Course Catalogue

Bachelor of Science (External) Degree Programme in Electronics and Automation Technologies

Last updated: 20220320

Introduction

BSc (External) in Electronics and Automation Technologies degree is designed for students aspiring to become a professional in the field of electronics and automation. Students pursuing this degree will not only learn fundamentals related to Electronics, Programming, Physics, Mathematics, and Statistics but also develop practical skills required to become competitive in the emerging technologically advanced job markets such as IoT. Development of soft skills is embedded in the curriculum enabling our students to approach problems scientifically, to be innovative and to become confident leaders in technology driven global businesses.

Rationale

Sri Lanka currently enjoys rapid growth in some sectors such as aviation, maritime, education, energy and commerce. Foriegn direct investment is also encouraged in specific sectors such as export manufacturing (areas such as electronics, machinery and appliances, construction material, boat industry, motor spare parts). The global economic outlook for Digital Economy related sectors such as Internet of Things (IoT) technologies anticipate rapid growth in the light of the 4th industrial revolution. Therefore, employment opportunities remain vibrant in such sectors for qualified and skilled personnel. In the Physical Sciences, only 30% out of the nearly 10,000 eligible candidates obtain university entrance on an annual basis into the state university system. Expanding educational opportunities in emerging fields of technology will remain critical to engage youth in economic development driven by the advanced technologies.

BSc (External) degree in Electronics and Automation Technologies expects to fulfil the above expectations through providing a highly engaging learning environment that inculcates an innovative mindset and technical competencies through the study of essentials in Electronics and Information Technology. Unlike traditional external degree programmes, the blended learning approach of the programme provides an ideal learning platform for working individuals as well as guarantees the completion of the programme within the stipulated programme duration. Activity-based classes held during weekends provide guidance and technical skills development under the close supervision of our highly competent academic staff. This fast track degree programme is therefore ideal both for those already working or seeking careers in the electronics industry. The degree is awarded upon completion of a minimum of 90 course credits offered during a span of 3 years. The program is placed at Sri Lanka Quality Framework (SLQF) - Level 5 as per the University Grants Commission guidelines.

The Program Learning Outcomes (PLOs)

At the end of the 3 years (SLQF Level 5) BSc in Electronics and Automation Technologies Degree holder should be able to:

PLO1: demonstrate knowledge and proficiency in the terminologies, theories, concepts, practises and skills specific to basic physics, mathematics, electronics, computing and automation

PLO2: apply the fundamentals of physics, mathematics, electronics, and computing to develop and conduct appropriate experimentation, analyse and interpret data and draw conclusions

PLO3: identify, develop, and apply appropriate techniques, resources, and modern electronics and ICT tools to solve real-world problems

PLO4: formulate practical solutions to real-world problems while managing resources

PLO5: practice professionalism and uphold ethical standards and improve/update skills required for employment and life-long learning

PLO6: effectively communicate and disseminate knowledge, information and ideas to specialists and a wider society

PLO7: perform independently as well as interdependently

Abbreviation

BSc (External) Elec & Auto Tech

Programme Structure

BSc (External) in Electronics and Automation Technologies programme will be completed in three years (90 Credits / SLQF Level 5) and consists of three exit levels.

LEVEL I: Diploma in Electronics and Automation Technologies (30 Credits)

LEVEL II: Advanced Diploma in Electronics and Automation Technologies (60 Credits)

LEVEL III: BSc (External) in Electronics and Automation Technologies (90 Credits)

Course code description: P Q R S (example: 1101)	
P	Level (1,2,3)
Q	Revision number =1
R	0,1 (Core) 2 (Core practicals) 3 (Foundation) 4 (Supplement) 5 (Soft Skills)
S	0-9 (Course number)

Level 1					
Course code	Course title	Credits	Notional Hours	Type	
EA 1101	Analogue Electronics - I	2	100	Core	*
EA 1102	Electronic Circuit Simulations	2	100	Core	*
EA 1103	Sensors & Actuators	2	100	Core	*
EA 1104	Introduction to Programming	2	100	Core	*

EA 1105	Algorithms and Computations	2	100	Core	*
EA 1106	Physics for Engineering	2	100	Core	*
EA 1107	Measurements Laboratory	2	100	Core	*
EA 1120	Analogue Electronics Laboratory	3	150	Core	*
EA 1121	Digital Electronics Laboratory	3	150	Core	*
EA 1130	Calculus	2	100	Foundation	
EA 1131	Probability and Statistics	2	100	Foundation	
EA 1140	Web Application Development I	2	100	Supplementary	
EA 1150	Computer Applications	2	100	Soft skills	
EA 1151	Creativity and Innovation	2	100	Soft skills	
EA 0040	Intensive English Course	-	-	Enhancement	
EA 0050	Intensive Mathematics Course	-	-	Enhancement	

* Compulsory courses to be eligible for Diploma in Electronics and Automation Technologies

Level 2

Course code	Course title	Credits	Notional Hours	Type	
EA 2101	Analogue Electronics - II	2	100	Core	*
EA 2102	Computer Architecture	2	100	Core	*
EA 2103	Data Communication Techniques	2	100	Core	*
EA 2104	Digital Signal Processing	2	100	Core	*
EA 2120	Microcontroller Laboratory	3	150	Core	*
EA 2121	Sensors and wireless communication for IoT	3	150	Core	*
EA 2122	Instrumentation Laboratory	2	100	Core	*
EA 2130	Applied Numerical Methods	2	100	Foundation	*
EA 2131	Data Analytics	2	100	Foundation	*
EA 2140	Database Management	2	100	Supplementary	
EA 2141	Mobile Application Development I	2	100	Supplementary	
EA 2142	Computer networking	2	100	Supplementary	
EA 2150	Business Economics	2	100	Soft skills	
EA 2151	English for Communicating Science	2	100	Soft skills	

* Compulsory courses to be eligible for Higher Diploma in Electronics and Automation Technologies

Level 3				
Course code	Course title	Credits	Notional Hours	Type
EA 3101	Power Electronics	2	100	Core
EA 3102	Programmable Logic Controllers	2	100	Core
EA 3103	Advanced Fabrication Techniques	2	100	Core
EA 3104	Applied Machine Learning	2	100	Core
EA 3120	Data Acquisition for IoT	3	150	Core
EA 3121	Robotics Laboratory	3	150	Core
EA 3131	Multivariate Analysis	2	100	Foundation
EA 3140	Web Application Development II	2	100	Supplementary
EA 3141	Mobile Application Development II	2	100	Supplementary
EA 3142	Fundamentals of Cyber Security	2	100	Supplementary
EA 3150	Entrepreneurship	2	100	Soft skills
EA 3151	Business Communication	2	100	Soft skills
EA 3160	Final Year Project	4	500	Core

Courses vs Program Learning Outcomes (PLOs) Map

Course Code	Course Title	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7
EA 1101	Analogue Electronics - I	H	M	H	M	L	L	L
EA 1102	Electronic Circuit Simulations	M	H	H	H	L	M	L
EA 1103	Sensors & Actuators	H	M	H	M	L	L	L
EA 1104	Introduction to Programming	M	H	H	H	L	M	L
EA 1105	Algorithms and Computations	M	H	H	H	L	M	L
EA 1106	Physics for Engineering	H	H	M	M	L	L	L
EA 1107	Measurements Laboratory	M	H	H	H	L	H	M
EA 1120	Analogue Electronics Laboratory	M	H	M	H	L	H	M
EA 1121	Digital Electronics Laboratory	H	H	H	H	L	M	M
EA 1130	Calculus	H	M	H	L	L	L	L
EA 1131	Probability and Statistics	H	M	H	L	L	L	L
EA 1140	Web Application Development I	M	M	H	H	L	H	M
EA 1150	Computer Applications	L	L	L	H	H	H	L
EA 1151	Creativity and Innovation	L	L	L	L	H	H	M
EA 0040	Intensive English Course							
EA 0050	Intensive Mathematics Course							
EA 2101	Analogue Electronics - II	H	M	H	M	L	L	L
EA 2102	Computer Architecture	H	M	H	M	L	L	L
EA 2103	Data Communication Techniques	H	M	H	M	L	L	L
EA 2104	Digital Signal Processing	H	M	H	H	L	L	L
EA 2120	Microcontroller Laboratory	M	H	H	H	L	H	M
EA 2121	Sensors and wireless communication for IoT	H	M	H	M	L	L	L
EA 2122	Instrumentation Laboratory	M	H	H	H	L	H	H
EA 2130	Applied Numerical Methods	H	M	H	L	L	L	L
EA 2131	Data Analytics	H	M	H	L	L	L	L
EA 2140	Database Management	M	M	H	H	L	H	H
EA 2141	Mobile Application Development I	M	M	H	H	L	H	H
EA 2142	Computer networking	M	M	H	H	L	L	L
EA 2150	Business Economics	L	L	L	M	L	H	L
EA 2151	English for Communicating Science	L	L	L	M	H	H	L
EA 3101	Power Electronics	H	M	H	M	L	L	L
EA 3102	Programmable Logic Controllers	M	H	M	H	L	H	M
EA 3103	Advanced Fabrication Techniques	M	H	M	H	L	H	M
EA 3104	Applied Machine Learning	M	H	M	H	L	H	M
EA 3120	Data Acquisition for IoT	M	H	H	H	L	H	M

EA 3121	Robotics Laboratory	M	H	H	H	L	H	M
EA 3131	Multivariate Analysis	H	M	H	L	L	L	L
EA 3140	Web Application Development II	M	H	H	H	L	H	M
EA 3141	Mobile Application Development II	M	H	H	H	L	H	M
EA 3142	Fundamentals of Cyber Security	M	M	H	H	L	L	L
EA 3150	Entrepreneurship	L	L	H	H	H	H	H
EA 3151	Business Communication	L	L	L	L	H	H	L
EA 3160	Final Year Project	L	H	H	H	M	H	H

H - Highly correlated; M - Moderately correlated; L - Correlated

Course modules vs Level Descriptors Learning Outcomes for SLQF Level 5

Course Code	Course Title	Level Descriptors Learning Outcomes for SLQF Level											
		1	2	3	4	5	6	7	8	9	10	11	12
		Subject / Theoretical Knowledge	Practical Knowledge and Application	Communication	Teamwork and Leadership	Creativity and Problem Solving	Managerial and Entrepreneurship	Information Usage and Management	Networking and Social Skills	Adaptability and Flexibility	Attitudes, Values and Professionalism	Vision for Life	Updating Self/ Lifelong Learning
		PLO 1	PO 2, PO 4	PO 5, PO 6	PO 5, PO 7	PO 3	PO 5, PO 7	PO 2	PO 7	PO 7	PO 5	PO 5	PO 5, PO 7
EA 1101	Analogue Electronics - I	H	M	L	L	L	L	M	L	L	L	L	L
EA 1102	Electronic Circuit Simulations	M	H	M	L	L	L	H	L	L	L	M	L
EA 1103	Sensors & Actuators	H	M	L	L	L	L	M	L	L	L	L	L
EA 1104	Introduction to Programming	M	H	M	L	L	L	H	L	L	L	M	L
EA 1105	Algorithms and Computations	M	H	M	L	L	L	H	L	L	L	M	L
EA 1106	Physics for Engineering	H	H	L	L	L	L	H	L	L	L	L	L
EA 1107	Measurements Laboratory	M	H	H	M	L	M	H	M	M	L	H	M
EA 1120	Analogue Electronics Laboratory	M	H	H	M	L	M	H	M	M	L	H	M
EA 1121	Digital Electronics Laboratory	H	H	M	M	L	M	H	M	M	L	M	M
EA 1130	Calculus	H	M	L	L	L	L	M	L	L	L	L	L
EA 1131	Probability and Statistics	H	M	L	L	L	L	M	L	L	L	L	L
EA 1140	Web Application Development I	M	H	H	M	L	M	M	M	M	L	H	M
EA 1150	Computer Applications	L	H	H	H	H	H	L	L	L	H	H	H

EA 1151	Creativity and Innovation	L	L	H	H	H	H	L	M	M	H	H	H
EA 0040	Intensive English Course												
EA 0050	Intensive Mathematics Course												
EA 2101	Analogue Electronics - II	H	M	L	L	L	L	M	L	L	L	L	L
EA 2102	Computer Architecture	H	M	L	L	L	L	M	L	L	L	L	L
EA 2103	Data Communication Techniques	H	M	L	L	L	L	M	L	L	L	L	L
EA 2104	Digital Signal Processing	H	H	L	L	L	L	M	L	L	L	L	L
EA 2120	Microcontroller Laboratory	M	H	H	M	L	M	H	M	M	L	H	M
EA 2121	Sensors and wireless communication for IoT	H	M	L	L	L	L	M	L	L	L	L	L
EA 2122	Instrumentation Laboratory	M	H	H	H	L	H	H	H	H	L	H	H
EA 2130	Applied Numerical Methods	H	M	L	L	L	L	M	L	L	L	L	L
EA 2131	Data Analytics	H	M	L	L	L	L	M	L	L	L	L	L
EA 2140	Database Management	M	H	H	H	L	H	M	H	H	L	H	H
EA 2141	Mobile Application Development I	M	H	H	H	L	H	M	H	H	L	H	H
EA 2142	Computer networking	M	H	L	L	L	L	M	L	L	L	L	L
EA 2150	Business Economics	L	M	H	L	L	L	L	L	L	L	H	L
EA 2151	English for Communicating Science	L	M	H	H	H	H	L	L	L	H	H	H
EA 3101	Power Electronics	H	M	L	L	L	L	M	L	L	L	L	L
EA 3102	Programmable Logic Controllers	M	H	H	M	L	M	H	M	M	L	H	M
EA 3103	Advanced Fabrication Techniques	M	H	H	M	L	M	H	M	M	L	H	M
EA 3104	Applied Machine Learning	M	H	H	M	L	M	H	M	M	L	H	M
EA 3120	Data Acquisition for IoT	M	H	H	M	L	M	H	M	M	L	H	M
EA 3121	Robotics Laboratory	M	H	H	M	L	M	H	M	M	L	H	M
EA 3131	Multivariate Analysis	H	M	L	L	L	L	M	L	L	L	L	L
EA 3140	Web Application Development II	M	H	H	M	L	M	H	M	M	L	H	M
EA 3141	Mobile Application Development II	M	H	H	M	L	M	H	M	M	L	H	M
EA 3142	Fundamentals of Cyber Security	M	H	L	L	L	L	M	L	L	L	L	L
EA 3150	Entrepreneurship	L	H	H	H	H	H	L	H	H	H	H	H
EA 3151	Business Communication	L	L	H	H	H	H	L	L	L	H	H	H
EA 3160	Final Year Project	L	H	H	H	M	H	H	H	H	M	H	H

H - Highly correlated; M - Moderately correlated; L - Correlated

Course Details

<table>
<tr><td colspan="5">Level1</td></tr>
<tr><td>Course Code:</td><td colspan="4">EA 1101</td></tr>
<tr><td>Course Name:</td><td colspan="4">Analogue Electronics - I</td></tr>
<tr><td>Credit Value:</td><td colspan="4">02</td></tr>
<tr><td>Core/Optional</td><td colspan="4">Core</td></tr>
<tr><td>Prerequisites</td><td colspan="4">None</td></tr>
<tr><td rowspan="2">Hourly Breakdown</td><td>Theory</td><td>Practical</td><td>Independent learning</td><td>Notional</td></tr>
<tr><td>16</td><td>--</td><td>84</td><td>100</td></tr>
<tr><td colspan="5">Course Aim:
The aim of this course is to provide students with an understanding of basic analogue electronic components and systems used in automation.</td></tr>
<tr><td colspan="5">Intended Learning Outcomes:
At the end of this course, students will be able to;
● explain the science behind the fundamental electronic components
● analyse, design, and synthesise diode, transistor, and op-amp circuits
● explore analogue electronics principles behind digital circuits</td></tr>
<tr><td colspan="5">Course Content (Main topics, Subtopics):
Electronics configuration and electrical properties of materials: insulators, conductors, semiconductors: intrinsic and extrinsic semiconductors, doping, p & n-type materials, PN junctions: formation, depletion region, barrier potential; Introduction to analogue electronics: analogue and digital signals, frequency spectrum, maximum power and voltage transmission; Use of Thevenin's theorem in modelling; Diodes: junction diode and its applications, rectifier circuits, Zener diodes, voltage regulation, IC regulators, low voltage power supply, limiting and clamping circuits, special diode types and their applications; Bipolar junction transistors: operation of an NPN transistor, transistor biassing and transistor as an amplifier, basis of transistor amplifier operation: voltage amplifiers, voltage transfer characteristics (VTC), linear amplifiers, small signal-voltage gain, bias point Q; small-signal operation transistor designing of a common emitter amplifier, voltage gain, transistor breakdown and temperature effect; as a switch; designing of basic logic gates using diodes and BJTs, Physical characteristics of Logic families; Introduction to op-amp: ideal op-amps concept, feedbacks, golden rules; Basic op-amp circuits and their input output characteristics: voltage follower, inverting amplifier, non-inverting amplifier, summing amplifier, integrator, differentiator, instrumentation amplifiers, comparators, schmitt trigger;</td></tr>
<tr><td colspan="5">Teaching /Learning Methods: Lectures, Tutorials</td></tr>
<tr><td colspan="5">Assessment Strategy:</td></tr>
<tr><td colspan="2">Continuous Assessment
30%</td><td colspan="3">Final Assessment
70%</td></tr>
</table>

Details: In-class assignments	**Theory (%)** 100	**Practical (%)** --	**Other (%) (Specify)** --

Recommended Reading:

1. Sedra, A., & Smith, K. (2001). *Microelectronic circuits*. New York: Oxford University Press.
2. Horowitz, P., & Hill, W. (2002). *The Art of Electronics*. Cambridge University Press.

Level1				
Course Code:	EA 1102			
Course Name:	Electronic Circuit Simulations			
Credit Value:	02			
Core/Optional	Core			
Prerequisites	None			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**
	4	12	84	100

Course Aim:

This course aims at providing students with hands-on experience in electronic circuit simulations based on existing circuit models.

Intended Learning Outcomes:

At the end of this course, students will be able to;

- analyse electronic circuits using appropriate simulation tools
- design electronic circuits taking practical limitations into consideration
- construct and present technical details of simulation results

Course Content (Main topics, Subtopics):

Importance of circuit simulations, different circuit simulation packages and engines: Pspice engine; Schematic drawing: selecting, inserting, and deleting components, modification of component properties, wiring, modifications for simulations; Bias point analysis on resistor networks, circuits with BJTs, FETs and op-amps; DC Sweep: linear circuits and non-linear circuits; AC sweep: transistor amplifiers, RC Circuits, RLC circuits, filter circuits; Time and frequency-domain circuit analysis; Digital circuit simulation; Basic microcontroller simulations;

Teaching /Learning Methods: Lectures, Interactive laboratory sessions

Assessment Strategy:

Continuous Assessment 40%	Final Assessment 60%		
Details: in-class assignments	Theory (%) 40	Practical (%) 60	Other (%) (Specify) --

Recommended Reading:

1. Malik, N. (2019). *Electronic Circuits: Analysis, Simulation, and Design*. Pearson.
2. Tobin, P. (2013). *PSpice for Circuit Theory and Electronic Devices*. Macmillan Publishers.

Level1				
Course Code:	EA 1103			
Course Name:	Sensors & Actuators			
Credit Value:	02			
Core/Optional	Core			
Prerequisites	None			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**
	16	--	84	100

Course Aim:

This course aims at providing students with a fundamental understanding of the operation and application of sensors and actuators.

Intended Learning Outcomes:

At the end of this course, students will be able to;

- explain the operation principles of different sensors and actuators
- characterize sensors in terms of metrological criteria and evaluate their performance
- calibrate and estimate errors in sensors and actuators
- design interfacing and controlling circuits for various sensors and actuators

Course Contents (Main topics, Subtopics):

Introduction to sensors, actuators and transducers: performance characteristics: transfer function, sensitivity, accuracy, precision, linearity, hysteresis, span, dynamic range, error, stability, response time; Different types of sensors and their applications: pressure, force, position, temperature, RH, flow, velocity, acceleration, volume, magnetic field, radiation, light intensity; Sensor calibration: improving accuracy, finding transfer function, error estimation; Sensor interfacing circuits: selected topics in op-amps, voltage follower, inverting amplifier, non-inverting amplifier, summing amplifier, integrator, differentiator, instrumentation amplifiers, comparators, Schmitt trigger; Actuator driving circuits: resistive, capacity and inductive loads; Basic feedback control;

Teaching /Learning Methods: Lectures, Tutorials

Assessment Strategy: Assignments and end of semester written examination

Continuous Assessment 30%	**Final Assessment** 70%		
Details: Assignments	**Theory (%)** 100	**Practical (%)** --	**Other (%) (Specify)** --

Recommended Reading:

1. Doebelin, E. (2012). *Measurement Systems: Application and Design*. McGraw-Hill Education.
2. Ranganathan, S. (2003). *Transducers Engineering*. Allied Publishers Pvt. Ltd.
3. Nise, N. S. (2015). *Control Systems Engineering* (7th ed.). Wiley.

Level1				
Course Code:	EA 1104			
Course Name:	Introduction to Programming			
Credit Value:	02			
Core/Optional	Core			
Prerequisites	None			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**
	16	--	84	100

Course Aim:

This course aims at providing students with hands-on experience in basic algorithm development and computer programming.

Intended Learning Outcomes:

At the end of this course, students will be able to;

- analyze a problem and illustrate the solution through a flowchart
- comprehend the elements of procedural programming and the basic structure of a program
- develop programs to achieve simple tasks

Course Content (Main topics, Subtopics):

Algorithm design and representation using flowcharts; Introduction to languages: history, high level and low-level languages, compiled vs interpreted languages; Setting up the programming environment; C programming fundamentals: keywords, comments, variables, data types, constants, statements, basic I/O operations, typecasting, escape sequences; Operators: arithmetic, logical, relational, and bitwise operators, expressions, operator precedence; Basic program control: conditional statements, loops, break/continue statements; Functions: function prototype and definition, arguments, function calls, variable scope, recursive functions; Arrays: array declaration and initialization, multi-dimensional arrays; Pointers

Teaching /Learning Methods: Lectures, Interactive laboratory sessions

Assessment Strategy:

Continuous Assessment 60%	**Final Assessment** 40%		
Details: Assignments	**Theory (%)** --	**Practical (%)** 100	**Other (%) (Specify)** --

Recommended Reading:

1. Kernighan, B. W., & Ritchie, D. M. (1988). *C Programming Language (2nd ed.)*. Prentice-Hall.
2. Jones, B. L., & Aitken, P. G. (2002). *Sams Teach Yourself C in 21 Days (6th ed.)*. Sams.

Level1				
Course Code:	EA 1105			
Course Name:	Algorithms and Computations			
Credit Value:	02			
Core/Optional	Core			
Prerequisites	None			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**
	16	--	84	100

Course Aim:

The aim of this course is to provide hands-on experience in advanced concepts in programming by developing standard algorithms.

Intended Learning Outcomes:

At the end of this course, students will be able to;

- critically analyze and breakdown complex problems using a divide and conquer approach
- develop computer programs to solve real-world problems
- design, develop, and reuse software libraries

Course Content (Main topics, Subtopics):

Pointers and pointer arithmetic, Structures; File handling and advanced I/O operations; Command line arguments and parsing; Dynamic memory allocation, Debugging; C standard library functions: mathematical functions, string manipulation, error handling, time functions; Advanced compiler use: programming with multiple source files, modular programming techniques, preprocessor directives, Statistical data analysis: error analysis, curve fitting; Simple sorting algorithms: bubble sort, selection sort; Random numbers and simple Monte Carlo algorithms

Teaching /Learning Methods: Lectures, Interactive laboratory sessions

Assessment Strategy:

Continuous Assessment 60%	**Final Assessment** 40%		
Details: Assignments	**Theory (%)** --	**Practical (%)** 100	**Other (%) (Specify)** --

Recommended Reading:

1. Kernighan, B. W., & Ritchie, D. M. (1988). *C Programming Language (2nd ed.)*. Prentice Hall.
2. Jones, B. L., & Aitken, P. G. (2002). *Sams Teach Yourself C in 21 Days (6th ed.)*. Sams.

Level1				
Course Code:	EA 1106			
Course Name:	Physics for Engineering			
Credit Value:	02			
Core/Optional	Core			
Prerequisites	None			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**
	16	-	84	100

Course Aim:

The aim of this course is to build a strong foundation in basic Physics principles required for Electronics with special focus on applications of Mathematics in Physics.

Intended Learning Outcomes:

At the end of this course, students will be able to;

- identify the vector and scalar nature of physical quantities
- apply concepts in waves and vibrations to physical phenomena
- apply the laws of electricity and magnetism
- analyse phenomena in transient direct current circuits
- analyse direct/alternating current circuits

Course Content (Main topics, Subtopics):

Nature of Science: physical quantities and units, physical quantities as vectors & scalars ; Waves & Vibrations: simple harmonic motion, damped oscillators, quality factor, forced oscillators, normal modes, resonance, electrical oscillators, properties of waves, wave superposition and interference, Fourier analysis; Electricity and Magnetism: Charges, Coulomb's law, electric fields, Gauss's law of electricity, electric potential, capacitors and dielectrics, magnetic fields, Gauss's law of magnetism, Ampere's law, Faraday's law of induction, electromagnetic waves; Electrical circuits: direct current circuits, Ohm's law, Kirchhoff's circuit laws, electric power and energy, transient direct current circuits, alternating current (AC) circuits, impedance, analysis of AC circuits using phasors.

Teaching /Learning Methods: Lectures

Assessment Strategy:

Continuous Assessment 30%	**Final Assessment** 70%		
Details: Assignments	**Theory (%)** 100%	**Practical (%)**	**Other (%) (Specify)**

Recommended Reading:

1. Young, H. D., Freedman, R. A., & Ford, A. L. (2006). *Sears and Zemansky's university physics (Vol. 1).* Pearson education.
2. Serway, R. A., & Jewett, J. W. (2018). *Physics for scientists and engineers.* Cengage learning.

Level1				
Course Code:	EA 1107			
Course Name:	Measurements Laboratory			
Credit Value:	02			
Core/Optional	Core			
Prerequisites	None			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**
	-	36	64	100

Course Aim:

This introductory laboratory course is designed to build basic skills in conducting controlled Physics experiments which require handling measuring instruments, interpreting data, and estimating uncertainties.

Intended Learning Outcomes:

At the end of this course, students will be able to;

- measure physical quantities using the relevant laboratory instruments with considerations for measurement accuracy and precision
- apply basic error analysis systematically to estimate uncertainties associated with measured quantities
- infer experimentally major physical quantities related to mechanics, thermal physics, properties of matter, and geometrical optics
- understand the relationship between experiment and theory
- communicate verbally and in writing the results, analysis, and findings of an experiment

Course Content (Main topics, Subtopics):

Project-based learning will be encouraged to develop scientific thinking. Focus will be placed on designing an experiment, methods for data acquisition, analysis and interpretation of results subjected to constraints in measurement precision and accuracy. Most experiments will be inspired by Physics, covering selected areas in properties of matter, mechanics, physical optics, *etc.*

Teaching /Learning Methods: Take-home experiments

Assessment Strategy:

Continuous Assessment 60%	**Final Assessment** 40%		
Details: Weekly Experiments & Viva: 60%	Theory (%) -	Practical (%) 40%	Other (%) -

Recommended Reading:

1. Squires, G. L. (2001). *Practical Physics*. Cambridge University Press.
2. Tyler, F. (1977). *A Laboratory Manual of Physics*. Hodder Education.

Level1				
Course Code:	EA 1120			
Course Name:	Analogue Electronics Laboratory			
Credit Value:	03			
Core/Optional	Core			
Prerequisites	None			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**
	--	40	110	150

Course Aim:

This course aims to provide students with hands-on experience in the design and construction of electronic circuits.

Intended Learning Outcomes:

At the end of this course, students will be able to;

- recognize basic analogue electronic components
- describe the operation of basic analogue electronic components and circuits
- formulate requirements to design an analogue electronic circuit suitable for a given application
- design, implement, analyse, and test analogue electronic circuits
- scientifically communicate (verbally and in writing) the design, implementation, analysis, and testing related to an analogue electronic circuit

Course Contents (Main topics, Subtopics):

This course focuses on providing students with hands-on learning in applications in analogue electronics through relevant laboratory work and a series of experiments. The course involves exercises such as designing a circuit for a relevant application using analogue electronic components, devices, integrated circuits and systems/units. The course also involves participating in student-centred lecture sessions, performing design, testing, and validation. In addition, students are expected to complete a capstone project based on the experimental content discussed in the course.

Teaching /Learning Methods: Laboratory-based experiments and Capstone project

Assessment Strategy:

Continuous Assessment 40%	**Final Assessment** 60%		
Details:	**Theory (%)** --	**Practical (%)** 100	**Other (%) (Specify)** --

Recommended Reading:

1. Horowitz, P., & Hill, W. (2015). *The Art of Electronics*. Cambridge University Press.
2. Malvino, A., & Bates, D. (2010). *Electronic Principles (7th ed.)*. McGraw-Hill Education.
3. Boylestad, R. L., & Nashelsky, L. (2008). *Electronic Devices and Circuit Theory (10th ed.)*. Prentice-Hall.

Level1				
Course Code:	EA 1121			
Course Name:	Digital Electronics Laboratory			
Credit Value:	03			
Core/Optional	Core			
Prerequisites	None			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**
	16	32	102	150

Course Aim:

The course aims to provide students with hands-on experience in the design and construction of digital electronic circuits while providing them with a fundamental understanding of combinational and sequential logic circuits.

Intended Learning Outcomes:

At the end of this course, students will be able to;

- recognize basic digital electronic components
- describe the operation of basic digital electronic components and circuits
- formulate requirements to design a digital electronic circuit suitable for a given application
- design, implement, analyse, and test optimal digital electronic circuits
- scientifically communicate (verbally and in writing) the design, implementation, analysis, testing, and optimization related to digital electronic circuits

Course Contents (Main topics, Subtopics):

Introduction to digital electronics: analogue and digital representation, number systems and codes: binary, BCD, grey code; basic logic gates: AND, OR, NOT, NAD, NOR, XOR, XNOR; Boolean logic and algebra: Boolean equations, truth tables, algebraic simplification, Karnaugh maps; combinational logic circuits: AND-OR-INVERT, NAND only, and NOR only logic design, arithmetic operations: half adder, full adder, subtractor, multiplier, data control structures: encoder, decoder, multiplexer, demultiplexer; sequential logic circuits: latch as a memory element, introduction to sequential logic circuits, latches/flip flops: SR, D, T, JK, registers: counters: synchronous and asynchronous counters, binary up/down counters, specialized counter circuits, shift registers: serial/parallel data converters; I/O: synchronous and asynchronous inputs, edge detectors, bouncing, debouncing circuits; CMOS and TTL logic ICs; State machines; HDL

Teaching /Learning Methods: Lectures, Laboratory-based experiments

Assessment Strategy:

Continuous Assessment 40%	**Final Assessment** 60%		
Details:	**Theory (%)** 60	**Practical (%)** 40	**Other (%) (Specify)** --

Recommended Reading:

1. Kleitz, W. (2007). *Digital Electronics: A Practical Approach (8th ed.)*. Pearson College Div.
2. Pedroni, V. A. (2010). *Circuit Design and Simulation with VHDL (2nd ed.)*. The MIT Press.

Level1				
Course Code:	EA 1130			
Course Name:	Calculus			
Credit Value:	02			
Core/Optional	Foundation			
Prerequisites	None			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**
	16	--	84	100

Course Aim:

The aim of this course is to make students capable of applying calculus to solve problems in the fields of electronics and automation.

Intended Learning Outcomes:

At the end of this course, students will be able to;

- explain fundamental concepts of Calculus
- analyze concepts, definitions and results in Calculus with real-world applications
- apply Calculus to solve problems in Physics and Electronics

Course Contents (Main topics, Subtopics):

Limits and derivatives: Limit of a function, Calculating limits using the limit laws, Continuity, Derivatives and rates of changes; Differentiation rules: Derivatives of polynomials and exponential functions, the product and quotient rules, derivatives of trigonometric functions, chain rule, implicit differentiation, derivatives of logarithmic functions; Application of differentiation: Maximum and minimum values, the mean value theorem, optimization problems; Integrals: Areas and distances, the definite integral, the indefinite integrals, the substitution rule; Application of integration: Areas between two curves, volumes, Volumes by cylindrical shells; Techniques of integration: Integration by parts, Trigonometric integrals, Trigonometric Substitution, Integration by partial fractions; Polar coordinates: Polar coordinates, conic sections; Infinite series and sequences: Sequences, Series, Power series, Taylor and Maclaurin series; Partial derivatives: Partial Derivatives, Tangent planes and linear approximations, maximum and minimum values; Calculus for electronics: average in electronics, calculus of Kirchoff's law, op-amp differentiation and integration, transistor parameters, Fourier series and spectrum analysis.

Teaching /Learning Methods: Lectures, tutorials

Assessment Strategy:

Continuous Assessment	**Final Assessment**
40%	60%

Details: Assignments, Quizzes	**Theory (%)** 100	**Practical (%)** --	**Other (%) (Specify)** --

Recommended Reading:

1. Stewart, J. (2015). *Calculus: Early Transcendentals (8th ed.)*. Cengage Learning.
2. Smith, K. J., Strauss, M., & Toda, M. (2017). *Calculus (7th ed.)*. Kendall Hunt Publishing.

Level1				
Course Code:	EA 1132			
Course Name:	Probability and Statistics			
Credit Value:	02			
Core/Optional	Foundation			
Prerequisites	None			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**
	10	6	84	100

Course Aim:

The aim of this course is to make students capable of applying probability and statistics to improve experimental procedures and findings in the fields of electronics and automation.

Intended Learning Outcomes:

At the end of this course, students will be able to;

- explain fundamental concepts of error, probability, and statistics
- analyze uncertainties in experiments using appropriate statistical methods
- propose improvements to reduce associated experimental errors

Course Contents (Main topics, Subtopics):

Uncertainties in measurements: measuring errors, accuracy, precision, significant figures and round off, uncertainties; Descriptive statistics: types of data; scales of measurement, data summarization, measures of location; measures of dispersion; Probability: counting rules, set theory, permutations and combinations; Probability distributions: probability density function and probability (mass) function, cumulative distribution function, expected value, variance, Uniform, Bernoulli, binomial, Poisson, uniform, exponential, normal, central limit theorem; Error analysis: instrumental and statistical uncertainties, propagation of errors, error formulas and applications; Regression: polynomial regression, nonlinear regression, the goodness of fit;

Teaching /Learning Methods: Lectures, Interactive laboratory sessions

Assessment Strategy:

Continuous Assessment 30%	**Final Assessment** 70%		
Details: In-class and take-home assignments	**Theory (%)** 100	**Practical (%)** --	**Other (%) (Specify)** --

Recommended Reading:

1. Bevington, P., & Robinson, K. D. (2002). *Data Reduction and Error Analysis for the Physical Sciences* (3rd ed.). McGraw-Hill Education.
2. DeGroot, M. H., & Schervish, M. J. (2011). *Probability and Statistics (4th ed.)*. Pearson.
3. Ellenberg, J. (2015). *How Not to Be Wrong: The Power of Mathematical Thinking*. Penguin Books.
4. Hodges, J. L., & Lehmann, E. L. (2013). *Basic Concepts of Probability and Statistics*. Literary Licensing, LLC.

Level1				
Course Code:	EA 1140			
Course Name:	Web Application Development I			
Credit Value:	02			
Core/Optional	Supplementary			
Prerequisites	None			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**
	06	10	84	100

Course Aim:

The aim of this course is to provide students with hands-on experience in basic concepts of web application development.

Intended Learning Outcomes:

At the end of this course, students will be able to;

- describe modern web application design concepts
- compose static web pages by adding dynamic content with the use of client side tools
- develop simple web applications with server side scripting

Course Content (Main topics, Subtopics):

Introduction to the Internet: history, W3C; HTML: introduction, HTML tags, web development IDEs; UI design: fundamentals of UI design, characteristics of good web UI design, adapting designs for screens and printers, fundamentals of calligraphy; Style sheets: concept, inheritance, specificity, text and background styling, typographical principles, box model, floating and positioning elements, grids/flex and grid theory, page layouts, pseudo classes; Client side programming: client-server architecture vs p2p architecture, integrating JavaScript (JS) to websites, form validation, cookies and local storage, OOP with JS; Server side programming: basic concepts, introduction to php, handling forms, handling sessions and user logins, graphics, JSON, XML, YMAIL;

Teaching /Learning Methods: Lectures, Interactive sessions

Assessment Strategy:

Continuous Assessment	**Final Assessment**
40%	60%

Details: Assignments	**Theory (%)**	**Practical (%)**	**Other (%) (Specify)** 100%

Recommended Reading:

1. *W3Schools Free Online Web Tutorials*. (n.d.). W3Schools. https://www.w3schools.com/

Level1				
Course Code:	EA 1150			
Course Name:	Computer Applications			
Credit Value:	02			
Core/Optional	Soft skills			
Prerequisites	None			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**
	16	--	84	100

Course Aim:

This course aims at providing hands-on experience in computer-based productivity tools and platforms.

Intended Learning Outcomes:

At the end of this course, students will be able to;

- demonstrate effective use of common system and application software
- review and choose appropriate software tools for a given scenario
- maintain the quality of workflow adhering to the regulations and etiquette

Course Content (Main topics, Subtopics):

Impact of computer hardware on the performance of software applications: processor, clock speed, cache, generations, power consumption, primary memory, HDD and SSD; BIOS vs UEFI; USB: type C: thunderbolt, PD, external drives and graphics cards; Operating systems: Windows and Linux; Word processing applications: basic editing and text formatting: fonts, alignment, and indentation; types of views, find, search and replace, spell checker, objects embedding, headers & footers, styles, mail merge, save and backup options, page setup, margins and printing; Spreadsheet applications: common user interface components, basic editing, data entry, move, copy, and cut and paste functions, insertion, deletion and modifications at sheet/workbook level, formulas. built-in spreadsheet functions, addressing and referencing schemes, graphs and charts, different views and printing; presentation applications; SAS: cloud-based applications and storages; Netiquette

Teaching /Learning Methods: Lectures, Interactive laboratory sessions

Assessment Strategy:

Continuous Assessment 60%	**Final Assessment** 40%

Details: Assignments	Theory (%) --	Practical (%) --	Other (%) (Specify) 100
Recommended Reading: 1. Materials provided on the LMS			

<table>
<tr><td colspan="5">Level1</td></tr>
<tr><td>Course Code:</td><td colspan="4">EA 1151</td></tr>
<tr><td>Course Name:</td><td colspan="4">Creativity and innovation</td></tr>
<tr><td>Credit Value:</td><td colspan="4">02</td></tr>
<tr><td>Core/Optional</td><td colspan="4">Soft skills</td></tr>
<tr><td>Prerequisites</td><td colspan="4">None</td></tr>
<tr><td rowspan="2">Hourly Breakdown</td><td>Theory</td><td>Practical</td><td>Independent learning</td><td>Notional</td></tr>
<tr><td></td><td>16</td><td>84</td><td>100</td></tr>
<tr><td colspan="5">Course Aim: This course aims at providing an experience in rediscovering the innate creativity of individuals and to explore the process of translating that ability towards innovation.</td></tr>
<tr><td colspan="5">Intended Learning Outcomes:
At the end of this course, students will be able to;
● Identify the importance of creative thought,
● relate creativity to innovation,
● apply concepts in innovation and design thinking,
● work in a group and relate to organisational cultures and leadership,</td></tr>
<tr><td colspan="5">Course Content (Main topics, Subtopics):
Creativity: four Ps of creativity, creative process, design thinking, empathising and design thinking, design research strategies; Innovation: types of innovation, schools of innovation, challenges in innovation, idea management, divergent and convergent thinking, participation and co-creation in innovation; Leadership: behaviour, aspirations, skills, information, communication & sustainability commitments</td></tr>
<tr><td colspan="5">Teaching /Learning Methods: Lectures, Project</td></tr>
<tr><td colspan="5">Assessment Strategy:</td></tr>
<tr><td colspan="2">Continuous Assessment
30%</td><td colspan="3">Final Assessment
70%</td></tr>
<tr><td colspan="2">Details: Assignments</td><td>Theory (%)</td><td>Practical (%)
100%</td><td>Other (%)
(Specify)</td></tr>
<tr><td colspan="5">Recommended Reading:
1. Hemlin, S., Allwood, C. M., Martin, B., & Mumford, M. D. (2014). Creativity and leadership in science, technology, and innovation. Routledge.
2. Bilton, C., & Cummings, S. (2014). Handbook of management and creativity. Edward Elgar Publishing.</td></tr>
</table>

----Level 2---

Level2	
Course Code:	EA 2101

Course Name:	Analogue Electronics - II			
Credit Value:	02			
Core/Optional	Core			
Prerequisites	None			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**
	16	--	84	100

Course Aim:

The aim of this course is to expand students' theoretical knowledge in analogue electronics with the focus on amplifier design and characterization.

Intended Learning Outcomes:

At the end of this course, students will be able to;

- explain the behaviour and characteristics of amplifier system components
- compare and contrast properties of different oscillator circuits
- design and characterise amplifier circuits

Course Content (Main topics, Subtopics):

FETs: characteristics, types, linear amplifiers, power consumption, capacitance; Introduction to JFETs: input and output characteristics, transconductance; FET switches: analogue switching, limitations as a switch; MOSFETs: JFETs vs. MOSFETs, power MOSFETs, impedance, capacitance, thermal stability, MOSFETs vs. BJTs in current switching; Thyristors: SCR, Triac, Diac, UJT; Basic amplifier configurations: characterising amplifiers, class A, B, and AB power amplifiers; Oscillators: introduction, feedbacks, Wien bridge oscillator, phase shift oscillator, crystal oscillator; 555 timer IC: internal structure, astable, bistable, monostable operation, rectangular wave generators, voltage to frequency converters, PWM, PPM, duty cycle;

Teaching /Learning Methods: Lectures, Tutorials

Assessment Strategy:

Continuous Assessment 30%	**Final Assessment** 70%		
Details: Assignments	**Theory (%)** 100	**Practical (%)** --	**Other (%) (Specify)** --

Recommended Reading:

1. Sedra, A., & Smith, K. (2001). *Microelectronic circuits*. New York: Oxford University Press.
2. Horowitz, P., & Hill, W. (2002). *The Art of Electronics*. Cambridge University Press.

Level2				
Course Code:	EA 2102			
Course Name:	Computer Architecture			
Credit Value:	02			
Core/Optional	Core			
Prerequisites	None			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**
	16	--	84	100

Course Aim:

The aim of this course is to provide students with the basic concepts of stored programme architecture, and how different entities bind together to work as a single machine.

Intended Learning Outcomes:

At the end of this course, students will be able to;

- explain how alphanumeric characters are represented and how data & instructions are transferred across different peripherals in computers
- compare and contrast different computer architectures and memories
- compose and analyse programmes for different processors

Course Content (Main topics, Subtopics):

Numbers and systems: data representation, character codes, number representation, ASCII, Unicode, compliments, fixed and floating point representation, binary arithmetic, Boolean algebra; Architecture of a computer: Von-Neumann, Harvard, and Hybrid system; Modern processors and SOC: ARM; Instruction set design: assembly and machine language, firmware, RISC and CISC; Addressing modes: register, direct, indirect, indexed; Pipelining: instruction and arithmetic pipelines, structural hazards and data dependencies, branch delay and multicycle instructions; Memory hierarchy: cache memory, virtual memory; Peripherals: memory-mapped I/O devices, port-mapped I/O devices; Bus signals and interfacing; Typical programmable I/O chips; Multiprocessors: SISD, SIMD, and MIMD architectures, centralised and distributed shared memory- architectures;

Teaching /Learning Methods: Lectures

Assessment Strategy:

Continuous Assessment 30%	**Final Assessment** 70%		
Details: Assignments	**Theory (%)** 100	**Practical (%)** --	**Other (%) (Specify)** --

Recommended Reading:

1. Mano, M. (1993). *Computer System Architecture (3rd ed.)*. Englewood Cliffs: Prentice-Hall.

Level2				
Course Code:	EA 2103			
Course Name:	Data Communication Techniques			
Credit Value:	02			
Core/Optional	Core			
Prerequisites	None			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**
	16	--	84	100

Course Aim:

This course aims to provide students with an understanding of the basic operations of data communication systems.

Intended Learning Outcomes:

At the end of this course, students will be able to;

- identify components of a data communication system
- propose and justify data communication techniques used in a given system
- evaluate the suitability of techniques used in a data communication system and suggest improvements

Course Content (Main topics, Subtopics):

Introduction to data communication systems; Signal types and characteristics: continuous time and discrete time, analogue and digital, periodic and aperiodic, energy and power, deterministic and random; Analysis and transmission of signals: Fourier integral and transformation, transmission through a linear system, signal distortion over a communication channel; Modulations and demodulations: amplitude, angle, frequency; Sampling and analogue-to-digital conversion: sampling, PCM, digital multiplexing; Principles of digital data transmission: digital communication systems, line coding, pulse shaping, digital receivers and regenerative repeaters, digital carrier systems; Error correcting codes: redundancy for error correction, linear block codes, cyclic codes

Teaching /Learning Methods: Lectures, tutorials

Assessment Strategy:

Continuous Assessment 30%	**Final Assessment** 70%		
Details: Assignments	**Theory (%)** 100	**Practical (%)** --	**Other (%) (Specify)** --

Recommended Reading:

1. Lathi, B. P., & Ding, Z. (2009). *Modern Digital and Analog Communication Systems* (4th ed.). Oxford University Press.

Level2

Course Code:	EA 2104			
Course Name:	Digital Signal Processing			
Credit Value:	02			
Core/Optional	Core			
Prerequisites	None			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**
	06	10	84	100

Course Aim:

The aim of this course is to provide students with an understanding and hands-on experience in digital signal processing

Intended Learning Outcomes:

At the end of this course, students will be able to;

- describe the characteristics and transformations of discrete time signals mathematically
- manipulate signals upon transforming to frequency domain
- design digital filters and apply them to real-world applications
- propose and evaluate compression techniques to store filtered/formatted data

Course Content (Main topics, Subtopics):

Time domain and frequency domain signals: introduction to analogue filters, analogue to digital conversion, quantization, sampling theorem, aliasing, SNR; Linear time invariant systems: requirements for linearity, superposition, common decomposition methods; Digital filters: convolution, delta function, impulse response, median, moving average, windowed-sinc filters, Chebyshev, Butterworth, Savitzky-Golay; Fourier Analysis: Fourier transform properties, discrete Fourier transformation, power spectrum; Data compression: compression strategies, compression coding.

Teaching /Learning Methods: Lectures, interactive sessions

Assessment Strategy:

Continuous Assessment 30%	**Final Assessment** 70%		
Details: Assignments	**Theory (%)** 100	**Practical (%)**	**Other (%) (Specify)**

Recommended Reading:

1. Smith, S. W. (1997). *The Scientist & Engineer's Guide to Digital Signal Processing (1st ed.)*. California Technical Pub.

Level2	
Course Code:	EA 2120
Course Name:	Microcontroller Laboratory

Credit Value:	03			
Core/Optional	Core			
Prerequisites	None			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**
	--	32	118	150

Course Aim:

The aim of the course is to provide hands-on experience in microcontrollers to develop embedded systems.

Intended Learning Outcomes:

At the end of this course, students will be able to;

- critically evaluate the capabilities of microcontrollers and choose suitable one for a given application
- design circuits to interface external components to the microcontrollers
- synthesis programs for microcontrollers to achieve a given task

Course Content (Main topics, Subtopics):

Introduction to microcontrollers: popular microcontroller families, design cycle, architecture, downloaders, programmers, bootloaders; Programming built in hardware: flash memory, EEPROM, I/O ports, ADC, DAC, timers/counters, USART, SPI, I2C, interrupts and multitasking; Use of features: watch dog timer, brown out, sleep modes, power supply and consumption, oscillator options, hardware and software timing; Interfacing external peripherals: design and develop circuits to interface indicators, sensors & actuators and write programs, communicating with PCs;

Teaching /Learning Methods: Interactive laboratory sessions

Assessment Strategy:

Continuous Assessment 60%	**Final Assessment** 40%		
Details: Assignments	**Theory (%)** --	**Practical (%)** 100	**Other (%) (Specify)** --

Recommended Reading:

1. Barnett, R. H., Cox, S., & O'Cull, L. (2012). *Embedded C Programming and the Atmel Avr* (2nd ed.). Cengage Learning.
2. Barnett, R., Cox, S., & O'Cull, L. (2003). *Embedded C Programming and the Microchip PIC (Book Only)*. Cengage Learning.

Level2	
Course Code:	EA 2121
Course Name:	Sensors and wireless communication for IoT
Credit Value:	03

Core/Optional	Core			
Prerequisites	None			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**
	--	40	110	150

Course Aim:

The aim of this course is to provide students with technical knowledge and hands-on skills to build Internet of Things (IoT) systems.

Intended Learning Outcomes:

At the end of this course, students will be able to;

- explain the usage of the term IoT in different contexts
- categorise the key components and layers of an IoT system
- compare and contrast IoT systems with traditional data collection approaches
- appreciate the role of cloud computing and data analytics in an IoT system
- build IoT systems using a methodical approach, and analyse & represent data in a user-friendly form

Course Content (Main topics, Subtopics):

Introduction to IoT: overview, technological trends, history and future of IoT, current impact on society, development cycle; Architecture of IoT system: IoT components, devices, hardware and software requirements, layers of IoT infrastructure, IoT embedded systems and microcontrollers; IoT communication: wireless and ah-hoc sensor networks, protocols, interfacing and developing APIs, cloud based data collection; Management: deploying data analytics and big data, IoT support, security & privacy, testing, standards, and data management;

Teaching /Learning Methods: Interactive sessions, laboratory work

Assessment Strategy:

Continuous Assessment 60%	**Final Assessment** 40%		
Details: Assignments	**Theory (%)** --	**Practical (%)** 100	**Other (%) (Specify)** --

Recommended Reading:

1. Buyya, R., & Dastjerdi, V. A. (2016). *Internet of Things: Principles and Paradigms* (1st ed.). Morgan Kaufmann.
2. Doukas, C. (2012). *Building Internet of Things with the Arduino*. Createspace.

Level2	
Course Code:	EA 2122
Course Name:	Instrumentation Laboratory
Credit Value:	02

Core/Optional	Core			
Prerequisites	None			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**
	--	32	68	100

Course Aim:

The aim of this course is to provide students with opportunity to develop simple electronic instrument through a methodical approach.

Intended Learning Outcomes:

At the end of this course, students will be able to;

- simulate, adapt, and construct electronic circuits and products
- produce electronic designs in end-user usable form
- produce summarised work in written and oral forms

Course Content (Main topics, Subtopics):

Semi open-ended type laboratory exercises for designing, building, and testing of circuits to perform various tasks including data acquisition and controlling. The students may be given circuit diagrams, but will be expected to design some parts or modify them to suit the applications concerned. They will then be expected to construct the circuits, test them, and produce a finished product complete with enclosures and user manuals.

Teaching /Learning Methods: mini-project

Assessment Strategy:

Continuous Assessment 100%	**Final Assessment**		
Details: Assignments	**Theory (%)** --	**Practical (%)** 100	**Other (%) (Specify)** --

Recommended Reading:

1. Laboratory instruction manuals

Level2				
Course Code:	EA 2130			
Course Name:	Applied Numerical Methods			
Credit Value:	02			
Core/Optional	Foundation			
Prerequisites	None			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**

	06	10	84	100

Course Aim:

This course aims at familiarising students with numerical methods for solving mathematical problems related to electronics.

Intended Learning Outcomes:

At the end of this course, students will be able to;

- survey common numerical methods
- apply numerical methods to obtain approximate solutions to problems
- derive numerical methods for standard mathematical operations
- analyse and evaluate the accuracy of common numerical methods

Course Content (Main topics, Subtopics):

Approximations and Errors in Computation: accuracy of numbers, errors, rules for estimating errors, error propagation, error in a series approximation, order of approximation, number systems and floating point representation of numbers; Interpolation: Newton's forward interpolation formula, Newton's backward interpolation formula, Lagrange's interpolation formula, divided differences, Newton's divided differences; Numerical Differentiation: numerical differentiation, formulae for derivatives; Numerical methods for Integration: numerical integration, Newton-Cotes Quadrature Formula, Gaussian integration, numerical double integration; Numerical methods for ODEs: introduction, Picard's method, Taylor's series method, Euler's method, Modified Euler's method, Runge kutta methods, predictor-corrector methods, Milne's method, Boundary value problems, finite difference method, shooting method;

Teaching /Learning Methods: Lectures,

Assessment Strategy:

Continuous Assessment 40%	**Final Assessment** 60%		
Details: Assignments	**Theory (%)** 100	**Practical (%)** --	**Other (%) (Specify)** --

Recommended Reading:

1. Hamming, R. W. (1973). *Numerical Methods for Scientists and Engineers*. Dover Publications.
2. Fausett, L., V. (2007). *Applied Numerical Analysis Using MATLAB* (2nd ed.). Pearson.
3. Grewal, B. S. (2019). *Numerical Methods in Engineering and Science: (C, C++, and MATLAB)*. Mercury Learning and Information.

Level2	
Course Code:	EA 2131
Course Name:	Data Analytics
Credit Value:	02
Core/Optional	Foundation
Prerequisites	None

Hourly Breakdown	Theory	Practical	Independent learning	Notional
	6	10	84	100

Course Aim:

The aim of this course is to provide students with the opportunity to learn the key aspects in data analysis with special attention on how to clean, analyse, and share data with the use of visualisations.

Intended Learning Outcomes:

At the end of this course, students will be able to;

- apply suitable data preprocessing techniques
- visualise data using suitable tools
- perform data analytics techniques
- draw meaningful conclusions and communicate the findings

Course Content (Main topics, Subtopics):

R essentials for data analytics; Data preprocessing techniques: import, transform/recode variables, handle missing values, univariate and multivariate outliers; Exploratory data analysis: tools for quantitative, qualitative and time related data; Basic data analytics techniques using R: linear and logistic regression, clustering methods;

Teaching /Learning Methods: Lectures with interactive hands-on sessions

Assessment Strategy:

Continuous Assessment 100%	Final Assessment --		
Details: Assignments	**Theory (%)**	**Practical (%)**	**Other (%) (Specify)** - -

Recommended Reading:

1. Teetor, P. (2011). *R Cookbook*. Van Duuren Media.
2. Maheshwari, A. (2020). *Data Analytics Made Accessible: 2020 edition*.

Level2				
Course Code:	EA 2140			
Course Name:	Database Management			
Credit Value:	02			
Core/Optional	Supplementary			
Prerequisites	EA 1140			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**

	04	12	84	100

Course Aim:

The aim of this course is to provide students with an understanding of databases and DBMS concepts in web application development.

Intended Learning Outcomes:

At the end of this course, students will be able to;

- analyse the data and data organisation needs
- apply the Entity-Relationship Model for building normalised relational data model
- use SQL for creating, manipulating, and controlling data
- synthesis client/server model based database system using three-tier architecture

Course Content (Main topics, Subtopics):

Databases and DBMSs: introduction, requirement of databases, data independency, DBMS; characteristics,, advantages; DBMS Classifications: Relational Systems and Other Systems; Relational Model Concepts: types, relations, relational constraints, relational operators; Relational Database Design: main phases, entity relationship model, drawing ER diagrams, functional dependency, normalisation; Structured Query Language: DDL, DML; Mysql/MariaDB: introduction; database, tables, queries, views, writing SQL, stored procedures, sata manipulations, aliases, join operators, group, sort; Database Management Tools: Phpmyadmin, Mysql Administrator; Interfacing databases: introduction, database operations with PHP, practical examples with Databases in IoT applications;

Teaching /Learning Methods: Lectures, Interactive sessions

Assessment Strategy:

Continuous Assessment 60%	**Final Assessment** 40%		
Details: Assignments	**Theory (%)** 50	**Practical (%)** 50	**Other (%) (Specify)** --

Recommended Reading:

1. Date, C. J. (2003). *An Introduction to Database Systems* (8th ed.). Pearson.
2. *W3Schools Free Online Web Tutorials*. (n.d.). W3Schools. https://www.w3schools.com/

Level2				
Course Code:	EA 2141			
Course Name:	Mobile Application Development I			
Credit Value:	02			
Core/Optional	Supplementary			
Prerequisites	None			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**

	-	16	84	100

Course Aim:

This course aims at providing students with hands-on experience in object-oriented programing and introduction to mobile application development.

Intended Learning Outcomes:

At the end of this course, students will be able to;

- describe different types of mobile apps and their limitations
- apply OOP techniques to design programmes
- develop mobile apps capable of interfacing IoT platforms

Course Content (Main topics, Subtopics):

Overview of Mobile Apps: introduction, history, capabilities and limitations, available platforms; Object Oriented Concepts: classes and interfaces, inheritance, encapsulation, polymorphism; Mobile App Development: development life cycle, development framework, development tools and IDEs, mobile app life cycle, simulators and emulators, debugging; UI design: modern trans in UI design, view, layouts, menus, drawers, dialogs, and the other containers; Interfacing external devices: accessing through wireless media, access over the internet;

Teaching /Learning Methods: interactive lectures,

Assessment Strategy:

Continuous Assessment 40%	**Final Assessment** 60%		
Details: Assignments	**Theory (%)**	**Practical (%)** 100	**Other (%) (Specify)** --

Recommended Reading:

1. Späth, P., & Friesen, J. (2020). *Learn Java for Android Development: Migrating Java SE Programming Skills to Mobile Development* (4th ed.). Apress.
2. Orosz, G. (2021). *Building Mobile Apps at Scale: 39 Engineering Challenges*. Primedia E-launch LLC.
3. Franceschi, H. J. (2017). *Android App Development* (1st ed.). Jones & Bartlett Learning.

Level2				
Course Code:	EA 2142			
Course Name:	Computer networking			
Credit Value:	02			
Core/Optional	Supplementary			
Prerequisites	None			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**
	30	--	60	100

Course Aim:

The aim of this course is to provide students with a full overview of computer networking.

Intended Learning Outcomes:

At the end of this course, students will be able to;

- describe computer networks in terms of OSI model
- explain the principles behind the transport, network, and link layers
- design and simulate computer networks
- grasp powerful network troubleshooting tools and techniques

Course Content (Main topics, Subtopics):

An Introduction to networking, networking standards and the OSI model, transmission basics and networking media, topologies and Ethernet standards, network hardware, client-server communication models in LAN, addressing, routing, TCP/IP suite, structure and operation of the domain name system used in TCP/IP suite, WANs and remote connectivity, wireless networking, network operating systems, voice and video over IP, network security, troubleshooting network problems, ensuring integrity and availability, network management

Teaching /Learning Methods: Lectures, Interactive sessions

Assessment Strategy:

Continuous Assessment 100%	**Final Assessment** -		
Details: Assignments	**Theory (%)**	**Practical (%)**	**Other (%) (Specify)**

Recommended Reading:

1. Dordal, P. L. (2014). *An Introduction to Computer Networks* (2nd ed.). Peter L Dordal.

Level2				
Course Code:	EA 2150			
Course Name:	Business Economics			
Credit Value:	02			
Core/Optional	Soft skills			
Prerequisites	None			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**
	16		84	100
Course Aim:				
Intended Learning Outcomes: At the end of this course, students will be able to; ● appreciate the fundamental concepts in economics ● Identify the impact of economic policy on a society ● analyse the supply and demand scenarios ● review the important sectors related to banking and finance				
Course Content (Main topics, Subtopics): Basics of Economics: goods and services, micro-/macro-economics, positive and normative economics, production possibility curve, opportunity cost, capitalistic economy, socialistic economy, mixed economy, economic cycles, inflation, recessions; Demand and Supply: total utility, marginal utility, law of diminishing marginal utility, law of equi-marginal utility, consumers' equilibrium, law of demand & elasticity of demand, law of supply & elasticity of supply, demand and supply equilibrium, consumer behaviour; Banking & Finance: concept of money, role of banks, credit, investments, capital markets, monetary policy of Sri Lanka				
Teaching /Learning Methods:				
Assessment Strategy:				
Continuous Assessment 100%	**Final Assessment**			
Details: Assignments	**Theory (%)** --	**Practical (%)** 100%	**Other (%) (Specify)**	
Recommended Reading: 1. Mankiw, N. G., Taylor, M. P., & Ashwin, A. (2016). *Business economics*. Hampshire: Cengage Learning. 2. Parkin, M., Powell, M., & Matthews, K. G. P. (2007). *Economics*. Addison-Wesley.				

Level2	
Course Code:	EA 2151
Course Name:	English for Communicating Science

Credit Value:	02			
Core/Optional	Foundation			
Prerequisites	None			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**
	--	16	84	100

Course Aim:

The course aims to address the academic and professional communication needs of students studying in the science and technology disciplines and to develop necessary language skills.

Intended Learning Outcomes:

At the end of this course, students will be able to;

- comprehend discipline-specific texts and talks
- identify objectives of a scientific presentation
- summarise the content and prepare a script for a presentation
- present findings of an experiment/project effectively

Course Contents (Main topics, Subtopics):

Basics of speaking English, expressing opinions, preparing for a 'Lab Talk', audience analysis, objectives for the presentation, summarising, preparing a script for a talk, techniques to deliver an effective presentation, handling questions from the audience;

Teaching /Learning Methods: Interactive sessions

Assessment Strategy:

Continuous Assessment 60%	**Final Assessment** 40%		
Details: In-class assignments	**Theory (%)** --	**Practical (%)** 100	**Other (%) (Specify)** --

Recommended Reading:

1. Jay, A. (1970). *Effective Presentation: The Communication Of Ideas By Words And Visual Aids.* Management Publications Limited.
2. Anholt, R. R. H. (2014). *Dazzle 'em with Style: The Art of Oral Scientific Presentation.* Academic Press.

----Level 3---

Level3	
Course Code:	EA 3101
Course Name:	Power Electronics

Credit Value:	02			
Core/Optional	Core			
Prerequisites	None			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**
	16	-	84	100

Course Aim:

The aim of this course is to provide students with basic concepts of power electronics with more emphasis on designing and evaluation of power electronics.

Intended Learning Outcomes:

At the end of this course student will be able to;

- interpret the fundamental principles and applications of power electronics circuits to solve related problems
- design switching regulators according to specifications
- use computer-aided techniques for the design of power converter circuits
- appreciate the latest developments in power electronics

Course Content (Main topics, Subtopics):

Power electronics systems applications and future development; Basic switching regulator topologies: basic operations, critical inductance criterion, continuous and discontinuous-conduction modes; Mathematical modelling of switching regulators: small-signal approximation for linearity, approximation techniques, switching regulator transfer functions and salient features; Switching regulators with transformer isolation: fly back converter, forward converter, half and full-bridge converters, push-pull converter; Feedback control design: classical control design, bode plot and Nyquist stability criterion, voltage and current-mode controls; Converter dynamics and control: AC equivalent circuit modelling, converter transfer functions, controller design, input filter design, AC and DC equivalent circuit modelling of the discontinuous conduction mode, current programmed control; Magnetic components: inductor, transformer, saturation, hysteresis, and residual flux. motor controlling, power driving.

Teaching /Learning Methods: Lectures and Tutorials

Assessment Strategy:

Continuous Assessment 30%	**Final Assessment** 70%		
Details: assignments	**Theory (%)** 100	**Practical (%)** --	**Other (%) (Specify)** --

Recommended Reading:

1. Kassakian, J. G., Schlecht, M. F., & Verghese, G. C. (1991). *Principles of Power Electronics*. Pearson College Div.
2. Erickson, R. W., & Maksimovic, D. (2012). *Fundamentals of Power Electronics*. Springer Publishing.
3. Lee, Y. S. (2017). *Computer-Aided Analysis and Design of Switch-Mode Power Supplies*. Routledge.

Level3

Course Code:	EA 3102			
Course Name:	Programmable Logic Controllers			
Credit Value:	02			
Core/Optional	Core			
Prerequisites	None			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**
	6	10	84	100

Course Aim:

The aim of this course is to provide students with basic concepts of PLC with more attention to practical applications.

Intended Learning Outcomes:

At the end of this course, students will be able to;

- explain the use of pneumatics/hydraulics in automation
- develop applications using PLCs
- model, design and implement micro-level automation system using PLCs and SCADA
- diagnose automation systems

Course Content (Main topics, Subtopics):

Introduction to hydraulics and pneumatics: pneumatic generation, purification and flow control, control valves, pure pneumatic/hydraulic control systems, electro-pneumatic/hydraulic control systems; Sensors: limit switches, photo sensors, magnetic sensors, inductive sensors, ultrasonic sensors, process control sensors used for humidity, pressure, temperature, load and flow measurements; actuators: motors and electrical linear drives, pneumatic and hydraulic cylinders and linear drives, pneumatic and hydraulic rotary drives and motors; PLCs operation and construction of switching modules and PLCs, high-end PLCs, programming methods: STL and CSF, FBD and Ladder methods, simple instructions, NC and NO contacts, latch and unlatch outputs, pulse edge evaluation, on-delay and off-delay timers, counters, timer/counter applications, program control instructions, data manipulation instructions, math instructions, converting relay ladder diagram into PLC relay ladder diagram, PID and PWM functions; SCADA: principles of SCADA and industrial network security, SCADA system components, regulatory requirements and architecture protocol.

Teaching /Learning Methods: Interactive sessions

Assessment Strategy:

Continuous Assessment 60%	**Final Assessment** 40%		
Details: Assignments	**Theory (%)** -	**Practical (%)** 100	**Other (%) (Specify)**

Recommended Reading:

1. Groover, M. (2018). *Automation, Production Systems, and Computer-Integrated Manufacturing* (5th ed.). Pearson.
2. Lee, Y. S. (2017). *Computer-Aided Analysis and Design of Switch-Mode Power Supplies*. Routledge.

Level3				
Course Code:	EA 3103			
Course Name:	Advanced Fabrication Techniques			
Credit Value:	02			
Core/Optional	Core			
Prerequisites	None			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**
	6	10	84	100

Course Aim: This course aims at providing students with hands-on experience in designing and fabricating electronic system components using various fabrication techniques and integrating them to form electronic and automation systems.

Intended Learning Outcomes:

At the end of this course, students will be able to;

- describe principles of operation of digital fabrication techniques
- evaluate the usability of various digital fabrication techniques for a given scenario
- choose materials and evaluate suitability of materials to design components and systems
- design electronic system components using data from appropriate sources
- manufacture system level components and construct integrated systems

Course Content (Main topics, Subtopics):

Introduction to conventional electronics manufacturing; Introduction to additive and subtractive manufacturing; techniques in circuit fabrication: fabrication of components of electronic systems; 2D and 3D modelling software; CAD modelling: 3D scanning data, data from imaging, slicing, effect of part orientation; printing techniques: fused deposition modelling (FDM), computer numerical control (CNC) milling, Inkjet printing (IJP), multi-material layered manufacturing; manufacturing materials: inks, substrates, bio compatible materials, and flexible materials; manufacturing process optimization and quality control.

Teaching /Learning Methods: Laboratory sessions

Assessment Strategy:

Continuous Assessment 60%	**Final Assessment** 40%		
Details: Assignments	**Theory (%)** 50%	**Practical (%)** 50%	**Other (%) (Specify)**

Recommended Reading:

1. Chua, C. K., Yeong, W. Y., Low, H. Y., Tran, T., & Tan, H. W. (2021). *3D Printing and Additive Manufacturing of Electronics: Principles and Applications (World Scientific 3D Printing)*. World Scientific Publishing Company.

Level3				
Course Code:	EA 3104			
Course Name:	Applied Machine Learning			
Credit Value:	02			
Core/Optional	Core			
Prerequisites	None			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**
	-	16	84	100

Course Aim:

The aim of this course is to survey machine learning approaches in real world applications.

Intended Learning Outcomes:

At the end of this course, students will be able to;

- recognise real-world problems compliant to machine learning
- choose and apply appropriate ML tools for a given problem considering the strength and weaknesses of the tool
- analyse results to verify the correctness and identify sources of error

Course Content (Main topics, Subtopics):

Introduction to machine learning: history, supervised vs unsupervised learning, deterministic vs probabilistic models, classification and regression problems; Supervised learning: basic regression methods, basic classification methods, decision trees for regression and classification, ensemble methods, parameter tuning, use-cases; Unsupervised learning: clustering (k-means, EM, spectral clustering), use-cases; Kernel learning: creating non-linear algorithms by "kernelization", support vector machines for classification and regression, use-cases; Introduction to neural networks: Neural network architectures, Neural network training, Use-cases

Teaching /Learning Methods: Interactive sessions

Assessment Strategy:

Continuous Assessment 100%	**Final Assessment**		
Details: Assignments	**Theory (%)**	**Practical (%)**	**Other (%) (Specify)**

Recommended Reading:

1. Burkov, A. (2019). *The Hundred-Page Machine Learning Book*. Andriy Burkov.
2. Géron, A. (2019). *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems* (2nd ed.). O'Reilly Media.
3. Raschka, S., & Mirjalili, V. (2019). *Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow 2, 3rd Edition*. Packt Publishing.

Level3				
Course Code:	EA 3120			
Course Name:	Data Acquisition for IoT			
Credit Value:	03			
Core/Optional	Core			
Prerequisites	None			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**
	-	24	126	150

Course Aim:

The aim of this course is to provide students with hand-on experience on using data acquisition systems for IoT.

Intended Learning Outcomes:

At the end of this course, students will be able to;

- perform requirement analysis of a DAQ system
- choose suitable components for the requirement of DAQ
- calibrate and evaluate performance of the DAQ system

Course Content (Main topics, Subtopics):

ADCs/DACs, sensor calibration, mathematical modelling, hands-on learning in designing and evaluation of data acquisition (DAQ) systems, exercises in designing, evaluation, and calibration of DAQ systems.

Teaching /Learning Methods: Laboratory exercises

Assessment Strategy:

Continuous Assessment 60%	**Final Assessment** 60%		
Details: Assignments	**Theory (%)**	**Practical (%)** 100	**Other (%) (Specify)**

Recommended Reading:

1. Laboratory sheets

Level3	
Course Code:	EA 3121
Course Name:	Robotics Laboratory

Credit Value:	03			
Core/Optional	Core			
Prerequisites	None			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**
	16	32	102	150

Course Aim:

The aim of this course is to provide an introduction to robotics and provide students with hands-on experience in developing simple robotic systems.

Intended Learning Outcomes:

At the end of this course, students will be able to;

- describe the working principle of sensors and actuators used in robots
- interface sensors to microcontrollers/ single board computers
- perform precision controlling of motors and the other actuators using microcontrollers/single board computers
- apply mathematical, algorithmic and control principles of robots to simple robotic manipulators and simple robotic locomotives

Course Content (Main topics, Subtopics):

Introduction: history of robots, an overview of robot types and mechanisms, manipulation, locomotion/navigation, autonomous/unmanned; Planar and spatial kinematics: motion planning, mechanism design for manipulators and mobile robots; control design: actuators, sensors, drivers; wireless networking, human-machine interface, and embedded software.

Teaching /Learning Methods: Lectures, practical sessions

Assessment Strategy:

Continuous Assessment 60%	**Final Assessment** 40%		
Details: Assignments	**Theory (%)**	**Practical (%)** 100	**Other (%) (Specify)**

Recommended Reading:

1. Craig, J. (2017). *Introduction to Robotics: Mechanics and Control* (4th ed.). Pearson.
2. Correll, N. (2016). *Introduction to Autonomous Robots: Kinematics, Perception, Localization and Planning* (2nd ed.). Magellan Scientific.

Level3	
Course Code:	EA 3131
Course Name:	Multivariate Analysis
Credit Value:	02

Core/Optional	Foundation			
Prerequisites	None			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**
	–	16	84	100

Course Aim:

The aim of this course is to provide students with the opportunity to experience the requirement of multivariate analysis and allow them to use multivariate analysis tools to solve problems.

Intended Learning Outcomes:

At the end of this course, students will be able to;

- identify the need for multivariate analysis
- choose the appropriate multivariate method for a problem
- depict multivariate data with appropriate tools
- apply appropriate multivariate methods to conduct analysis
- interpret results and make statistical inference

Course Content (Main topics, Subtopics):

Introduction: overview of multivariate analysis, aspects of multivariate modelling; Basic multivariate statistics: mean, variance, ovariance, correlation, linear combination of variables, geometric concepts, distances multivariate statistics; Interdependence methods: principal component analysis, factor analysis, cluster analysis, correspondence analysis, multidimensional scaling; dependance method: multiple regression models, logistic regression canonical correlation, discriminant analysis;

Teaching /Learning Methods: Lectures, Interactive sessions

Assessment Strategy:

Continuous Assessment 60%	**Final Assessment** 40%		
Details: Assignments	**Theory (%)**	**Practical (%)** 100	**Other (%) (Specify)**

Recommended Reading:

1. Johnson, R. A., & Wichern, D. W. (2007). *Applied Multivariate Statistical Analysis (6th Edition)* (6th ed.). Pearson.
2. Manly, B. F. J., & Alberto, J. N. A. (2016). *Multivariate Statistical Methods: A Primer* (4th ed.). Chapman and Hall/CRC.

Level3	
Course Code:	EA 3140
Course Name:	Web Application Development II
Credit Value:	02

Core/Optional	Supplementary			
Prerequisites	None			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**
	--	16	84	100

Course Aim:

The aim of this course is to provide students with an understanding of advanced concepts in web application development.

Intended Learning Outcomes:

At the end of this course, students will be able to;

- provide examples of modern UI and UX
- design and develop web applications using frameworks
- produce functional web applications by configuring/hosting them on web/database servers

Course Content (Main topics, Subtopics):

UX designing: typography, preparing images, colour and contrast, JS frameworks; Server Side programing: OOP, connecting databases, handling files and graphics, debugging and optimization, introduction to MVC architecture and server side frameworks; Hosting web applications: Web Servers, CMS, access control, Name Servers, DNS and URLs, DNS Records; Introduction to APIs;

Teaching /Learning Methods: Lectures, Interactive sessions

Assessment Strategy:

Continuous Assessment 40%	**Final Assessment** 60%		
Details: Assignments	**Theory (%)** --	**Practical (%)** 100%	**Other (%) (Specify)**

Recommended Reading:

1. *W3Schools Free Online Web Tutorials*. (n.d.). W3Schools. https://www.w3schools.com/

Level3				
Course Code:	EA 3141			
Course Name:	Mobile Application Development II			
Credit Value:	02			
Core/Optional	Supplementary			
Prerequisites	EA 2141			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**
	-	16	84	100

Course Aim:

The course aim is to provide students with sufficient knowledge to design and publish mobile applications in standard repositories.

Intended Learning Outcomes:

- design and develop mobile applications for different devices
- integrate online database with the mobile application to store and retrieve data
- publish mobile applications for public

Course Content (Main topics, Subtopics):

Introduction to UI design: layouts, fragments, supporting different devices, views, menus, drawers, dialogs, flexible UI design; Working in the background: AsyncTask, threads, services, notifications, alams, network and connectivity; Storing and retrieving data: preferences, Sqlite, content providers, techniques for storing data, storing application data, store and retrieve files, connecting to databases; Accessing sensors; Accessing services and APIs; Monetizing, promoting and distributing applications;

Teaching /Learning Methods: Interactive Lectures,

Assessment Strategy:

Continuous Assessment 60%	**Final Assessment** 40%		
Details: Assignments	**Theory (%)**	**Practical (%)** 100%	**Other (%) (Specify)**

Recommended Reading:

1. Späth, P., & Friesen, J. (2020). *Learn Java for Android Development: Migrating Java SE Programming Skills to Mobile Development* (4th ed.). Apress.
2. Orosz, G. (2021). *Building Mobile Apps at Scale: 39 Engineering Challenges*. Primedia E-launch LLC.
3. Franceschi, H. J. (2017). *Android App Development* (1st ed.). Jones & Bartlett Learning.

Level3				
Course Code:	EA 3142			
Course Name:	Fundamentals of Cyber Security			
Credit Value:	02			
Core/Optional	Supplementary			
Prerequisites	EA 2142			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**
	12	04	84	100

Course Aim:

Course aim is to provide students with a fundamental understanding of Cyber Security to ensure the security of digital services and IoT based systems.

Intended Learning Outcomes:

- describe principles of cyber security
- identify vulnerabilities in the existing system
- explain network security and risk management
- explain cryptography and its role in data communication
- identify security risk in an IoT based system

Course Content (Main topics, Subtopics):

Introduction to cyber security: basic security framework and CIA triad, operating system security; Steganography: network security & risk management, vulnerability, treat, attack, risk, control, network authentication, SSL, VPN, IPSec, firewall, IDS & IPS, BCP & DRP; Vulnerability assessment: risk mitigations, internal control, passive attack; Active attack: cryptographic techniques and its impact, Symmetric key cryptography, DES, Triple DES, AES, ECB, CBC, asymmetric key cryptography, public key, RSA algorithm, PGP, Hash functions;

Teaching /Learning Methods: Lectures

Assessment Strategy: Assignments

Continuous Assessment 40%	**Final Assessment** 60%		
Details: Assignments	**Theory (%)** 70%	**Practical (%)** 30%	**Other (%) (Specify)**

Recommended Reading:

1. Pfleeger, C., Pfleeger, S., & Margulies, J. (2015). *Security in Computing* (5th ed.). Pearson.
2. Paar, C., Pelzl, J., & Preneel, B. (2009). *Understanding Cryptography: A Textbook for Students and Practitioners* (1st ed.). Springer.

Level3				
Course Code:	EA 3150			
Course Name:	Entrepreneurship			
Credit Value:	02			
Core/Optional	Soft skills			
Prerequisites	None			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**
		20	80	100

Course Aim:

The aim of this course is to develop students' entrepreneurial skills and behaviour.

Intended Learning Outcomes:

At the end of this course, students will be able to;

- Identify the need for entrepreneurship
- relate entrepreneurship with appropriate business models,
- evaluate the applicability of technology to introduce innovation in product development process ,
- analyse strategies for managing innovation.

Course Content (Main topics, Subtopics):

Entrepreneurship: creativity to innovation, social needs, social entrepreneurship, business climate, analysing the business scenarios; Business models: blue ocean strategy, business models and value proposition, business model failure, prototyping to business plans; Technology in innovation: marketing of innovation, management planning, management strategies, forecasting, sustainable conditions, context and patterns; Management of Innovation: creation of intellectual property rights (IPR), types of IPR, patents and copyrights, business and technology incubators, managing investors for innovation, future markets and innovation needs.

Teaching /Learning Methods: Lectures/ Workshops

Assessment Strategy:

Continuous Assessment 100%	**Final Assessment**		
Details: Assignments	**Theory (%)** --	**Practical (%)** 100	**Other (%) (Specify)** --

Recommended Reading:

1. Kumar, V. (2012). *101 Design Methods: A Structured Approach for Driving Innovation in Your Organization* (1st ed.). Wiley.
2. Verloop, J., & Wissema, J. G. (2004). *Insight in Innovation: Managing innovation by understanding the Laws of Innovation* (1st ed.). Elsevier Science.
3. Dutz, M. A., & O'Connell, S. D. (2013). *Productivity, Innovation and Growth in Sri Lanka: An Empirical Investigation*. World Bank.

Level3				
Course Code:	EA 3151			
Course Name:	Business Communication			
Credit Value:	02			
Core/Optional	Soft skills			
Prerequisites	None			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**
	16		84	100

Course Aim:

The aim of this course is to train students how to communicate successfully throughout a business which

is a critical requirement for the future prosperity of the organisation.				
Intended Learning Outcomes: At the end of this course, students will be able to; ● communicate effectively in the social and business interactions ● develop and deliver a formal presentation ● synthesise succinct written business documents				
Course Content (Main topics, Subtopics): Communication basics: importance of effective communication, communication in context, principles of verbal communication, emphasis strategies, differences in perception, get to know your audience, ethics,; Business correspondence: good writing, writing styles, principles of written communication, planning a document, making an argument, text, email, netiquette, business proposals, reports, résumé; Presentations: choosing a topic, finding resources, principles of non verble communication, visual aids;				
Teaching /Learning Methods: Interactive sessions				
Assessment Strategy:				
Continuous Assessment 100%		**Final Assessment** -		
Details: presentations, interactive document preparation workshops, assignments	**Theory (%)**	**Practical (%)**	**Other (%) (Specify)**	
Recommended Reading: 1. *Business Communication for Success*. (2015). University Of Minnesota Libraries Publishing.				

Level3				
Course Code:	EA 3160			
Course Name:	Final Year Project			
Credit Value:	04			
Core/Optional	Core			
Prerequisites	None			
Hourly Breakdown	**Theory**	**Practical**	**Independent learning**	**Notional**
	--	60	340	400
Course Aim: The aim of this course is to train students to solve real world problem using scientific method				
Intended Learning Outcomes: At the end of this course, students will be able to; ● identify a scientific/industry problem ● survey existing solutions for problems ● formulate a solution optimising resources				

- communicating solution to stakeholders in written and oral forms

Course Content (Main topics, Subtopics):

Individual or group of students will be assigned a project of one-year duration. The project may be research oriented or a development of devices, techniques, algorithms related to electronics. A dissertation submitted on the project will be examined at a seminar presentation.

Teaching /Learning Methods:

Assessment Strategy: Dissertation and oral presentation

Continuous Assessment 60%	**Final Assessment** 40%		
Details: Assignments	**Theory (%)** --	**Practical (%)** 100	**Other (%) (Specify)** --

Recommended Reading:

1. Research articles