to examples in automotive electronics, sensors and microwave communications.
Examples of current electronic packaging and interconnection strategies will be examined in detail, including single- and multi-layer printed circuit boards in various materials (epoxy laminate, ceramic, glass, silicon). The advantages of surface mount over leaded technology will be emphasised and a logical approach to the principles of multi-chip module design will be developed. The emerging and competing technologies for the packaging and interconnection of optical devices and fibres will be covered.

continuous process improvement (BUEC 5571):

This module focuses on the basic principles of continuous improvement including focusing on customers, understanding processes and involving people; continuous improvement and its relationship to planning and operating processes; continuous improvement and its relationship to commitment, strategies, teamwork, results and development towards excellence. The module will also explain the recognised tools and techniques for defining opportunities and prioritising.



delivery of modules and assessments

The modules will be delivered over a two-week period, during which workshops, group discussions, seminars and tutorials will also be held. There will be course work assignments and support hours to provide background guidance for each module. Each module is based on a 30-hour lecture equivalent, i.e. 20 hours of lectures and 10 hours of tutorials, plus discussions and workshops.
The taught modules will be evaluated via the University Written Examination. Each module will have 40% percent of assessed course work based on lectures, seminars, workshops and self-taught topics, and 60% will be examined. Pass marks will be 50% for each module, with distinction awarded for extraordinary students.

project

It is not a mandatory requirement that an assigned M.Sc. project includes business case studies. However, such case studies may be useful for an industrially supported project. The project will begin in the first semester with the following time-plan:

- Selection and award of project topics by week 5 in the first semester;
- Completion of the Literature Review and project planning by week 12;
- Completion of the first project report by the beginning of the spring term and commencement of project;
- Completion of the second interim report by the end of week 7 in the spring semester;
- Completion of experimental work by the end of July, followed by the final report by the middle of August;
- Project report evaluation;
- Joint supervision and continuous assessment of assigned project;
- Viva-voce examination in early September, followed by a project examination by the appointed External Examiner.

funding

The course fee for Home and EU students is £4000, which includes the demonstration and running costs for the state-of-the-art laboratory classes. The scholarship for home and EU students with 2.ii grade is £750.
The overseas course fee in the first year is £10,307 and will be reviewed each year to include the access and running costs for fabrication laboratories at Leeds and Sheffield (£1000 per student).
A merit-based scholarship is set at £3000 for selected non-EU students.

entry requirements

The main goal of this taught interdisciplinary course is to provide an advanced level of training for scientists and engineers with high 2.ii and 2.i degrees from Physics, Chemistry, Materials, Mechanical Engineering, Electronics and Electrical Engineering, and Manufacturing Engineering disciplines. Overseas students must have at least an aggregate of 65% marks at the Bachelors level prior to admission. Candidates with work-based experience in related areas and with relevant qualifications are also eligible for admission and scholarships.

how to apply

Prospective applicants should send their completed M.Sc. taught programme application form to:

Mrs Joy Bielby (Course Secretary)
The Institute for Materials Research (IMR)
Houldsworth Building
University of Leeds
Clarendon Road
Leeds LS2 9JT (UK)
E-mail: j.bielby@leeds.ac.uk
Phone: 0113 343 2348 (UK& N.Ireland)
++ 44 113 343 2348 (overseas)
Fax: 0113 343 2384 (UK & N.Ireland)
++ 44 113 343 2384 (overseas)

Enquiries related to the course may also be sent to the academic-in-charge:

Professor Animesh Jha
The Institute for Materials Research (IMR)
Houldsworth Building
University of Leeds
Clarendon Road
Leeds LS2 9JT (UK)
E-mail: a.jha@leeds.ac.uk
Phone: 0113 343 2342 (UK& N.Ireland)
++ 44 113 343 2342 (overseas)

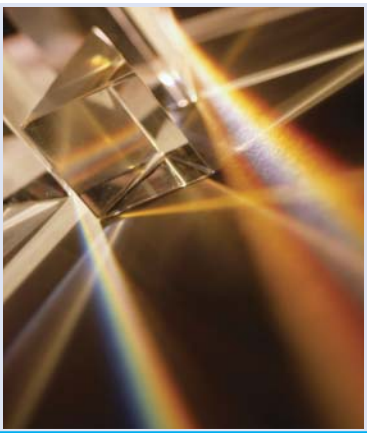
The M.Sc. application form can be downloaded from the website www.leeds.ac.uk/students/tp2002.pdf
All queries regarding the course should be sent to Mrs Joy Bielby at the above address.

what are the career opportunities?

The M.Sc. course will equip students with an advanced level of knowledge for the components used in photonic and optoelectronic devices. Employment opportunities are with major telecom companies, fibre device manufacturers, computer hardware and semiconductor manufactures. Worldwide the major employers are: Lucent, Alcatel Optronics, Nortel, Avanex, OFS-Fitel, Bookham Technologies (US, Europe), Samsung (Asia), Reliance (India), NEC, Agilent and INTEL.

The course will also provide opportunities for people in industry to acquire advanced level of knowledge via the Diploma and the Certificate programmes.

More useful addresses are overleaf.



Accommodation Services
Refectory Building
University of Leeds
Leeds, LS2 9JT
Tel: 0113 343 6086/6087
Fax: 0113 343 6077
Email: accom@adm.leeds.ac.uk
www.leeds.ac.uk/accommodation/

Unipol Student Homes
8-12 Fenton Street
Leeds, LS1 3EA
Tel: 0113 243 0169
Fax: 0113 234 3549
Email: info@unipol.leeds.ac.uk
www.unipol.leeds.ac.uk

International Students Centre
University of Leeds
Leeds, LS2 9JT
Tel: 0113 343 4022/3
Fax: 0113 343 4056
Email: international@leeds.ac.uk
www.leeds.ac.uk/students/intl/

Leeds University Union
University of Leeds
Leeds, LS2 9JT
Tel: 0113 380 1234
Fax: 0113 380 1205
www.leeds.ac.uk/union/

Disability Services
University of Leeds
Leeds, LS2 9JT
Tel: 0113 343 3927
Fax: 0113 343 3926
www.leeds.ac.uk/services/disability.html

Dr. Peter Parbrook
Department of Electronic
and Electrical Engineering
Mappin Street
Sheffield S1 3JD
Tel: 0114 222 5366
Fax: 0114 272 6391
Email: p.parbrook@sheffield.ac.uk

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