CRANFIELD UNIVERSITY

MSc in Computational & Software Techniques in Engineering

APPLICATIONS OF COMPUTATIONAL ENGINEERING DESIGN OPTIMISATION (ESTIA)

Group Project, 2025/2026

Introduction

I, Professor Chris Phillips, am the module leader for the 40-credit Group Project module that you will undertake as part of your MSc with Cranfield University. I can be contacted by email - I do have a Cranfield email address, but please use chris.phillips@ncl.ac.uk. I can guarantee that I will answer anything sent to this address fairly promptly. You may also contact me via WhatsApp using +447879477519. However please see below for further details of how to contact me.

In this assignment you are required to work in groups, with 4 students in each group – so 5 groups in total. You are allowed to form your own groups, but the number of groups, and the number of students in each group, is fixed. You should establish a person who will be the Lead Contact for all groups/students throughout the project. The Lead Contact should identify themself to me at the earliest opportunity, and certainly while you are all visiting Cranfield University, and well before you return to Biarritz. The Lead Contact will need to ensure that the group constraints (number of groups, number of students in each group) are satisfied.

Each group should have a Group Lead. Each group should also have a group name based on a theme. This year's theme is Château in the Loire valley. The Lead Contact should inform me of the group compositions (that is, who is in which group), who the Group Leads are, and what the names of the groups are, again, at the earliest opportunity.

Any future contact with me (for example, to clarify any aspects of this group project specification) should normally be through the Lead Contact. Should there arise a need for an online catch-up session whereby I speak with all Group Leads together this should be arranged through the Lead Contact. In addition to this, should any Group Lead wish to contact me individually and directly they are free to do so, but this should only be in relation to a matter that they are unable/unwilling to feed through the Lead Contact. Similarly, should any individual wish to contact me directly they are again free to do so, but only in relation to a matter that they are unable/unwilling to feed through their Group Lead.

The aim of the assignment is to apply collective knowledge, in particular from the modules you have attended during your MSc studies in the area of design optimisation. This module has three assessment components/Parts that must be passed individually and collectively. Assessment is entirely through coursework, there is no written examination. Time will be allocated for delivery of the module during the 2 weeks January 26th – February 6th when I will be visiting ESTIA. However, you are expected to work on the project before, during, and after that period.

This Group Project has two components, product and process, and both are important. The product is the solution of a technical problem based on the use of optimisation techniques, and will involve some software development. The process is concerned with how effectively the group works in achieving that product.

The full details of the work to be completed will not be available at the outset. Instead details will be defined from time to time via an update to this document which I will email to the Lead Contact for distribution to the Group Leads, and from there to all group members. **Any times specified in this document are UK times.**

Although I will try to avoid doing so, I reserve the right to update this document in other ways from time to time, but only where I believe it to be in the interests of students, for example, to clarify what is required. If you spot any bugs/anomalies please raise them through the Lead Contact and ask them to forward details to me as soon as possible.

Meetings

While this assignment aims at giving you the opportunity, freedom and responsibility to identify what your contributions might be, a number of tasks are deemed to be standard across all groups.

Task, and sub-task, allocation to individual group members is decided by the group members themselves and every group member should track their time commitment to the project starting from their receipt of the assignment up until the final submission date. Each group member is required to maintain a log on a weekly basis, each week ending midnight Sunday.

You are required at the outset to identify the strengths and development opportunities of each group member. To assist you with this you will be provided with two documents, a Skills Matrix and a Strengths Ticklist. Each individual group member must complete these documents, addressing the topics as frankly as possible, and then share these with the rest of the group. You are also required to undertake, and reflect on, a free online personality test, such as Myers-Briggs, to determine your personality type. The real Myers-Briggs test costs money, but there are free examples that you can find on the web. These analyses will help you with your review at the end of the module of how effectively you and the group worked while completing the technical work.

You are required to take an Agile approach to tackling the technical work, with scrums, stand-ups, etc.

You must hold a meeting of all group members as soon as your group membership has been established, and no later than Friday November 14th 2025. At this meeting you are required to discuss the Skills Matrix, Strengths Ticklist, and Myers-Briggs test results of all group members, and then allocate initial roles to individuals appropriately. This is not to say that you may not take on a role for which you have identified a relative weakness as there is an opportunity here to develop that skill. Further a reallocation is possible at any stage in light of experience and as the group project develops. You must also identify appropriate free project management tools that you will employ whilst working on this project.

Students are expected to be creative, identify their own contributions and carry out the technical and non-technical work. This is an assignment where you are encouraged to think 'out of the box'.

Formal Submission requirements

The formal (summative) assessment of the group assignment is based on the following marking scheme:

- Part 1: 50% Group Coursework Portfolio - a collection of documents describing the technical results (the product) that the group has achieved by addressing a number of technical Tasks (Tasks 2-4 and 6-7 to be identified below) which will be released via an updated version of this specification from time to time. Each Task will involve the production of a report which should be sent to me by the Group Lead via email at a time/date specified in the Task. This email

submission is intended primarily so that I can monitor that you are making progress, although I will endeavour to give some feedback and an indicative/provisional mark. All reports must subsequently be collated as a single document, one per group, and submitted by the Group Lead to Canvas by the deadline specified. Only in exceptional circumstances should any changes be made to these documents between the first time you send them to me, and the final Canvas submission. Should you wish to make changes you will need my prior approval, which will not normally be given. You will need to explain why you believe I should consider granting your request

- Part 2: 30% Group Oral Presentation – this is in two parts. There is an interim in-person oral presentation (Task 5) at which you will present progress made so far. This is worth 10%. A second presentation (Task 9) is worth 20%, and will be delivered online later in the academic year. Each presentation may be in a fairly standard format, but you are strongly encouraged to consider alternatives, such as PechaKucha, or perhaps a mixture. Attendance at the oral presentations by all group members is compulsory. The two presentations must be collated as a single document and submitted by the Group Lead to Canvas by the deadline specified below.

- Part 3: 20% - this is in two parts. Each group member should write two reflective self-assessments (Task 1 and Task 8), with Task 8 making extensive reference back to Task 1.

- This is a group project, only one submission per group, by the Group Lead, is required for each of Parts 1 and 2. However, each group member is required to submit their own Part 3.

The Tasks

Task 1 (Individual Report) – released by 20/10/2025:

This Task requires each student to reflect on their skills and how these might be employed to support the group's work.

For each individual member of the group there must be an analysis of the strengths/development opportunities of that group member and an initial proposal of what role(s) they would like to undertake over the duration of the group project. Each group member must include a discussion of their personality test (Myers-Briggs or other), Skills Matrix, and Strengths Ticklist, and documents covering these should be attached as appendices.

This Task is worth 5% and contributes to Part 3 above.

Individual reports should be collated by the Group Lead who will share them with all group members and then send them as a single document by email to reach me by midnight 14/11/2025.

Task 2 (Group Report) – released by 20/10/2025:

This Task requires each group to consider how they might make use of the skills of each group member and plan, as much as possible, how the group project is to be tackled.

As indicated above, you need to hold a first group meeting on or before November 13th 2025. At this meeting you should discuss the strengths and development opportunities of the group members as identified by all group members in Task 1. From that discussion you should propose an agreed initial allocation of roles and responsibilities of each member. You must also identify the project management tools that you intend to use throughout the length of the group project. You must also identify a provisional timeline in the form of a GANTT chart which you should refer to, and update, from time to time between the start of the group project and the end. A group report must be produced that summarises these discussions.

This Task is worth 5% and contributes to Part 1 above.

This report should be sent by email to reach me by midnight 21/11/2025.

Task 3 (Group Report) – released by 20/11/2025:

This Task requires you to investigate further the unconstrained and constrained optimisation techniques that have been introduced as part of your Cranfield degree. It is likely to involve some coding, and will involve the production of a detailed report describing your findings.

As part of your coursework for the Computational Optimisation Design module you studied at Cranfield you were required to minimise the Griewank Function by using a stochastic scheme such as Simulated Annealing or Particle Swarm Optimisation. In this and following tasks you are required to investigate techniques of unconstrained and constrained nonlinear optimisation, but you can choose to write code from scratch, use code you have already written, or make use of publicly available source code. The credit you get will be the same, whichever approach you take, but you will, naturally, be expected to acknowledge the authorship of any code you make use of that is not your own. It is important that you have full access to the source code, not 'black box' routines.

Using both the Particle Swarm and the Simulated Annealing techniques, solve three optimisation problems (covering both constrained and unconstrained) of your choice (but NOT related to a cooling tower, and NOT one that you studied for your Computational Optimisation Design coursework) and summarise your results. You are required to compare the performance of these methods. One way of measuring performance is to count the number of evaluations of the objective function on the assumption that, for a suitably 'complicated' objective function, each such evaluation is expensive in terms of time. Use this measure, and any other appropriate measures (e.g. elapsed time), to compare performance. You must include graphical representations of your results.

In this, and subsequent, tasks, if you are employing a penalty function to ensure that constraints are met you should experiment with various multiplying constants to see what effect, if any, they have on ensuring that any constraints are satisfied.

This Task is worth 10% and contributes to Part 1 above.

This report should be sent by email to reach me by midnight 12/12/2026.

Task 4 (Group Report) – released by 11/12/2025:

This Task is similar to Task 3 but involves the investigation of different optimisation techniques.

This Task is worth 10% and contributes to Part 1 above.

This report should be sent by email to reach me by midnight 23/01/2026.

Task 5 (Group Presentation) – released by 23/01/2026:

This Task requires you to present a summary of your findings so far.

The presentation part of this Task is worth 10% and contributes to Part 2 above.

You do not need to send anything to me by email in response to this Task.

Task 6 (Group Report) – released by 23/01/2026:

This Task requires you to apply the optimisation techniques employed in Task 3 and Task 4 to a specified optimisation problem.

This Task is worth 20% and contributes to Part 1 above.

This report should be sent by email to reach me by midnight 06/03/2026.

Task 7 (Group Report) – released by 05/03/2026:

This Task will involve the use of ABAQUS.

This Task is worth 5% and contributes to Part 1 above.

This report should be sent by email to reach me by midnight 26/03/2026.

Task 8 (Individual Report) – released by 25/03/2026:

This Task will require each group member to reflect on their, and the group's, performance over the past few months. Timesheets covering the time you have spent on the group project should be attached as appendices.

This Task is worth 15% and contributes to Part 3 above.

You do not need to send anything to me by email in response to this Task.

Task 9 (Group Presentation) – released by 25/03/2026:

This Task requires you to give a presentation describing the work you have done on the group Project.

This Task is worth 20% and contributes to Part 2 above.

You do not need to send anything to me by email in response to this Task.

Deadlines:

For each group, the Group Lead should submit 2 documents, one for each of Part 1 and Part 2. Each group member should additionally submit their own Part 3. The deadline for the submission of Parts 1, 2 and 3 is **9:30 am UK time Friday May 15th 2026**.

Chris Phillips

Last updated 16/11/2025