MODULE DESCRIPTION FORM

DEPARTMENT OF MECHANICAL AND AEROSPACE ENGINEERING

ME527 Introduction to Engineering Optimisation

Module Registrar: Dr Edmondo Minisci edmondo.minisci@strath.ac.uk	**Taught To (Course): Cohorts for whom class is optional**		
Other Lecturers Involved:	**Credit Weighting: 10**	**Semester: 2**	
Assumed Prerequisites: • Very good programming skills • Good knowledge of matrix algebra and function analysis	**Compulsory / optional class**	**Academic Level: 5**	**Suitable for Exchange: Y**

Module Format and Delivery (HOURS i.e. 1 credit = 10hrs of study):

Lecture	Tutorial	Laboratory	Groupwork	External	Online	Project	Assignments	Private Study	**Total**
18	20						32	30	100

Educational Aim

This module aims to provide an introduction to optimization techniques for continuous problems and to the approaches to formulate and solve optimization problems in engineering. Using a combination of lectures, computer lab tutorials, and assignments, students will develop an understanding of the overall design optimisation process and the performance of different optimisation algorithms, when applied to solve real engineering design problems.

Learning Outcomes

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

LO1 Understand basic theoretical principles in optimization

LO2 Learn and implement, in a computer environment, different optimisation algorithms and assess their performances

LO3 Formulate engineering design problems as mathematical optimization problems.

LO4 Solve engineering optimisation problems through the use of available optimisation tools and self-developed ones.

Syllabus

The module will teach the following:

- Introduction
  - Description of the optimisation process, and Overview of real problems
  - Brief classification of problems and optimisation algorithms
- Problem formulation
  - Unconstrained/Constrained problems
  - Single objective / Multi-objective problems
- Optimisation algorithms and applications
  - Optimisation theory
  - Local optimisation algorithms without and with constraints / Available software libraries
  - Global optimisation algorithms without and with constraints / Available software libraries
- Approaches to handle expensive numerical models
  - Design of Experiment and Surrogate modelling approaches
  - Surrogate based optimisation approaches

Assessment of Learning Outcomes

Criteria

For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

LO1
C1 Students should be able to understand and describe how a general optimisation process works.
C2 Students should be able to describe the possible main features of the optimisation problems.

LO2
C1 Students should be able to describe/implement the main characteristics/steps of mostly used optimisation algorithms.
C2 Student should be able to choose the best suited optimisation algorithm on the basis of the known features of the problem.

LO3
C1 Student should be able to understand main features of real design optimisation problems and convert them to the most convenient mathematical format.

LO4
C1 Students should know the most used optimisation libraries and should be able to apply and adapt them to solve cases of interest.

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
(within Assessment and Feedback Policy at: https://www.strath.ac.uk/staff/policies/academic/)

Regular feedback and discussion will be available in tutorial sessions.

Individual feedback will be available by appointment with the course lecturers.

Feedback from online tests will enable students to reflect on their understanding of the subject material as soon as they start working on the coursework.

Formal, summative feedback will be provided by the return of online test marks to students after assessment. Individual feedback on the online test may be arranged, via drop-in sessions or single appointments.

Discussion of the course material between teacher-student and also amongst peers will be encouraged in tutorial sessions. Students will also be encouraged to discuss the coursework with their peers to improve learning.

The coursework will be returned with marks and written feedback to allow students to reflect on their performance. Coursework results will be discussed as soon as possible (date and time will be agreed to meet and review the submissions and the feedbacks).

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

Examination (online tests)				**Coursework**		**Practical**		**Project**	
Number	Month(s)	Duration	***Weighting***	Number	***Weighting***	Number	***Weighting***	Number	***Weighting***
2	February March	30 mins each	30% (15%each)	1	50%	5	20% (4% each)		
LO1-LO4				LO1-LO4		LO1-LO4		*	

* ***L/Os:*** *Indicate which Learning Outcomes (L01, L02, etc) are to be assessed by exam/coursework/practical/project as required.*

Coursework / Submission deadlines (*academic weeks*):
Coursework 1: Submission Monday of week 11

Resit Assessment Procedures:
Submission of alternate ^^coursework prior to commencement of the August exam diet.

^^Students must contact the module Registrar for details as soon as results confirm that a resit is required.

PLEASE NOTE:
Students must gain a summative mark of 50% to pass the module. Students who fail the module at the first attempt will be re-assessed prior to the August diet. This re-assessment will consist entirely of coursework. No marks from any previous attempts will be transferred to a new resit attempt.

Recommended Reading

*****Purchase recommended **Highly recommended reading *For reference**

A reading list of recommended texts is issued at the start of the class. No single text is used. Comprehensive lecture slides are provided

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

Date	Time	Room No
Weekly	To be agreed	Check timetable webpages for details

Session: 2020/21

Approved:

Course Director Signature:	**Dr Stuart Grey**
Date of Last Modifications:	**10 September 2020**

(Updated August 2020)

MODULE TIMETABLE

Module Code:	**ME527**	**Module Title:**	**Introduction to Engineering Optimisation**

Brief Description of Assessment:

The assessment will be done through two online tests counting 30% of final mark (15% for each test), a coursework, counting 50% of the final mark, and five lab assignments counting 20% (4% for each assignment).

Assessment Timing

Indicated on the table below are the start/submission dates for each assignment/project and the timing of each exam/assessment. Dropdowns may be left blank. Add extra notes below the dropdowns where relevant.

Please note: Timings can and will change, this should only be used as a guide.

Semester One	W&D Wk	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	Exam Period
	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item.

Semester Two	C&D Wk	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	Exam Period
	Choose an item. Choose an item.	Choose an item. Choose an item.	Lab Report Submission	Lab Report Submission	Online Test	Lab Report Submission	Lab Report Submission	Online Test Coursework Set	Lab Report Submission	Choose an item. Choose an item.	Choose an item. Choose an item.	Coursework Submit	Choose an item.