

Interdisciplinary Honours Class NEXT GENERATION ROBOTICS (NGR)

Extra programme for first year bachelor students 2019/2020

Introduction

Robotics is a multi- and interdisciplinary engineering domain. The creation of innovative robots needs high level research in all disciplines involved. It is a “mission” in which top level engineers of these disciplines work closely together. Currently the TU Delft does not offer bachelor programmes with this “mission” scope. It is expected that industry will need more and more these broadly educated and mission driven engineers (Kamp & Klaassen, 2016). We want to attract excellent and motivated students from this mission driven group already in the first year of study, by offering them a challenging robotics programme. The size of the programme is 30 EC on top of the regular programme and both programmes have to be completed within three years.

What is the Interdisciplinary Honours Class NGR?

The Interdisciplinary Honours Class NGR is an extra programme and starts in the first year of the regular bachelor programme. It has a duration of 2.5 years with a size of at least 30 EC and max 45 EC, in which students complete a full “design circle”. They do this by starting with the definition of a mission in the first year and ending with implementation, operation, evaluation of the results and suggestions for a next step in a dedicated minor and bachelor end (team) project. The NGR programme aims for the same target group as the students that are aimed for at the regular Honours programmes. Therefore, a successful first year in the NGR programme will meet the requirements for selection into the HPB (see below).

What does the NGR programme offer?

Theory and masterclasses : 7-12 EC

Extra courses from other domains to acquire theory necessary for developing robots next generation. Extra theory is dependent of major regular programme. Necessary knowledge: mechanics, programming skills, electronics, data-acquisition, systems and control, sensors, micro controllers, basics embedded systems, basics human-machine interaction.

Projects 12-30 EC

- The students define a mission that can be used to create a consistent set of projects over the years.
- Students can choose a project to work on in small groups (2-3 students)
- Students can choose for small projects or one large project
- Students write a paper or report as result of at least one project

Other parts of programme

- Special cases /topics
- Participation (international) conferences in the Robotics field
- (International) collaboration (competitions/summercourses etc.)
- Industry visits and projects
- Implementation of the full mission, demonstrate it and interpret the results
- Be part of the outreach programme of the university

How many hours will I have to study?

An average student needs 28 hours of study to obtain 1 ECTS point. This means that an average student must study 40 hours per week for the regular 60 ECTS year programme. The honours class NGR has 10 additional ECTS points per year, bringing the total to 70 EC per year. But it is expected

that excellent students need less time than average students. The honours class NGR starts in the second semester and the programme will cost you on average 8-10 hours extra per week. It is our experience that students selected for this programme in 2016/2017, also use part of the (summer) holidays to work on projects.

Do I pay additional tuition fees?

No additional fees are charged for enrolling into the honours class NGR. It is possible that during the programme students can have some additional (travel) costs.

Who can apply for this extra programme?

Excellent and talented first year bachelor students from:

- Aerospace engineering
- Electrical Engineering
- Information science
- Mechanical Engineering

Max. 15 participants: 3-4 from each faculty. The students will form a team.

What are the admission criteria?

- Your grades at high school (min. GPA Math B and Physics: 8 or equivalent for international students) and high grades in the first semester at TU Delft, will give us confidence how you cope with your regular programme. The higher these grades, the higher your chance to be selected.
- Next to these pieces of evidence (high school grade list and OSIRIS list with courses and grades first quarter), we expect a motivation letter and a recommendation letter from one of your teachers at high school.
- In the motivation letter we expect that you:
 - ✓ describe your experience in the past with making a robot ;
 - ✓ describe your experience with solving complex problems in a team;
 - ✓ describe examples that prove you are goal-oriented and have the perseverance to achieve your goals;
 - ✓ describe robot applications that inspire you.;
 - ✓ describe your motivation and ambitions to make a difference in Robotics Next generation.

If you are, or plan to become a member of a student association, we advise you not to apply because this membership will take up too much of your time.

How can I apply?

You can apply between 24 March and 30 March 2020 by sending all the required documents to your faculty honours coordinator:

Faculty Aerospace Engineering

Jos Sinke

J.Sinke@tudelft.nl

Faculty 3mE

Pelle Alons

honourscommittee-3mE@tudelft.nl

Faculty E.E.M.C.S.

Joanna Daudt

J.P.R.B.Daudt@tudelft.nl

Subject: application NGR

You can be invited for an interview on 6,7 and 8 April 2020

What do we expect from the selected students?

- Students are expected to finish the first year of their regular study in one year with a grade point average of 8 or higher with inclusion of the assignments. Participation in this programme will be stopped if the student does not meet the selection criteria for the honours programme.
- Students are expected to finish regular programme and the integrated honours programme in three years in order to receive an honours certificate and a certificate from the Robotics Institute

(some extension is possible depending on the faculty policy with regards to the duration of the honours programme).

- Expected study load: First year: 8-10 EC; Second year: 10-12 EC; Third year: 8-12 EC.
- Students will be encouraged to take courses (max. 5 EC) offered by TU Delft and meant for all honours students.
- Taking the minor (advanced) Robotics is strongly advised.
- It is expected that selected and admitted students also choose a robotics research/development assignment in their final bachelor thesis (supervision and assessment according to the guide lines and assessment criteria from their major programme).

What are the returns on investment for students?

- Early orientation and preparation to become inter- and multidisciplinary innovative team players in Robotics.
- Experience to work with (research and industrial) experts and motivated peers.
- Extra challenge to broaden and deepen knowledge and experience.
- Possibility to experience state of the art developments in research and industry.
- Possibility to explore your own creativity, communication and innovative skills.
- After the first year regular programme students become member of the TU Delft honours community (if they have met all the demands).
- This special programme will enable early network building in the Robotics field.
- Possibility to work on a mission from the start with enough time and skills to accomplish this possibility to write and present a scientific paper.
- Possibility to work in an interdisciplinary team and to experiment with the different engineering roles.
- Possibility to choose for master track Robotics from four faculties (LR, EE, CE/CS and Mechanical Eng.).
- This honours programme is embedded in the TU-Delft Robotics Institute and students become part of the (international) robotics community

Do I get a TU Delft Honours certificate upon successful completion of the Excellence Track?

If you successfully complete the Interdisciplinary Honours Class Next Generation Robotics within 3 years, you will receive a TU Delft Honours certificate. More information about the TU Delft Honours programme can be found on [this website](#). Next to this honours certificate you will also receive an extra statement letter from the TU Delft Robotics Institute that you have successfully completed the Next Generation Robotics Interdisciplinary Honours Class.

What if this Honours Class is too much for me?

If you feel you have misjudged the level of the Honours Class NGR or the amount of work, you can stop at any time and continue as a regular student with your bachelor studies. It is a good idea to discuss this with the project leader/coordinator.

Organisation, infrastructure and coaching

The Faculty Electrical Engineering, Mathematics and Computer Science (secretary) in collaboration with the Robotics Institute are responsible for the programme and will support the students from the different disciplines. The selected students will become member of the Robotics Institute. The following scientist from the Robotics Institute will contribute to an interesting and effective learning environment and the assessment of students:

Dr. ir. C.J.M.Verhoeven, programme leader

Dr. J.P.R.B.Daudt, programme coordinator

Dr. G.C.H.E. de Croon, Control and Simulation (LR)

Prof.dr.C.M.Jonker, Interactive Intelligence (EWI)

Prof.dr.ir.M.Wisse, Biorobotics (3mE)

Quality assessment

The Robotics Institute is responsible for the quality assessment. On the process and product the coaches will have great impact. Other pieces of evidence are results of taking part in competitions and/or their contribution to solving problems from industrial partners of Robo valley. Students have to describe in a midterm- and end report how they have met the goals of the honours programme. The faculty honours coordinators will be consulted at the selection and during the programme, when students from their faculty are selected.

The individual NGR programme of the students may need adaptation because of planning or capacity issues along the way. The coach and the NGR coordinator at the faculty will give advice for changes to the individual programme of the students. Since the NGR programme is an extra-curricular, non-accredited programme no rights can be claimed by the students, except for the Honours Programme, which is mentioned in the OER.

Portfolio and final assessment

The following parts are compulsory for NGR students and they have specific NGR honours course codes

Course code	Content	EC's
EWI NGR theory	Theory and inspiration module: Three master classes with assignment (2 EC each): <ul style="list-style-type: none"> ▪ Mechatronics of a robot ▪ Programming in Python ▪ Simulating with ROS Workshops on demand during projects like for example: <ul style="list-style-type: none"> ▪ Vision and perception ▪ Distributed systems ▪ Machine learning and robots ▪ State of the art developments Next to the theory module excursions will be organised and students	10 EC
EWI NGR project(s)	Students must participate in a group project for at least 10 EC. In the projects students will apply the knowledge of the master classes and workshops.	≥ 10 EC
Regular courses related to the programme	Students are encouraged to do one regular course outside their own major programme like OOP, Electronics, statics.	5 EC
HPB modules	In the second and third year NGR students can take interfaculty HPB modules	5 EC

To prepare the master classes students will study MOOCs.

- Teachers/experts will be asked to give the NGR students an assignment so they can show they have mastered the necessary knowledge. The assignments are related to the NGR project.
- Students have to register their activities and time dedicated in a portfolio on the NGR google drive.
- If students read papers they have to make a summary and have to indicate why the paper is useful for Robotics.

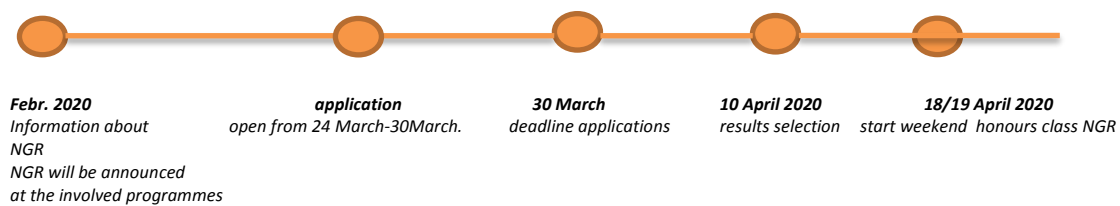
The NGR projects are closely linked to the regular programme parts (minor Robotics and Bsc End Project). NGR projects are subsidised and made possible by companies.

At the end of the NGR programme students have to give a presentation what they have learned. Members of the NGR programme committee will assess their portfolio and their presentation.

Selection and start

- Start first year: 20 April 2020
- Start weekend: 18 and 19 April (compulsory attendance)
- Application open: from 24 March and 30 March 2020
- Application deadline: 30 March (24:00)
- Selection interviews: 6, 7 and 8 April
- Selection on the basis of GPA High School and the grades after first semester in combination with motivation letter and interview.
- Selection will be done by the involved faculty honours programme coordinators.

Timeline for involved programmes and students:



References

Kamp, A & Klaassen, R (2016). Impact of global forces and empowering situations on engineering education in 2030. In s.n. (Ed.), Proceedings of the 12th international CDIO conference (pp. 1-20). Turku: CDIO.