Electrical and Electronic Engineering Modules for Visiting Students 2024/25

This highly sought-after field addresses some of the most pressing challenges facing society today. Students taking these modules will not only gain the skills and expertise needed to tackle these issues, but will be able to make a global impact by shaping a better future.

Launching in September 2024, this innovative new course is designed to equip students with the Future Skills to thrive in the fast-paced world of technology. Students will master the art of harnessing artificial intelligence and other cutting-edge technologies to design, develop and implement intelligent electrical and electronic systems. As a result, students will contribute to ground-breaking solutions that positively influence society and pave the way for a brighter tomorrow.

Updated April 2024/PJW

Entry requirements: GPA of 2.75 or above (out of 4.0) or equivalent

Pre-requisites:

- Level 4: prior introductory university-level study of mathematics is very useful.

Taught at: Roehampton Vale campus

Notes:

1. All modules are at undergraduate level only.
2. Students enrolled on Study Option 1 are required to study the entire module over both semesters.
3. Whilst the University makes every effort to ensure that this information is correct at the time of updating (April 2024), it cannot accept responsibility for omissions or subsequent changes. Module availability and content may be subject to change, as part of the University's policy of continuous improvement and development.
4. Details of assessment for students enrolled on either Study Option 2 or 3 where provided are **indicative only** and may also be subject to change as part of the above policy.

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KEY TO MODULE DESCRIPTORS
SUITABILITY OF MODULE FOR STUDENTS VISITING KU ON STUDY OPTION ____
1: Indicates module is suitable for students visiting KU on Study Option 1 (Whole Year)
2: Indicates module is suitable for students visiting KU on Study Option 2 (Autumn)
3: Indicates module is suitable for students visiting KU on Study Option 3 (Spring)

INTRODUCTORY - LEVEL 4

MODULE CODE	TITLE	SUITABILITY		
LEVEL 4 – INTRODUCTORY				
ER4002	Electrical Engineering Principles	1		3
ER4001	Introduction to Robotics	1		
EG4017	Engineering Mathematics	1	2	
EG4016	Programming for Engineers	1		3
ER4006	Microcontrollers and Interface Electronics	1		

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Module Code	**ER4002**
Module Title	**Electrical Engineering Principles**
Level	4
Prerequisites	introductory university-level study of mathematics is very useful
Credits	4 (US) 7.5 (ECTS)
Suitability	• Open to Study Abroad/International Exchange students for Study Options **1** or **3** • Not open to Erasmus students (as Level 4)
Content	This module comprises both theory and practical. The module starts by looking at electrical charge and how electricity is created, before moving on to look at passive components such as resistors, capacitors and inductors and how they behave in simple direct current (DC) circuits. The study of inductors leads nicely into the topic of magnetism and then onto DC generators and motors which starts by exploring the fundamental principles of machines before moving on to look at various basic types. The second part of the module focuses on alternating current (AC). Firstly, passive components are revisited, this time in basic AC circuits. The relationship between resistance, reactance and impedance; voltage, current and impedance; and reactive, true and apparent power are examined in the class and tutorial sessions whilst simple circuits containing combinations of resistors, capacitors and inductors are explored in the laboratory. Induction is then revisited for transformers before the final section which covers the theoretical aspects of AC generators and motors before looking at typical AC machines. ➢ **Topics:** • Analyse a range of electrical systems including its generation. • Passive components and their operation in direct current and alternating current circuits in terms of circuit power of individual components. • Construct models of magnetism and self and mutual induction. • Employ computational methods in analysing alternating current and the operation of passive components in alternating current circuits. • Direct current generators and motors. • Operation and construction of transformer and operation. • Alternating current generators and motors.

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Teaching	Lectures, practical workshops and tutorials
Assessment	Portfolio of two electrical labs (each lasting two hours) (100%)
Last updated	15/05/24 PJW

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Module Code	**ER4001**
Module Title	**Electronic Circuits and Systems**
Level	4
Prerequisites	introductory university-level study of mathematics is very useful
Credits	4 (US) 7.5 (ECTS)
Suitability	• Open to Study Abroad/International Exchange students for Study Options **1** or **3** • Not open to Erasmus students (as Level 4)
Content	Electronic circuit and system fundamentals play a vital role across many engineering disciplines. This module is designed to provide students a firm understanding of the principles of electronic circuits and systems including digital electronics. In this module, students will be introduced to the fundamental electronic components and their application in the design of electronic circuits and systems. Students will also learn to analyse various types of electronic circuits and systems. This module encourages the use of simulation tools for the design and analysis of electronic circuits and systems to enhance analytical as well as employability skills. ➢ **Topics:** • Introduction to electronic circuits and systems • Resistive elements in series and parallel • Ohm's Law and Kirchoff's Laws • Voltage and current divider circuits • Semiconductors and diodes • Bipolar junction transistors • Digital electronics • Number Systems and Logic gates • Boolean algebra • Combinational logic circuits

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Electrical and Electronic Engineering Modules for Visiting Students 2024/25

Teaching	Lectures, tutorials and computing workshops
Assessment	• 3000-word lab report (50%) • Online Exercise (lasting three hours) (50%)
Last updated	15/05/24 PJW

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Module Code	**EG4017**
Module Title	**Engineering Mathematics**
Level	4
Prerequisites	None
Credits	4 (US) 7.5 (ECTS)
Suitability	• This module is taught entirely during the **Autumn semester** • Open to Study Abroad/International Exchange students for Study Options **1** or **2** • Not open to Erasmus students (as Level 4)

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Content	The aim of this module is to provide a thorough background in engineering mathematics and equip students with the mathematical skills essential for solving engineering problems. The topics introduced will serve as basic tools for studies in many engineering subjects. This comprises algebra, functions, statistics and probability, trigonometry, calculus, differential equations and vectors. Students will be empowered to understand and be able to use the language and methods of mathematics in the description, analysis and design of engineering systems. The emphasis is on using mathematical tools to solve engineering problems. The computing software used will typically include MATLAB and Excel. ➢ **Topics:** • Matrices, vector analysis, trigonometry functions and complex number • Differentiation and Integration: Revision of basic rules and methods for differentiating and integrating a function of one variable, maximum, minimum, points of inflection, and partial differentiation. • Differential equations: First order equations with separable variables, first order linear equations. • Vectors: Addition of vectors, scalar and vector products, applications to three-dimensional geometry. • Statistics and Probability: Mean and standard deviation, regression and correlation. • Numerical Methods: Numerical integration with trapezium and Simpson's rules, Newton's method for solving algebraic equations.
Teaching	Lectures, tutorials and practical sessions
Assessment	• 2 x online maths tests (25% each) • 1 x online maths and computing tests (50%)
Last updated	15/05/24 PJW

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Module Code	**EG4016**
Module Title	**Programming for Engineers**
Level	4
Prerequisites	None
Credits	4 (US) 7.5 (ECTS)

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Suitability	• Open to Study Abroad/International Exchange students for Study Options **1** or **3** • Not open to Erasmus students (as Level 4)
Content	This module is designed to introduce students to scripting in one of the most popular programming languages in industry, which is widely used for data processing, automation of tasks and more recently for machine learning (ML) and artificial intelligence (AI) specifically in the engineering industry. The module has been designed to cover all the fundamentals of programming, which should provide a valuable transferrable skill set that can be fed forward to provide the essential skills needed for scripting in other computer languages in higher-level modules. ➢ **Topics:** • The functionality and operation of an integrated development environment (IDE). • Fundamentals of Object-Oriented Programming (OOP). • Structure and syntax of a program in a language such as Python. • Variables, constants, comments and script formatting. • Basic data structures (Boolean; integer; float; string) and data type conversion. • Inputting data and printing. • Importing functions and modules • Decision structures and looping techniques. • Complex data structures (list; set; dictionary; tuple). • Slicing (lists; strings). • Arrays (1D; 2D; Array methods). • Creating user defined functions. • Plotting data. • Reading and writing to csv files • Classes and methods
Teaching	Lectures, workshops and practical sessions
Assessment	• Portfolio of two computer labs (each lasting one hour), 50% each
Last updated	15/05/24 PJW

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Electrical and Electronic Engineering Modules for Visiting Students 2024/25

Module Code	**ER4006**
Module Title	**Microcontrollers and Interface Electronics**
Level	4
Prerequisites	none
Credits	8 (US) 15 (ECTS)
Suitability	• Open to Study Abroad/International Exchange students for Study Option **1** • Not open to Erasmus students (as Level 4)
Content	This module is designed to introduce students to both the operation and functionality of microcontrollers and the techniques used to interface them to sensors and transducers, with the aim to monitor and control a closed loop system. Interface circuitry, operation of sensors and actuator control is covered in depth, along with the inclusion of devices to extend the number of analogue and digital port lines on a microcontroller. ➢ **Topics:** **Microcontrollers** • Introduction to microcontrollers; using an IDE to create, test and debug programs. • Data types, variables, constants, comments, mathematical and Boolean operators. • Data type conversion, in-built functions. • Techniques to display text and waveforms on an eternal computer screen during program execution. • The use of on-line virtual development software to simulate circuits, program microcontrollers and interface sensors and actuators. • Accessing and controlling analogue and digital ports. • Decision structures and loops (While, If, For, Case, Nesting). • Pulse width modulation (PWM). • Arrays and sound. • User defined functions. • Driving LCD modules. • Multi-tasking techniques. • DC motor control circuits. • Keypad and keyboard data input. **Interfacing electronics** • Introduction to op-amps (unity gain buffer; inverting and non-inverting amplifiers). • Implementing DAC chips (unipolar & bipolar). • ADC chips and range optimising circuits. • Interfacing to sensors (temp; pressure; light; sound; tilt; hall; touch; displacement).

	• Interfacing to a range of actuators and devices (speaker; DC motor; LED; LCD). • T-bridge and H-bridge DC motor control designs. • Digital potentiometers (implementation in amplifiers; filter circuits). • Optical isolators. • IR sensor systems (optical switches). • Digital signal recovery using a Schmitt trigger. • Circuits to drive high current devices (NPN; PNP; Darlington; FETs; solid state & mechanical relays). • Use of multiplexors to expand digital I/O ports. • The use of de-multiplexors to increase analogue input port capacity.
Teaching	Lectures, computing and electronics workshops and tutorials
Assessment	• Lab Exercise (30%) • Portfolio of two online exercises (lasting two hours) (70%)
Last updated	15/05/24 PJW

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