### Module Description

This module builds on the year 2 Instrumentation & Control module. The goal of the module is to equip the learner with the knowledge and skills required to specify, analyse, implement and test automatic control and robotics systems.

### Learning Outcomes

**On completion of this module the learner will/should be able to:**

1. Explain the differences in performance between different types of control systems and explain the principles involved in such systems.
2. Give reasons for the implementation of P, PI or PID control. Assess the effect of dead time on the behaviour of a control system. Examine the uses of cascade control and feedforward control.
3. Model 2nd-order physical systems using differential equations.
4. Represent 2nd-order system responses using Laplace Transform method.
5. Design closed-loop feedback systems.
6. Analyse closed-loop control systems in terms of stability performance.
7. Specify system performance in terms of time-domain and frequency-domain response.
8. Analyse control systems in terms of steady-state error.
9. Design, set up, operate and analyse complex control systems. Set up and operate robotic systems. Model control system behaviour using suitable methods. Analyse and present results of experimental work in tabular/graphical form. Advanced control of selected process parameters.

### Indicative Syllabus

**Control System Response**


**System Stability**

- Routh-Hurwitz Criterion, generating and interpreting a Routh table, special cases, stability design via Routh-Hurwitz.

**Frequency Response**

Steady-State Errors
Steady-state errors for unity feedback systems, performance, system type, steady-state errors for disturbances and non-unity feedback systems, steady-state error design via system gain.

Robotics

Teaching and Learning Strategy
Lectures: Presentation of concepts with engineering examples (delivery is largely envisaged to be online but could include some face-to-face aspects).
Tutorials: Worksheets and quizzes with the primary goal to further develop understanding of the module content (delivery will involve independent study followed/proceeded by face-to-face class based interaction, but could also include some online aspects).
Laboratory Work: Working with instrument systems, system control, and device calibration with the primary goal of acquiring advanced instrumentation and control knowledge and skills relevant to automation and robotics engineering situations (delivery will be face-to-face in a laboratory environment).
Independent Study: Study of provided module material with the primary goal to develop understanding of the module content via self centred learning. In addition to the weekly lectures/tutorials/labs, it is expected that students will also have to invest approximately 50 to 75 hours of independent study for completion of this module.

Assessment Strategy
Students will be assessed on the delivered material using a mixture of continuous assessments and a final exam. Assessments will be designed to assess students:
- knowledge and understanding of the material.
- comprehension of the material.
- contextual application of knowledge.
- analysis and synthesis of material.
- evaluation of outcomes.

Repeat Assessment Strategies
Repeat of the final exam will be offered.

Indicative Coursework and Continuous Assessment:

<table>
<thead>
<tr>
<th>Form</th>
<th>Title</th>
<th>Percent</th>
<th>Week (Indicative)</th>
<th>Learning Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment</td>
<td>Continuous Assessments</td>
<td>25 %</td>
<td>OnGoing</td>
<td>1,2,3,4,5,6,7,8,9</td>
</tr>
<tr>
<td>Practical Evaluation</td>
<td>Practical</td>
<td>25 %</td>
<td>OnGoing</td>
<td>1,2,3,4,5,6,7,8,9</td>
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</tbody>
</table>

End of Semester / Year Formal Exam:

<table>
<thead>
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<th>Form</th>
<th>Title</th>
<th>Percent</th>
<th>Week (Indicative)</th>
<th>Learning Outcomes</th>
</tr>
</thead>
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<tr>
<td>Closed Book Exam</td>
<td>Final Exam</td>
<td>50 %</td>
<td>End of Term</td>
<td>1,2,3,4,5,6,7,8,9</td>
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Blended Delivery Mode Average Weekly Workload:

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<th>Type</th>
<th>Description</th>
<th>Location</th>
<th>Hours</th>
<th>Frequency</th>
<th>Weekly Avg</th>
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</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>Lecture</td>
<td>Online</td>
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<td>Weekly</td>
<td>1.00</td>
</tr>
<tr>
<td>Practical</td>
<td>Practical/Tutorial</td>
<td>Laboratory</td>
<td>2</td>
<td>Fortnightly</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Recommended Reading Book List

**Journal Resources**
To be provided during module delivery (if required).

**Online Resources**
To be provided during module delivery (if required).

**Other Resources**
To be provided during module delivery (if required).

**Programme Membership**
GA_EAURG_B07 202000 Bachelor of Engineering in Automation & Robotics