**Fact File**

**MODE OF STUDY**
- Full-time: 1 year
- Part-time: 2 years

**ENTRY REQUIREMENTS**
- A first or second class honours degree in Mechanical or related Engineering
- A score of 6 or above in IELTS (for International students only)
- Equivalent Qualifications with Experience will be considered for the part-time mode

**ENQUIRIES**
Dr S. Sivaloganathan (Siva)
Course Director, Advanced Engineering Design MSc
School of Engineering and Design, Brunel University,
Uxbridge, Middlesex, UB8 3PH, UK
Tel +44 (0)1895 265853
Fax +44 (0)1895 269763
Email S.Siva@brunel.ac.uk
Web www.brunel.ac.uk/about/acad/sed/sedcourse/pg/acad/sed/sedcourse/pg/mechanical/engdes/

Tom Kissack
Marketing And Recruitment Manager
Tel +44 (0)1895 266634
Fax +44 (0)1895 269878
Email thomas.kissack@brunel.ac.uk

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**A course designed to differentiate itself from others in the UK by**

- advanced study in four themes (Mechanical Engineering, Mechatronics and Control, Manufacturing Engineering and Human Factors).
- focussed training on many contemporary CAE packages.
- design experience in an industrial context and dedicated individual work on the dissertation.

**Aimed at:**

- High calibre and ambitious Mechanical or related Engineering graduates.
- Experienced Engineers from the Industry (part-time route).

**Learn how to**

- Design products requiring multidisciplinary knowledge and comprehensive engineering analysis.
- Use six CAE software packages.
Advanced Engineering Design MSc

Who is this Programme designed for?
The Advanced Engineering Design MSc is aimed at
- High calibre and ambitious Mechanical Engineering graduates (first or second class honours). Others will be considered on an individual basis.
- Experienced Engineers from industry who wish to gain advanced knowledge and to learn new methodologies and techniques.

Why Advanced Engineering Design?
Supporting the novice designers by simply supplying knowledge is not enough, they also need to be aware of the general approach (Professor K. Wallace, Cambridge University). Engineering Design is the application of engineering principles, experience of ‘making’, and mathematical models and analysis. The design and production of complex engineering products often require the use of embedded intelligence and detailed engineering analysis involving mechanical, electronic and control functions. In this design process:
- Advanced theoretical knowledge and a wide range of computer driven tools, methods and methodologies are essential.
- Experienced Engineers require (a) advanced theoretical knowledge and (b) skill in the use of Computer Aided Engineering software.

The Advanced Engineering Design MSc is designed to meet the above design requirements.

Learning Outcomes
On completion, graduates are expected to work as design leaders in industry or in research institutions. They will be able to understand and apply advanced theoretical principles involved in complex engineering product design and development in a computer-assisted environment. Special individual attention will be given to make the graduates feel valued and self-fulfilled by equipping them with key employability skills.

Special Features of the Course
- Integration of four main themes, namely:
  1. Mechanical Engineering Design
  2. Design of Mechatronic Systems
  3. Manufacturing Engineering and
  4. Human Factors in Design

Course Outline
The Advanced Engineering Design MSc is run over twelve months, beginning with the taught phase followed by a four month focussed individual dissertation project. Six compulsory modules and an outputting ‘Design Experience’ module are taught from September to May. The dissertation project starts in June, after the examinations for the taught modules, and finishes in September.

Module 1: Engineering Design in Perspective:
This module is designed fundamentally to support the ‘Design Experience’ module by bringing the students to a common level of competence. It will enable students to learn (a) Essential Mechanics of Solids (b) Design Process (c) Preparation of Manufacturing Drawings using a modern CAE software (Pro/Engineer) (d) Machine shop practice (e) Hands on experience in motor control and (f) ADAMS software for mechanism synthesis. For part-time students attendance is optional.

Module 2: Manufacturing System Design and Economics
This module looks at advanced aspects of (a) Manufacturing Processes including description, analysis and classification of basic manufacturing processes; process capabilities; recent advances and developments in manufacturing processes; assembly systems; automation: robotics and NC machines; CAD/CAM application (b) Production Operations: including Plant layout; Group Technology; Cellular Manufacturing and Flexible Manufacturing Systems. Lean
manufacturing techniques, Kaizen, KANBAN, JIT, 5S, seven wastes, Poke Yoke, Value Chain, supply chain management and outsourcing, and design reuse. Inventory control and MRP, and quality control. (c) Design for Manufacture and Process Selection: including the relationship between design features and process capabilities, manufacturing system selection to realise a given design and (d) Economics for Manufacture: including Inventory Costing, Economic Order Quantities, Costing machine tool selection and cost of production strategy.

Module 3: Physical Human Factors in Design
In this module the student will (a) develop an understanding of the physical characteristics of humans (b) learn to use the main qualitative and analytical methods of human centred design (c) be led to appreciate the application of human centred design techniques by means of examples chosen from the automotive, electronic and consumer product industries and (d) acquire skills in multi-disciplinary thinking and multi-disciplinary design practice.

Module 4: Advanced CAE:
In this module the students will be taught (a) how the constituent entities of a physical object, points, edges, surfaces and solids are modelled for CAE, and the skills to implement them using a contemporary CAE software to create a computer model of a part or assembly (CATIA) (b) theory and some useful applications of computer models in mechanism synthesis and analysis using a contemporary CAE package for Mechanism Analysis (MATLAB, SIMULINK).

Module 5: Design Experience
In this module the students will learn and experience (a) the design of a multidisciplinary, large product or system in a manufacturing environment (b) the skills in project planning, management and execution as a team member (c) how to use various knowledge and skill components acquired during their undergraduate and postgraduate study and (d) how to acquire knowledge on a self-learning basis. It is normally based on a project taken from British Industry.

Module 6: Design of Mechatronic Systems
In this module the students will be taught how to (a) integrate mechanical, electronic and control functions (b) critically analyse and use mechatronic design concepts. (c) apply multiple discipline expertise in an integrating mechatronic process and (d) use advanced software to simulate power electronic circuits (PSPICE).

Module 7: Microprocessors and Embedded Control
This module covers the various elements of embedded system design i.e. the inclusion of a microprocessor system into a mechanism in order to control it. The specialist microprocessors commonly used, will be investigated in terms of how to program them, how to interface them to the real world and how to use particular features required for embedded systems. The other half of the module introduces the subject of control systems analysis and design with the aim of providing sufficient understanding to implement a feedback control system using a microprocessor.

Module 8: Structural Design and FEA
In this module the students will be taught (a) advanced theory in Finite Element Analysis, and Structural Design (b) useful applications of Structural Design and FEA, and the use of a contemporary CAE package for structural design, component design and FEA (ANSYS).

Delivery
The course is delivered in full and part-time modes. The full time mode has two full day lectures per week, while the part-time mode has one full day per week. Preparatory work and the software packages Pro/Engineer, MECHANICA/ABAQUS and ADAMS will be taught during the Monday, Wednesday and Friday of the first two weeks and Wednesday mornings of the first term in the module Engineering Design in Perspective. Part-time students are also encouraged to attend.

Achievements – Course Successes to Date!
- Employment Record: All 9 students from the first cohort obtained employment in the UK. 13 out of the fifteen students from the second cohort are in engineering employment. The third cohort has just started looking for work.
- The students from the first, second and third cohorts have been engaged in the design and development of a vertical access platform in their Design Experience module with the support of NiftyLift Ltd. The third cohort of students completed the Embedment Design of the machine. Mr Immanuel Doss took the detailed design and building of the machine as his dissertation project. The photos overleaf show the first cohort of students experiencing hired machines of similar type, and Immanuel’s prototype.
- All students, except one, completed the programme and obtained their MSc.
- One student from each of the first three cohorts has started PhD studies.
- Three students, one from each of the first three cohorts, have employment as KTP associates.
Every effort has been made to ensure the accuracy of the information in this brochure and the University will take all reasonable action to deliver courses and services in accordance with the descriptions set out in it. However, the University reserves the right to vary the content of courses, or to merge or discontinue them. It will, in the case of discontinuation, use all reasonable efforts to offer a suitable alternative.

All students are required, as a condition of registration, to abide by and submit to the University’s statutes, ordinances, regulations and rules, which are published on the University’s website: www.brunel.ac.uk/about/administration/rules

Dr Sivaloganathan graduated as a Mechanical Engineer from the University of Sri Lanka, Katubedde Campus in July 1976. He received his MSc in Production from the University of Aston in 1982 and PhD in Computer Aided Design from City University, London in 1991. He underwent a year of post-graduate apprenticeship in the manufacturing workshops of the Sri Lankan Government Railway. He worked in the Sri Lankan Cement Industry for almost nine years and finished as the commissioning engineer, and later the first Operations Manager for the newly commissioned plant in Lanka Cement Ltd.

In the UK, Dr Sivaloganathan joined the City University Quality Unit and worked as a Research Assistant to Professor H.P. Wynn, and researched on Taguchi Methods. He later joined the SERC Engineering Design Centre at City University as the Senior Research Assistant. He joined Brunel University in 1995 as a member of the academic staff to teach and research Design and CAD. At present he is a Senior Lecturer and Course Director for the Advanced Engineering Design MSc programme. During this time he worked with the Commonwealth Science Council and worked for the setting up of the Engineering Design Centres in Sri Lanka. He was the founding convenor of the biennial Engineering Design Conferences EDC98, EDC 2000 and EDC 2002.

Dr Sivaloganathan designed and developed the Advanced Engineering Design MSc programme which has been taught by Brunel University since 2005. Dr Sivaloganathan has supervised seven PhD students to completion. Another four students are reading for their PhD degrees at present. He has attracted several research grants from industry and research councils. His research interests are Design Methodology and CAD applications in Design.

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