School of Informatics Course Proposal Form (version: May 2021)

Please see Page 2 for instructions on which parts of this form to complete, whom to consult with to avoid unnecessary effort, and where to send the completed form.

Proposer(s): Zhibin Alex Li **Date: October 2021**

Cover page: Basic permanent course information

Unless otherwise noted, items in this section are entered into EUCLID and **cannot** be changed without creating an entirely new course.

Course Name	**Advanced Robotics**
Is this an EPCC course?	_x_ No (default) *(If you don't know what EPCC is, this is the right choice.)* __ Yes *(If so, leave Course Acronym blank, to be filled in by ITO as EPCC/<number> for Theon and our Sortable List.)*
Course Acronym *(used only School-internally)*	AdvR
SCQF Credit Level and Normal Year Taken	**Standard options for Informatics courses:** __ Level 8/Year 1 __ Level 8/Year 2 __ Level 10/Year 3 (also available in Year 4). *[In practice, most level 10 courses have many students in both UG3 and UG4. MSc students may take up to 20 credits at Level 10.]* _x_ Level 11/Year 4 (also available in Year 5 and MSc). *[These courses are listed as options in both UG and MSc DPTs.]* _x_ Level 11/PG (also available in Year 5). *[These courses are normally for MSc and UG5 students. They are not explicitly listed in UG4 DPTs, but UG4 students can take limited credits of them.]* __ Level 11/PG (only). *[These courses are not available to UG4 or UG5 students. Examples: CDT courses; CPD courses.]* **Other options. Please provide justification if using:** __ Level 9/Year 3 *[Deprecated except for compulsory UG3 courses. The course will not be available to other years.]* __ Level 10/Year 4 __ Other:
SCQF Credit Points	__10 _x_20 __40 __60 __80 __Other:
Delivery Location	_x_Campus __On-line Distance Learning
Course Type	_x_Standard (default) __Dissertation __Online Distance Learning __Placement __Student Led Individually Created Course __Year Abroad
Marking Scheme	_x_Standard (numerical) __Letter grade only __Pass/Fail *[Normally only for externally delivered courses]*

Guidance for remaining sections:

Before starting your proposal: please contact the DDoLT (Curriculum) informally before starting to complete this form, with at least the following information:

- Tentative course title, level, year, and number of credits
- Who the target audience is, and why the course is needed.

The DDoLT (Curriculum) or delegate will schedule a meeting with you to discuss your plans and whether a full course proposal makes sense. If so, you will be provided with further instructions.

Deadlines: New courses must be approved by the December BoS meeting to ensure allocation of teaching staff for the following academic year. Since it may require considerable discussion and iteration to prepare the proposal, you should **contact the DDoLT (Curriculum) as early as possible, ideally in spring or summer**, and you should **plan on submitting your full proposal by November.**

Submitting your proposal: When your proposal is complete, please submit to **iss-bos@inf.ed.ac.uk**.

Colour coding and item-by-item guidance:
Guidance is provided in italics for each item. Please also refer to the guidance for new course proposals at http://www.inf.ed.ac.uk/student-services/committees/board-of-studies/course-proposal-guidelines. Examples of previous course proposal submissions are available on the past meetings page http://web.inf.ed.ac.uk/infweb/admin/committees/bos/meetings-directory but note that the proposal form was updated in Apr 2021.

Sections in gold are for student view and are required before a course can be entered into DRPS.
Sections in orange are for School use but are still required for all courses (even those that have already been approved based on other documentation).
Section in gray are for consideration by the Board of Studies. They are normally required for all new course proposals but may be omitted in some cases, with permission (e.g., for invited proposals).

Glossary of terms:

(D)DoLT: (Deputy) Director of Learning and Teaching.

DRPS (The Degree Regulations and Programmes of Study): Provides the University's official listing and descriptions of courses, degree programmes, and the regulations that govern them; updated annually in April. Course information in DRPS is considered a contract with students.

DPT (Degree Programme Table): Lays out the course requirements for each year of a degree. All UoE degrees have a DPT in the DRPS.

Path: A system that students use to help choose courses and view options in their DPT. The information feeds through from DRPS but has a more student-friendly interface (e.g., by highlighting courses that are not running or where the student hasn't satisfied prerequisites).

SCQF (The Scottish Credit Qualifications Framework): Lays out the requirements for courses at different levels and with different numbers of credits.

1. Course overview and case for support

Except as noted, all fields are required and will go into the DRPS (course catalogue) entry for students. Important: Text in DRPS is effectively a contract with students, so should not include details that are likely to change from year to year.

Summary Description (for DRPS)

Provide a brief official description of the course, around 100 words. This should be student-friendly, as it is the part of the descriptor a student is most likely to read. If this course replaces another course, please say so in this summary.

This course will be a Masters degree level course and also available in UG 5, as the introduction to the core elements in robotics: kinematics, dynamics and control; state estimation and signal processing; digital control systems; optimisation and optimal control, motion planning and robot learning.

The aim of the course is to present an overview of the field, with an opportunity to develop practical skills using the key elements of the major algorithmic techniques that are used in real-world robotic applications. The course provides tutorials dedicated to programming and the implementation of algorithms - from the equations to code, in order to bridge the lectures on algorithms and lab sessions.

Lectures on these topics and labs will exercise knowledge of these techniques, based on a practical robotic task, such as robot manipulation. The practical lab will be carried out on an integrated humanoid robot, which will be developed in simulation and then deployed on the real robot.

Contribution to curriculum; target audience and expected demand; consultation (for BoS only)

Why is this course needed and how does it relate to existing courses and degree programmes (including any prerequisite courses)?	This new 20-point Advanced Robotics course is aligned with the effort of restructuring IPAB robotics courses. The existing robotics courses, eg RSS and IVR, were created quite some years ago when there were a few robotics academics, thus courses have a wider coverage and overly concentrated content. With the current teaching resources, a diversified and balanced teaching portfolio is needed, to create more specific courses with their own focuses, so students can choose and combine courses according to their needs. This new course will focus on the main stream and the most essential core fundamentals of robotics, with introduction to the Modern Robotics techniques, which is matching the current state of the art. We will provide a distinct and unifying perspective to mechanics/modelling, planning, and control for robots. Given the new design with the core robotics elements, this course is suitable and can be open to both undergraduate (year 4) and postgraduate students, which provides an tangible way of enlarging the student cohort effectively.

	Moreover, the new Advanced Robotics course has a distinct difference between mobile robotics course and advanced robotics course, which allows students to take both at the same time or in sequence. This new course aims to: • take both UG4 and MSc students (increase cohort size), balance teaching load within the school. • support the new MSc Robotics Degree if it takes place. • Create opportunities to attract more students and generate more income. • Course structure is more up to date and increase the Edinburgh's profile in Robotics, being competitive in the UK landscape versus Imperial College, QMUL, UCL, Bristol, Oxford, CMU and so on. Specifically, we have designed the new course to resolve the key limitations which led to limited student satisfaction at times: 1. Overly broad content. The new course focuses on the core robotics elements, removed domian-specific elements and keep the common, generic robotics knowledge and algorithms. 2. Course course-related resources for offline learning. Key elements of the new course can be found in two textbooks: Modern Robotics and Introduction to Robotics. 3. Increased whiteboard sessions, for step-by-step understanding of concepts, derivation of equations. 4. Transfer knowledge to implemention on the robot. The tutorials are redesigned as the mid-ground to link the lectures and practical, hence tutorials are now better linked to the practical. 5. Workload of lab practical. (a) Now new designed lab practical has evenly distrubuted tasks, with each starting at 3, 5, 7 respectively, given averagely 2 weeks to finish each task. Also, each task has similar level of difficulty and required time. (b) The new software codebase is python based, avoiding C++ and ROS which could incur additional implementation effort. Pre-requisites: none.

What is the target audience, in terms of background and interests, and what is the expected demand (class size) for the course? *State what your estimate is based on: e.g. by referring to projects in an area, sizes of similar courses, employer demand, etc. A survey of students may be requested once the main descriptor information is ready.*	This is aimed at students with any relevant mechanical, electronics & electrical engineering and computer science Background, who are keen to acquire: 1. in-depth knowledge on advanced robotics technologies 2. to enhance professional skills and knowledge associated with the technical and theoretical elements of robotics 3. to gain practical skills of integrating robotic systems Expected demand (class size) for the course: 50-100. This is partly based on the number of students taking the current IVR course (>100). The new Advanced Robotics excludes the mobile robotics elements, hence being complementary to the new Mobile Robotics course. We expect students take both the New Mobile Robotics course and the Advanced Robotics (MOB and AdvR), which gives an estimated number of 50-100 students. We have occasional requests about attending the robotics course from students in the school of engineering. Moreover, the school of engineering is trying to grow robotics activity, but there is a lack of robotic courses within engineering. Therefore, the new AdvR course can attract some students, approximately >10, from the school of engineering.
Has this proposal been discussed with the DDoLT (Curriculum) or DoLT prior to BoS submission?	_x_ Yes __ No
Who else has been consulted? *Proposals should typically be discussed with relevant colleagues, including the programme director (for MSc courses). Summarize their comments if needed.*	Prof Subramanian Ramamoorthy, IPAB director. Prof Michael Mistry, CDT director. Dr Steve Tonneau, robotics lecturer. Chris Lu, robotics lecturer. As well as other IPAB members through IPAB staff meetings.

Course Description (for DRPS)

*This student-facing description should normally include **(a)** a more in-depth description of the learning aims, nature and context of the course, **(b)** a rough outline of the content, and **(c)** a description of how the course will be taught, and how students are expected to engage with it and to demonstrate their achievement of the learning outcomes.*
***Note:** Please keep this section general enough to avoid the need for yearly updates, and keep in mind that you should have only around 15 lecture hours of examinable material per 10pts of a course. (10pt courses may have 18-20 lecture hours, but the rest should be used for guest lectures, revision sessions, assignment feedforward/feedback, etc.)*

This course will be a Masters degree level course and also available for year 5 undergraduates. This is an advanced course that starts with the fundamentals and then go in-depth with core elements in robotics. The focused topics cover: kinematics, dynamics and control; state estimation and signal

processing; digital control systems; optimisation and optimal control, motion planning and robot learning.

The aim of the course is to present a unified view of the field and essentials in robotics, culminating in a robotic lab practical. The lab involves the development of an integrated robotic system which embodies the key elements of the major algorithmic techniques used in real-world robotic applications.

In particularly, in order to bridge the lectures on algorithms and lab sessions, the course also provides tutorials dedicated to the practice of programming and the implementation of algorithms - from the equations to code.

Lectures on these topics will be complemented by labs that exercises knowledge of a cross section of these techniques, based on a robotic task such as robot manipulation. The practical lab will be carried out on an integrated humanoid robot, which will have the main development in the simulation, and then deployed on the real robot.

Assessment Weightings (for DRPS)

These should correspond approximately to the proportion of learning outcomes (below) that each component assesses. Note that assessed coursework is typically more time-consuming than exams for both students and staff. A typical course is based no more than 30% on coursework and doing so requires justification.

Written Exam __50___%
Practical Exam __0___% (*for courses with programming exams)*
Coursework __50___%

Additional Information, Assessment (for DRPS)

State briefly for students what type of coursework to expect, including whether implementation is required. E.g., "Coursework will involve implementing some of the methods discussed" or "The coursework will assess students' analysis and proof skills. No implementation is required." More specific information can be useful, but please keep it high level and do not include details that are likely to change from year to year.

Coursework 1: homework to complete, general questions in robotics (eg, coordinate transformation); involve implementing some of the methods. Coursework 1 starts first and is handed out in week 5 and submit on week 8.

Coursework 2: a report for practical labs; scientific writing, analysis of results and data. Note that coursework 2 is the report of the lab practical, which

Coursework 3: lab demo of robotic tasks; implementation of core robotics algorithms (forward inverse kinematics, PD control, signal processing, and task-space motion planning), practical skills of implementing robotic solutions and using physics simulation, tests and handson skills on real robots. Note that Coursework 3 consists of 3 tasks, spreading over the workload: task 1 starts at week 3; task 2 starts at week 5; and task 3 starts at week 7.
The content in the course lectures match the required tasks, meaning that students apply learned knowledge from week 1-2 on the task 1 on week 3. This learning and applying skills in a progressive manner.

Also, for each task, there is an average 2-weeks time to learn the course materials, and another 2-weeks time to complete each task of Coursework 3.

Learning Outcomes (MAXIMUM OF 5; for DRPS)

List the learning outcomes (LOs) of the course. These must be assessable (i.e., observable), so must specify what the student should be able to do concretely, not simply what they should "understand". Use concrete verbs that indicate (a) what type of assessment would be appropriate, and (b) what level of knowledge/thinking is expected (from recall to analysis to novel creation). ***Example verbs:*** *define, explain, implement, compare, justify. Assessments (described later) should be tied to the LOs.*

LOs should focus more on the types of thinking/skills developed than on the detailed course content, and should be appropriate to the level of the course: e.g., LOs at Level 11 should include more higher-level thinking skills than at Level 8. See how to write good learning outcomes and the descriptors of the SCQF Levels. Also, please consider including LOs related to ***social or ethical implications*** *or* ***meta-skills*** *as well as technically-focussed LOs.*

On completion of this course, the student will be able to

1) Analyse the fundamental principles and the essential concepts in canonical robotics topics, evaluate the suitability and applicability of the algorithms given a robotics problem.

2) Identify, propose, and develop robotic solutions to solve practical robotic tasks.

3) Program and implement theoretical algorithms using common programming languages, and develop proficiency in debugging the code.

4) Use common robotics-related software, and use simulation tools to successfully set up robotic tasks and environments.

5) Write up and deliver a technical and scientific report, and demonstrate analytical and critical thinking to explain the positive and negative results of the tasks, and evaluate the performance by using quantifiable metrics.

6) Increase awareness of health and safety issues while working with real robotic systems, acquire knowledge of basic safety procedures of operating robotic and/or electronic systems, learn practical skills in using physical emergency devices and implementing software safety measures.

Graduate Attributes, Personal & Professional Skills (for DRPS)

Please list the generic transferrable skills that this course will develop, as aligned with the UoE's Graduate Attributes framework. Examples from the four skills categories in the framework include:

Research and enquiry: *problem-solving, critical/analytical thinking, handling ambiguity, knowledge integration*

Personal effectiveness: *leadership, planning and organizing, flexibility and change management, entrepreneurship*

Personal responsibility and autonomy: *ethics and social responsibility, independent learning, self-awareness and reflection, creativity, decision-making*

Communication: *interpersonal/teamwork skills; verbal, written, cross-cultural, or cross-disciplinary communication*

- Develop interpersonal skills through teamwork with cohort student for the labs

- Practical skills of problem-solving and knowledge integration through applying knowledge to real world problems
- Communication skills in terms of verbal and written skills, through presentations of practical and reporting of results.
- Work Independently and time management skills to deliver multiple objectives through reporting and live demos.
- Cultural awareness and diversity through teamwork with international students.

2. Additional information on course design and resourcing (for BoS only, except where noted)

Breakdown of Learning and Teaching Activities (for DRPS)

Please fill in the number of timetabled hours per student for each type of activity. Do not include non-timetabled hours.

***A typical 10pt Informatics course** has:*

- *18-20 lecture slots (2/wk), but only ~15h should be examinable lectures, with the rest used for guest lectures, revision sessions, assignment feedforward/ feedback, etc. If unsure of plans, count these under 'lecture hours' but please explain tentative plans in the free text below.*
- *No more than 4-5 lab or tutorial hours. Please consider whether fewer can be used, e.g. by using some lecture hours for whole-class discussion/feedforward.*

***A typical 20pt course** has 30 lecture slots (3/wk) and no more than 8 lab/tutorial hours.*

Timetabled Hours	Type
26	Lecture Hours (24 examinable lecture hours; 2 hours of special topics and case studies which are not as part of exam)
5	Seminar/Tutorial Hours
0	Dissertation Project Supervision Hours
7	Supervised Lab
2	Supervised Workshop
1	Feedback/Feedforward hours
1	Summative assessment hours *[Normally 2h if using an exam; otherwise 0]*
2	Revision Session Hours

(Note for ISS: Remaining hours should be allocated to Directed and Undirected Learning Activities.)

Use of timetabled activities (not to be included in DRPS)

If labs or tutorials are planned, please describe their role in the course (e.g., as support for assessed coursework, review of exercises, discussion of ethical questions, etc). If a non-standard pattern or style of lectures is planned, please explain.

Lectures

On campus lectures, Monday 09:00 - 10:50, week 1 - week 8.

(24 examinable lecture hours; 2 hours of special topics and case studies; 2 hours of practical workshop; 2 hours of feedback and summative assessment; 2 hours of revision lectures.)

Tutorials

Mondays/Thursdays: 11:00 - 12:00, week 2 - week 6. Support basic skills in implementing core robotic algorithms into code.

Labs

Mondays/Thursdays: 15:00 - 16:00, week 3 to week 9. To solve a practical robotic task by applying the learned knowledge and integrate basic algorithms learned in the tutorials, and deliver an operational codebase in physics simulation and the real robot.

Note: the tutorials and labs will have 2 optional slots on either Mondays or Thursdays, to split student groups.

Summative assessment and time spent on assignments (not to be included in DRPS)

*Please describe your plans for summative assessment, in more detail than in the student-facing description: How many and what types of assessment are planned (oral presentation, report, programming, etc)? For each piece of assessment, please indicate **(a)** which learning outcome(s) it assesses; and **(b)** how many hours students are expected to spend on it.*

*Please minimize the time spent on summative assessments (for both students and markers) while robustly assessing the learning outcomes. See the School policy on Workload and Assessment, which places limits on the number of summative courseworks and time expectations: to ensure a 35-40h working week, we must limit time asked of students to **6-7h/wk in total per 10 credits, including contact hours, self-study, and coursework.***

Lectures: 32 hours, week 1-8, 4 hrs/week, including 24 hours of examable lectures, 2 hours of special topics and case studies, 2 hours of practical workshop, 2 hours of feedback and summative assessment, 2 hours of revision lecture.
Tutorials: 5 hours, week 2-7, 1 hr/week.
Labs: 7 hours, week 3-9, 1 hr/week.

Time spent on assignments outside of timetabled hours
Coursework 1, homework: 4 hours over 4 weeks, 1 hr/week.
Coursework 2, report: 8 hours over 5 weeks, 1.6 hrs/week.
Coursework 3, programming for labs: 14 hours over 7 weeks, 2 hrs/week

Tentative plans for feedback/formative assessment (not to be included in DRPS)

Please describe your current plans for providing feedback to students: e.g. oral feedback during labs/tutorials, automarked solutions to in-lecture or online quizzes, peer feedback, etc. We also encourage submission of at least one piece of (individual or group) written work, with formative feedback emphasizing how students can improve.

Some useful guides for planning effective and efficient feedback:

- *Two short IAD web pages: Five basic principles for feedback and Tips for improving feedback*
- *EngagED in... assessment and feedback. This flyer from IAD discusses assessment **of**, **for**, and **as** learning, and includes examples of innovative approaches that could help both with scaling to large courses and with causing students to reflect on and become engaged with their own assessment.*
- *Considerable further reading is available at the University pages on Enhancing Feedback.*

feedback/formative assessment

Coursework 1, feedback on week 8, provide solutions during revision lectures

Coursework 2, feedback on week 9, via an organized a feedback session.

Coursework 3, feedback on week 10, feedback given during live demo.

Decolonisation and Inclusivity (not to be included in DRPS)

*What actions are you taking towards making your course inclusive for all students, in terms of both **content** and **delivery**? Please be as specific as possible. If you are not taking any action, please justify. See suggestions and guidance here.*

Content:
While introducing technological development background, we will cover the development around different areas of the world, and give a more comprehensive overview.

We will provide a reading list of basic mathematical foundations needed for this course. And we will also cover the elementary basics within the course, provide a good level of self-sufficiency for the course itself.

Delivery:

Particularly we will specially design tutorial sessions, which can help students with no programming background to pass the learning curve quickly, and get started with all the basic skills for the course, eg programming, a standard procedure/practice of transferring equations into coding.

Anticipated Resource Requirements

If tutorials are needed, how many students per tutors? (*Please provide your desired number, and the maximum feasible number.)*	**10-15 students per tutor, cap at 20 per tutor.**
If labs are needed, how many students per demonstrator? (*Please provide your desired number, and the maximum feasible number.)*	**10 students per tutor, cap at 15 per tutor as the limit.**
Please estimate the number of hours required for marking, per student.	**2 hours per student**
If any other teaching support resource will be requested in order to **develop** or **maintain** the course, please provide an estimate of that here.	**Demonstrator, TA during the semester, Coursework/Exam Marker**
Do you anticipate any difficulty recruiting enough teaching support? *(For example if the course is very large or very specialized.)*	**No**
Does the course have any scaling limits due to available space or equipment?	**70 students due to the limit of real robot hardware.**
If equipment is required, please state how it will be procured and maintained.	**Nextage robots are already in place.**
Does the course have any external funding? *(Typically only for CPD courses)*	**NA**
Does the course need any special arrangements such as quotas, agreements with other schools, or registration arrangements? Does it have any atypical characteristics that may affect finance or student registration? Please specify if so.	Q: If we open to the school of Engineering, is there a separate procedure?

3. Further information for BoS consideration

A full proposal for a new course must include examples of exercises and assessment. Please provide these below, along with publicity information.

Course information and publicity

The course web page (typically the Learn landing page) will be linked from the Sortable Course List, and information such as timetables and assignment deadlines must be made available prior to the start of the academic year. Please specify here if any additional info/publicity is needed for your course, especially if it is aimed largely at non-SoI students.

In terms of student's background: It is required that students should have come from general engineering background, such as mechanical engineering, electronic engineering, computer signs and etc

Because this course requires students to have basic knowledge of mathematics and some level of proficiency or exposure to programming skills, or at least basic knowledge of programming languages.

Sample tutorial/lab sheet questions

Provide a list of tutorial questions and answers and/or samples of lab sheets. These need not be fully fleshed out but should indicate what sort of exercises will be provided to help students learn the material.

TBD

Sample assessment materials

*If the course is primarily assessed by **exam**, provide a sample exam question with model answers. The online list of past exam papers gives an idea of typical and alternative exam formats.*
*If the course is largely or primarily assessed by **coursework**, provide a sketch of a possible assignment with an estimate of effort against each sub-task and a description of marking criteria.*

Example:
Explain the following questions:
• For a robotic arm, what are the physical principles you can use for modelling its movement?
• Based on the physical principles, drive the mathematical model such that it can be programmed.

Any other relevant materials

Include anything else that is relevant, possibly in the form of links. If you do not want to specify a set of concrete readings for the official course descriptor, please list examples here.

TBD

4. Additional Course Details for DRPS

Except where otherwise noted, these fields are required for entry into EUCLID and will be visible to students in the DRPS entry.

Planned Academic Year of Delivery *(The first year you anticipate the course running, e.g. AY 2019-20)*	2022-2023
Keywords *Give a list of searchable keywords for the course.*	Robot forward and inverse kinematics, robot dynamics, system modelling, motion planning, control theories, inverse dynamics and joint space control, state estimation, sensor fusion, robot control and robot learning.
Course Organiser *(By default, the course proposer)*	Zhibin Alex Li
Intended Delivery Period	_x__Semester1 ___Semester 2 ___Full Year ___Summer ___Other (please specify):
Timetable considerations/conflicts *For School use. Please specify any constraints to be considered (e.g. overlap of popular combinations, other specialism courses, external courses etc). Include whether the semester delivery is constrained or could be flexible.*	NA
Reading List/Learning Resources (for DRPS) *You are encouraged to create resource lists using LEGANTO*	• Modern Robotics: Mechanics, Planning, and Control, Frank C. Park and Kevin M. Lynch • Introduction to Robotics, Fourth Edition, J. J. Craig, Pearson, 2017 • Franklin, Gene F., et al. Feedback control of dynamic systems. Vol. 3. Reading, MA: Addison-Wesley, 1994.
Feedback Information *Provide a high-level description of how and what type of feedback will be provided to students, for inclusion in DRPS.*	1. Mid-term lecture revision 2. Final revision lecture 3. In-term feedback via Piazza
Is this course available to visiting students?	_x__Yes (default) ___No **If no, please provide a justification here:**

Required pre-requisite courses *Use sparingly: these are enforced in PATH and can only be waived by approval from the School's Curriculum Approval Officer. Note that cross-year required pre-requisites may prevent MSc students from registering; consider using recommended pre-requisites or "other requirements" instead.*	_x_ No ___ Yes (please specify full course name(s) and code(s)):
Recommended pre-requisite courses	_x_ No ___ Yes (please specify full course name(s) and code(s)):
Required co-requisite courses *Specify any courses that must be taken in parallel with the existing course. Note that this leads to a timetabling constraint that should be mentioned elsewhere in the proposal.*	_x_ No ___ Yes (please specify full course name(s) and code(s)):
Prohibited Combinations *Specify any courses that may not be taken in combination with the proposed course].*	_x_ No ___ Yes (please specify full course name(s) and code(s)):
Other Requirements/Additional Information *This information is often used by MSc students and students from other Schools to see if they have appropriate background without having done our School's courses. So please avoid course titles, instead list specific knowledge and skills (such as mathematical concepts, programming ability or specific languages, etc).* *Also list any other constraints on registration, for example: "Only available to 4th Year Informatics students including those on joint degrees." or "This course is open to all Informatics students including those on joint degrees, and to students in the School of Mathematics. Other external students whose DPT does not list this course should seek permission from the course organiser."*	___ No _x_ Yes (please specify): General knowledge from common engineering background (such as mechanical engineering, electronic engineering, computer signs and etc): 1. Mathematics, eg linear algebra, calculus. 2. Basics of Physics, eg Newton's law. 3. Some level of proficiency or exposure to programming skills, or basic knowledge of programming languages.
Visiting Student Pre-requisites	_x_ Same as "other requirements" ___ Different than "other requirements" (please specify):

5. Placement in degree programme tables: for level 9-11 courses only (except EPCC)

This section is for consideration by the Board of Studies and will be used later by ITO to determine where the course will be added to existing degree programme tables.

Is this course restricted to students on a specific degree? *E.g., some courses are only available to students on a specific CDT or MSc.*	_x_ No ___ Yes (please specify and provide justification):
Is this course compulsory for students on any degree(s)?	___ No _x_ Yes (please specify and provide justification): If the new Master programme in Advanced Robotics will take place in the future, this will be the compulsory course
Any issues for part-time students? *Normally, part-time students have access to the same courses as full-time students on the equivalent degree. If you anticipate any problems with this, please specify here.*	Part-time students should be aware of the required course hours and study load, and self-verify if they are able to take the workload. Especially to join in the tutorials and practical that requires physical presence at particular time slots.

For optional courses:

If this course is available but non-compulsory for students on various degrees (most courses), please fill in this section. The choices here determine where the course appears in degree programme tables (DPTs) and the 2-3 character tags are displayed in the Informatics sortable course list.

Should this course be tagged as 'ML' (machine learning foundations and methods)? *Courses with the ML tag are typically very high-demand and most degrees limit the number of ML credits. If your course might appeal to a similar audience but draw off students from these large courses, please select 'no' and choose one of the tags below.*	_x_ No __ Yes
If you chose 'no', please choose at least one of the following tags… *Ideally, select exactly one, unless there is a good argument for more than one. These three are used in various combinations for many of our degrees.*	_x_ **FSS** (CS foundations, systems, and software) _x_ **AIA** (artificial intelligence applications and paradigms) __ **COG** (cognitive science: including HCI and NLP courses, but not most other AI courses. Please restrict to courses most relevant to natural cognition.)
…and also tick if any of the following tags or categories apply. *Do not tick any of these if you selected 'ML' already.*	__ **SE** (software engineering: including courses that are highly relevant to SE degrees. All SE courses should also be FSS. This tag is mainly relevant for UG SE degrees.)

	__Databases and data management systems (used for Data Science MSc and MSc(R)) __Unstructured data and applications (used for Data Science MSc and MSc(R)) __Level 11 Security courses (used for Security MSc) __ATFC Optional courses (used for ATFC MSc)
If you are not sure which tags are most appropriate or have other questions about this section, please note any comments/issues here.	