Imperial College
London

DE2 Electronics 2

Signals, Systems and Control

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Organization and Schedule (may change)

SCHEDULE (SPRING TERM 2024)

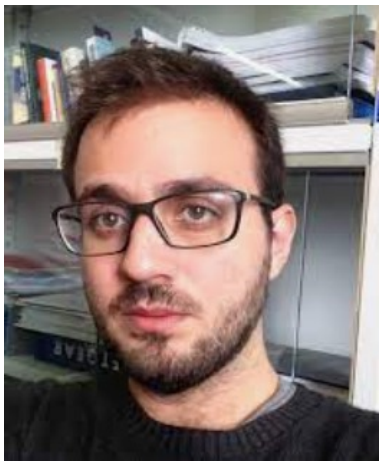
Week (starting)	Monday	Friday	Thursday Lab	Comments
1 (8 Jan)	-		-	Exam week
2 (15 Jan)	1, 2	3, 4	Lab 1 – Sig Proc & Matlab	
3 (22 Jan)	5, 6	Peter will be away	Lab 2 – Sig Proc & Pybench	
4 (29 Jan)	7	8 + tutorial	Lab 3 – Systems	
5 (5 Feb)	9	10 + tutorial	Lab 4 – IMU & OLED	
6 (12 Feb)	-	-	LAB Oral	DRAW week
7 (19 Feb)	11	12 + tutorial	Lab 5 – real-time systems	
8 (26 Feb)	13, 14	Peter will be away	Lab 6 – Motor Control	
9 (4 Mar)	Peter will be away	15, 16	Lab 7 – Challenges	
10 (11 Mar)	17	tutorial	Lab 8 – Challenges	
11 (18 Mar)	-	-	FINAL LAB Oral	Final week

- Textbooks (not compulsory)
  - BP Lathi, Linear Systems and Signals (International ed, ????)
  - Schaum's Outline of Feedback and Control Systems (~£29 Amazon)
- DRAW week Lab Oral (20%), Final week Lab Oral (20%)
- Examination on first week of Summer Term, 1.5 hour paper (60%)

Teaching team

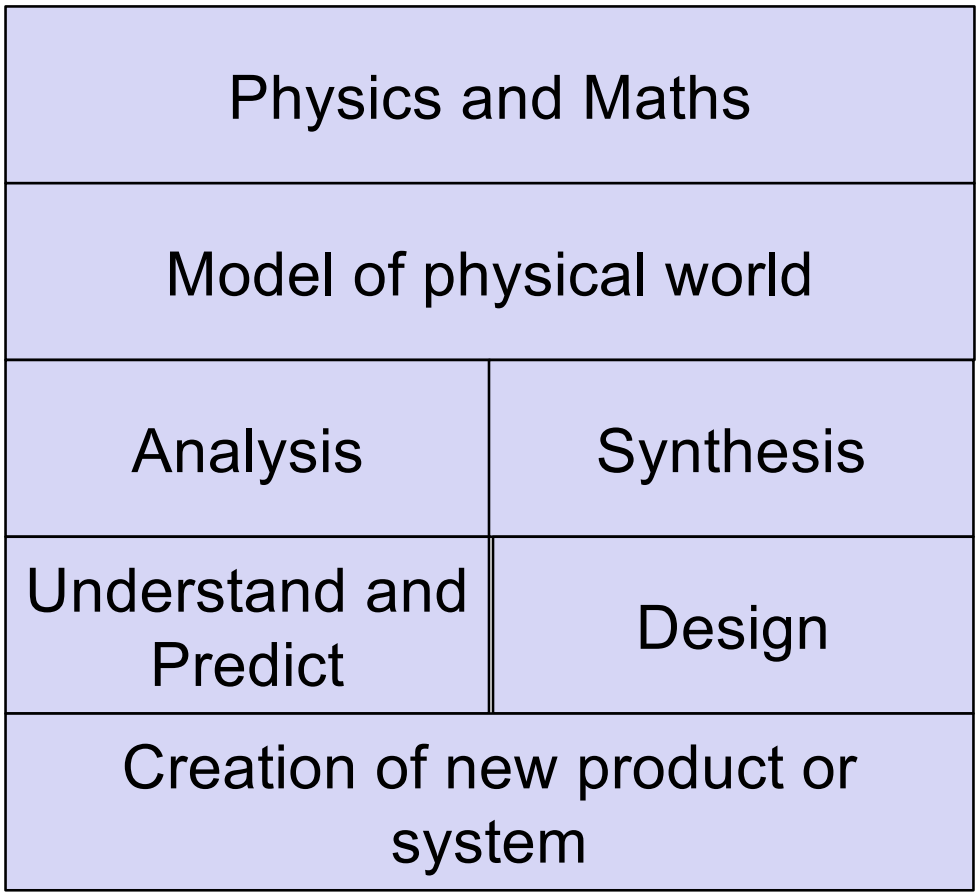
Peter Cheung

Anthony Quinn

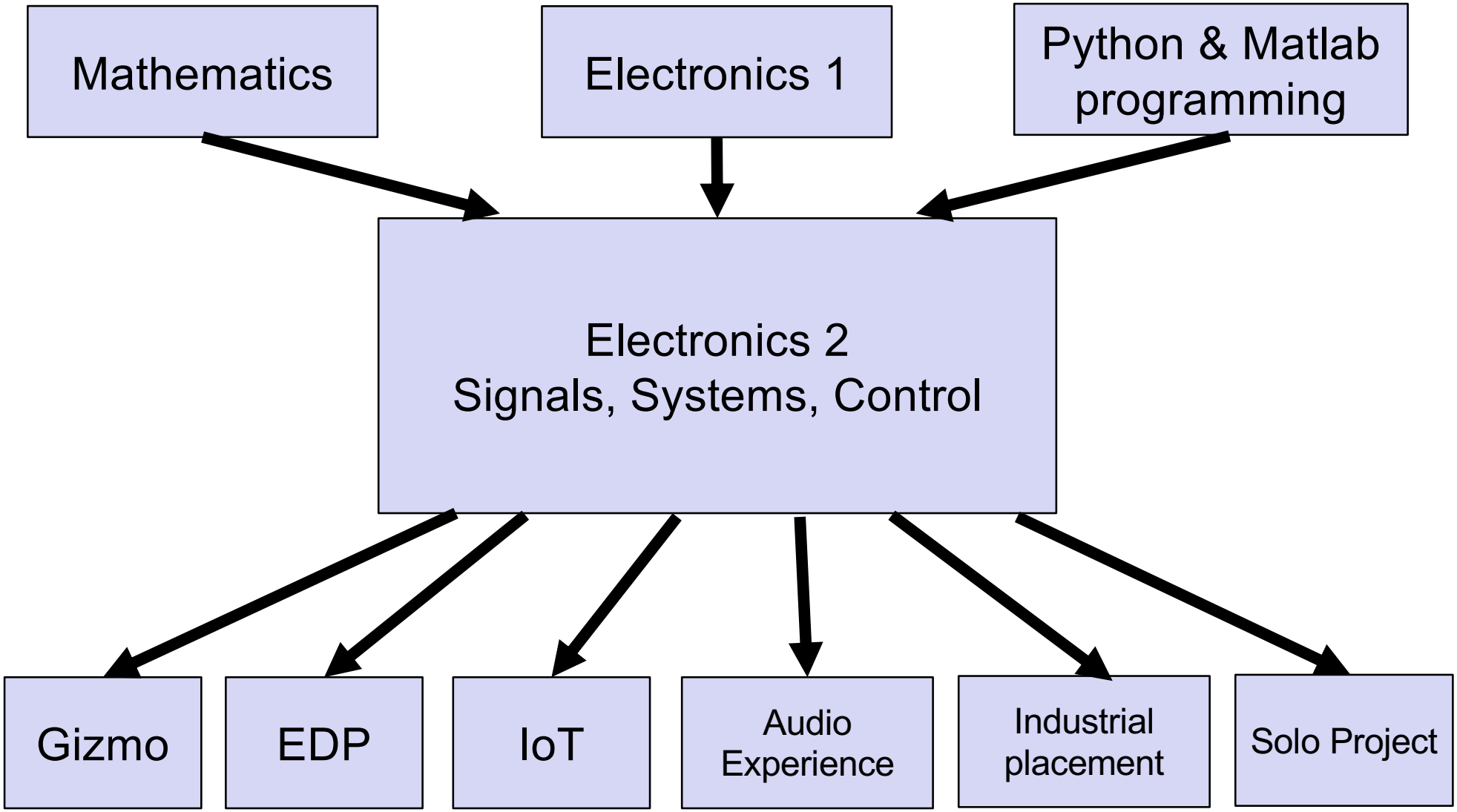


Pietro Ferraro

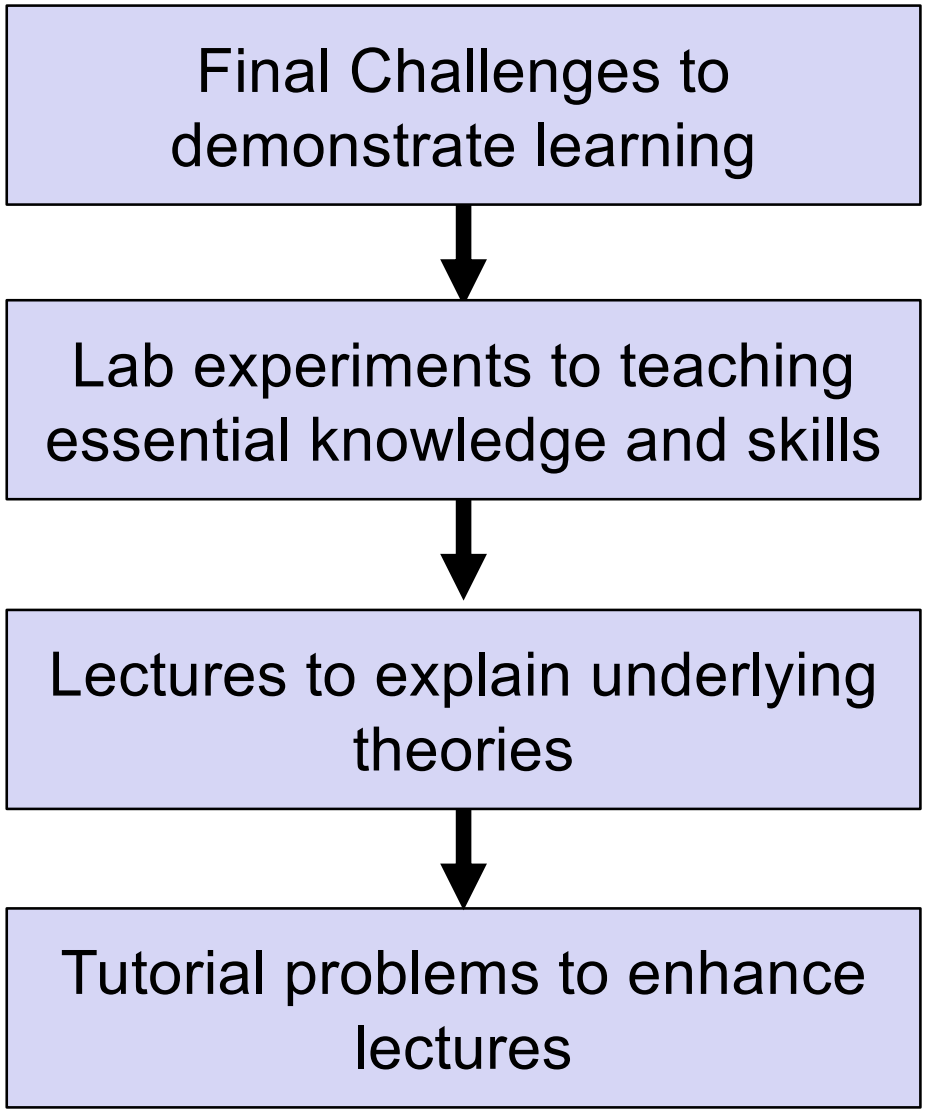
Why is this module important to Design Engineering?



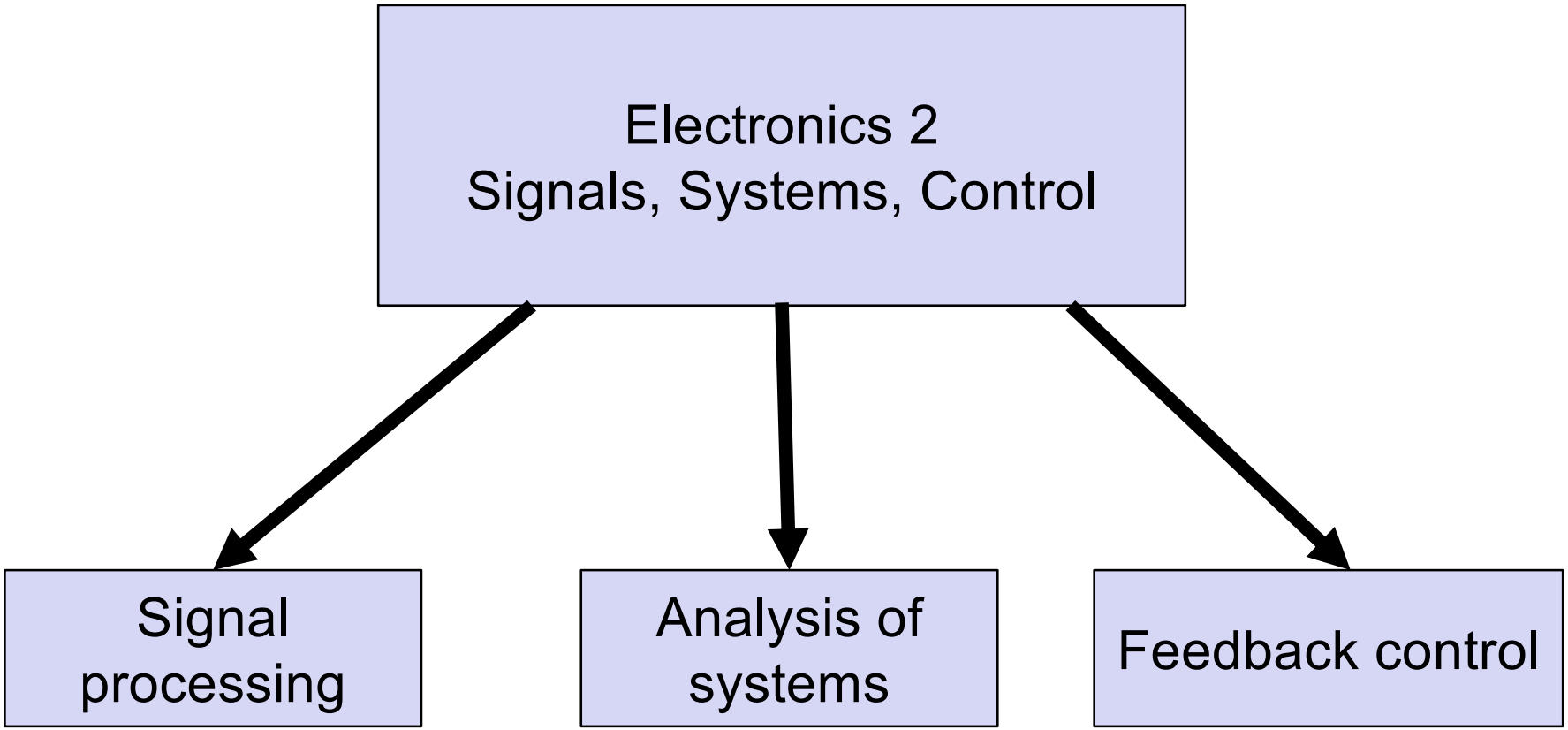
Context of Electronics 2



Course Design - Back-to-front

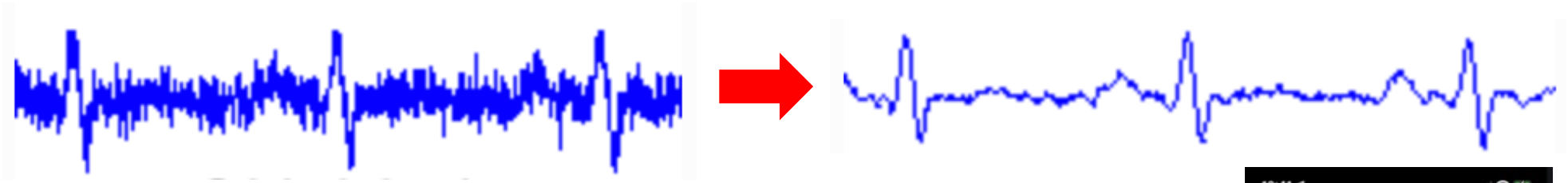


Three topics of Electronics 2



Why is signal processing important?

1. To reduce noise in an electrical signals – e.g. clean up ECG signal



2. To make correction or desired changes to the signal – e.g. blur surrounding while keep part of the camera photo in focus

3. Derive useful information from the signal – e.g. derive health condition of an individual on a phone

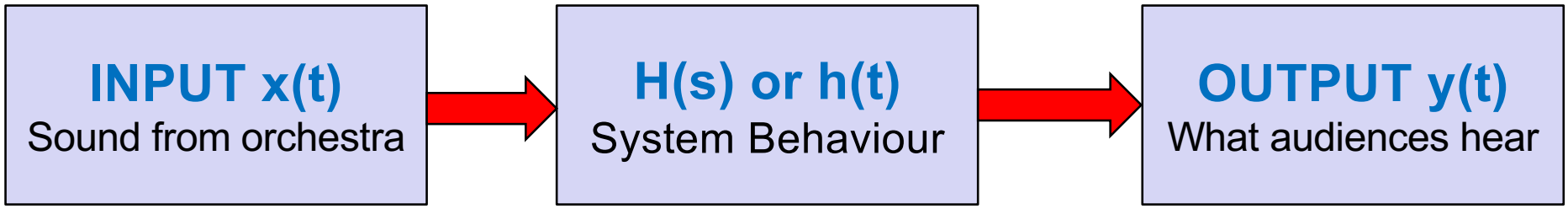
Why is system analysis important?

- Allow **analysis** and **prediction** of a situation, …
- …. so that we can **design** for **desirable outcomes**
- For example:

orchestra

Royal Albert Hall

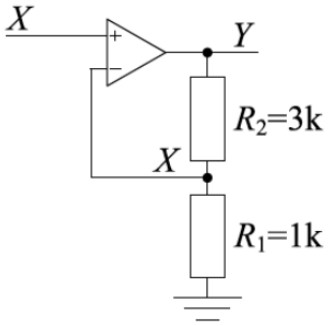
audiences



Why is feedback control important?

- Automatic correction of behaviour – e.g. robotic arm under load

- Achieve desired performance – e.g. keep Segway upright



- … and achieve the impossible – e.g. fly this flighter jet which is impossible for a human to fly

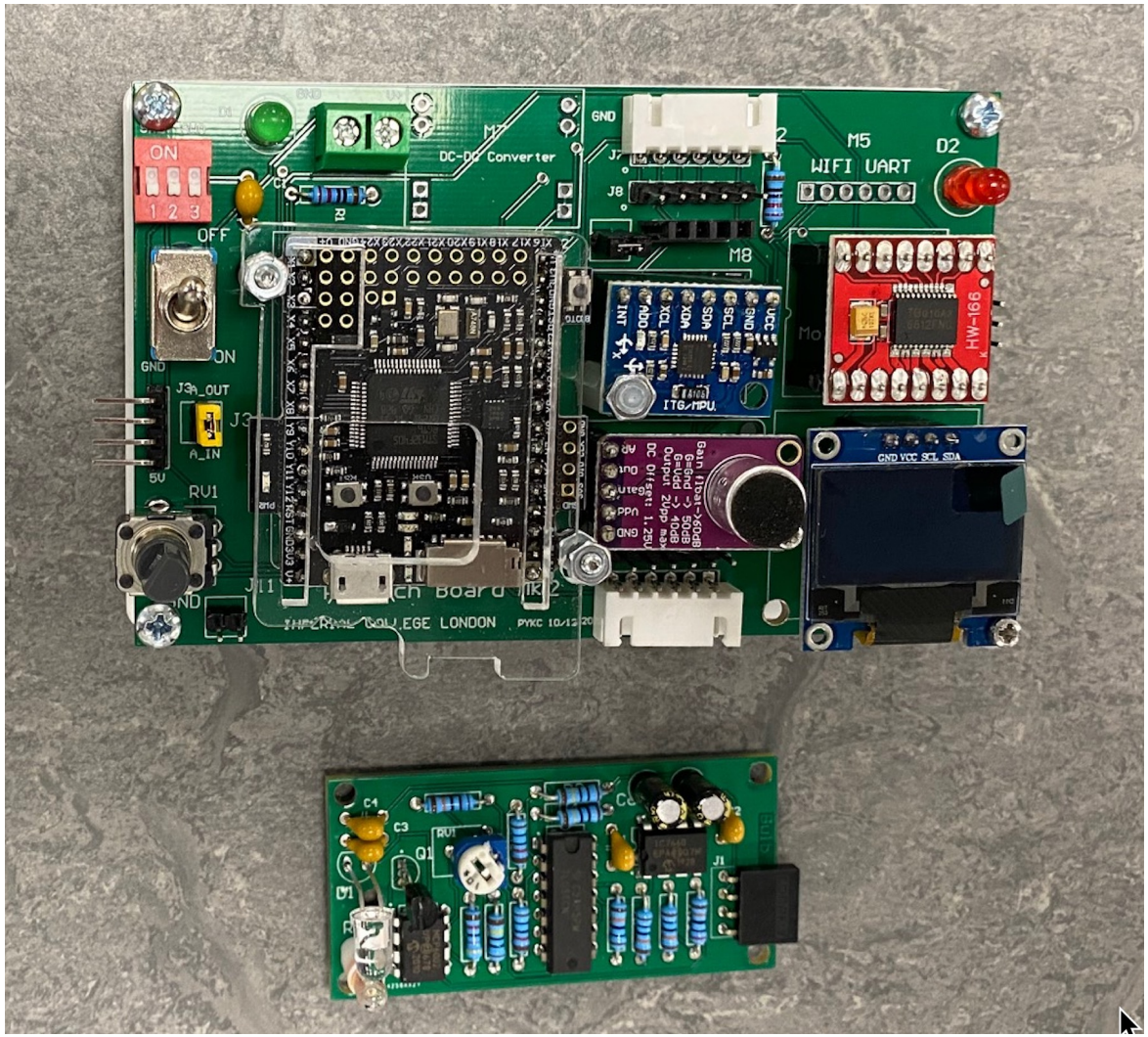
You will acquire these KNOWLEDGE

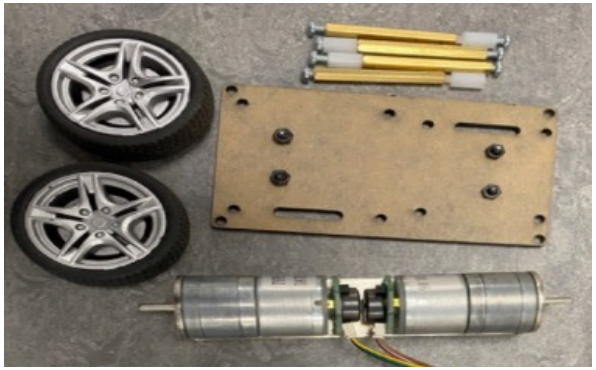
- Handling of discrete time, quantised signals
- Application of Fourier transform (time vs frequency domain)
- Application of Laplace transform
- Characterisation of dynamic systems
- Difference between steady state and transient response of a system
- Idea of convolution
- Basic digital filtering (and simple z-transform)
- Use of a simple feedback control method called PID control

You will acquire these SKILLS

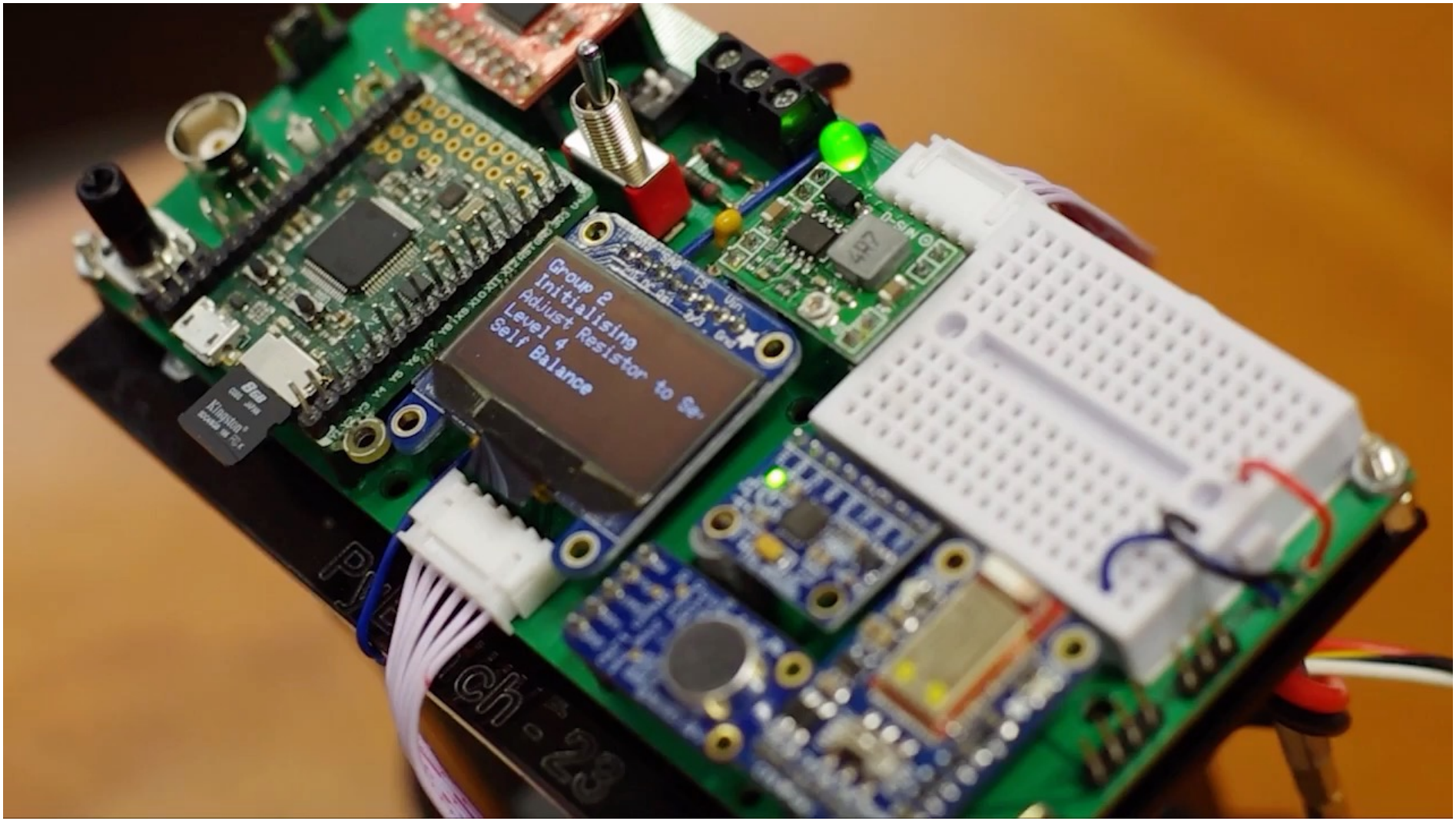
- Enhance your Python skills – particularly in Classes and object-oriented programming
- Learn embedded and real-time programming of a microcontroller
- Enchance your Matlab skills used for signal processing and GUI
- Apply mathematics to model and analyse physical systems

Lab-in-a-Box Kit





What your senior did before you



What next?

- Return Electronics 1 Kit if not already done so.
- Find yourself a lab partner.
- Complete survey form by Wednesday 17 Jan 2024 before noon:

  https://forms.office.com/e/4RUV6Bs9Nv

- Lab-in-a-Box will be issued to you on Thursday 18 Jan., during the Lab Session.

- Lab experiment (supervised) starts on Thursday 18 Jan morning.