Imperial College London

# MSc in Composites: the Science, Technology and Engineering Application of Advanced Composites

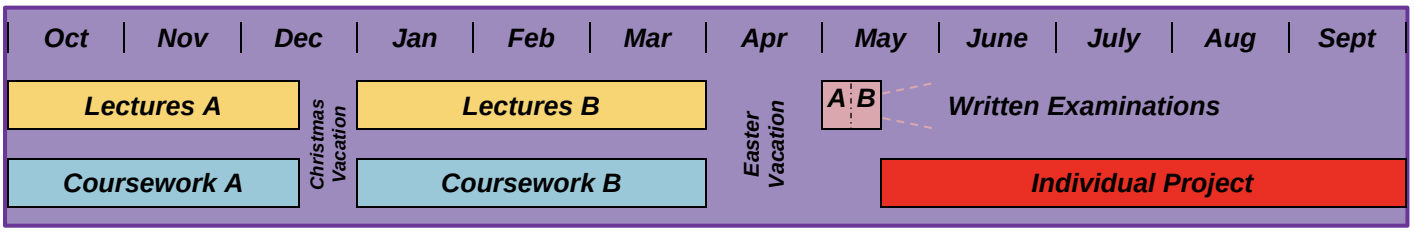
## Overview

The Department of Aeronautics provides a comprehensive and integrated programme addressing the science, technology and application of high performance composite materials. The programme is delivered by leading experts in the field of composites from Imperial College as well as from research organisations, industry, other universities and the Ministry of Defence. The underlying aim of the programme is to provide high quality postgraduates with the skills to take up leading roles in the design, research and development of composites technology for a wide range of industrial sectors including aerospace, transport, marine, offshore, sports goods and civil engineering.

## Accreditation

The programme is accredited by the Royal Aeronautical Society, the Institute of Materials, Minerals and Mining and the Institution of Mechanical Engineers.

## Programme Structure




The programme can be undertaken either on a 1 year full-time basis or by part-time attendance over two years. In the first year part-time students attend the lectures, complete the coursework assignments and sit the examinations for parts A indicated in the above programme structure. In the second year of attendance these students will complete the remainder of the lectures, coursework and examinations (parts B). The part-time students will normally carry-out the individual project during the May-Sept period of the second year but it is possible for the project work to be spread over the two years of part-time attendance.

## LECTURE MODULES

### PART A:

| | |
|---|---|
| Introduction to Composites | Revision Stress Analysis |
| Revision Chemistry | Fibres |
| Interfaces | Manufacturing Science |
| Composites Systems | Non Destructive |
| (Polymer, Ceramic, Metal) | Evaluation (NDE) |
| Stiffness and Strength | Mechanical Testing |

### PART B:

| | |
|---|---|
| Electrical Properties | Stress Analysis |
| Joining | Fracture |
| Laminate Analysis | Design |
| Fatigue | Analytical Techniques |
| Environmental Effects | Finite Element Analysis |
| Impact | |

## COURSEWORK PROGRAMME

### PART A:

**Laboratory classes and associated reports on:**

| | |
|---|---|
| *Flexure* | *Tension* |
| *Compression* | *Shear* |

**Literature Review:**

*This constitutes a written report of about 5000 words and an oral presentation. Students select a topic from a list supplied at the beginning of the academic session.*

### PART B:

| | |
|---|---|
| *Fracture* | *DSC/DMA* |
| *NDE* | *Channel Warping* |

**Group Design Study:**

*Students work in groups of 4/5 on a defined task e.g. design of a portable composite road bridge for disaster relief. The study includes regular progress meetings and a final oral presentation and report.*

## INDIVIDUAL PROJECT

The project constitutes a piece of individual research which must include some element of originality and can be wholly experimental, wholly theoretical, or a mixture of the two. Students select projects from a list of topics proposed by university staff and by industry. The results from the study must be set in context against published work. The project is assessed by progress in conducting the work (including 4 monthly progress reports), a dissertation of about 10,000 words, and an oral presentation.

It is expected that many projects will have significant industry support and may be wholly or partly undertaken in industry, as appropriate.

### *Project Key Dates*

**April/May ⇨ September (before start of new academic year)**
Project titles and short descriptions are collected from industry and university staff

**Early October**
Project titles and description issued to students

**Mid-January**
Students to submit selection forms. (If a company wishes to interview and select specific students for its projects then this process needs to be completed by mid-December)

**Mid-February**
Projects allocated to students

**Mid-May**
Students begin projects

**Mid-September**
Deadline for project report submission

**EXAMPLES OF EXTERNAL PROJECTS OFFERED IN 2012-13:**

- Fracture and Iosipescu shear of multi-angular laminates
- Shear-after-impact testing of composite laminates
- Methods of forming in-plane and out-of-plane wrinkles in composite test specimens
- The effect of test method on the experimental measurement of through-thickness strength of composite laminates
- Hansen's Solubility Parameters for Epoxy Laminates
- Development of a measurement system to determine the tack properties of prepreg materials
- Investigation of the factors which affect resin bleed out of preimpregnated materials during cure
- Investigation into the mechanical properties of glass fibre reinforced polymer (GFRP) composites comprising of novel chemistry matrices
- Investigation of the bond strength between surface treated steels and GFRP laminates using epoxy adhesive in extreme low temperature environments
- Development of material models and design optimization of prefabricated hybrid joints
- Effect of curing process on interlaminar morphology and subsequent mechanical performances of third generation pre-impregnated (*prepreg*) carbon-fibre UD tapes
- Recyclability of aero grade composites
- Optimisation of structural and electrical response of composite materials
- Weathering degradation of blades outer laminates
- Optimum mix ratios for novel epoxy systems
- Investigation of the environmental degradation of steel surface treatments
- Design of a resin dispensing system for filament winding process
- Investigation into the processing characteristics of a polyurethane (PU) resin system compared to an epoxy resin system
- Development of a method for testing the hot-wet tensile and compressive static and fatigue strength of composite laminates containing impact damage

### *Further Details*

For further information about the programme please visit: http://www3.imperial.ac.uk/aeronautics/pg/composites

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