Learner Guide 2023

Robotics Development RD412

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Table of Contents

How to use the guide:

The guide will provide an overview of the syllabus and will deliver the learning outcomes of the module. It will indicate each major topic that will be covered, as well as the learning outcomes of each topic.

The study guide is NOT a replacement of textbooks and should be used in conjunction with the required textbooks.

At the end of each study unit there will be a summary, followed by a number of self-assessment questions. These questions will assist you to prepare for the tests and exams. The following icons will be used in the study guide:

	Indicates the sections in the prescribed textbook that the student needs to study
	Indicates activities to be completed
	Indicates group activities to be completed
	Indicates exercises to be completed
	Indicates revision questions to be completed
	Indicates projects to be completed

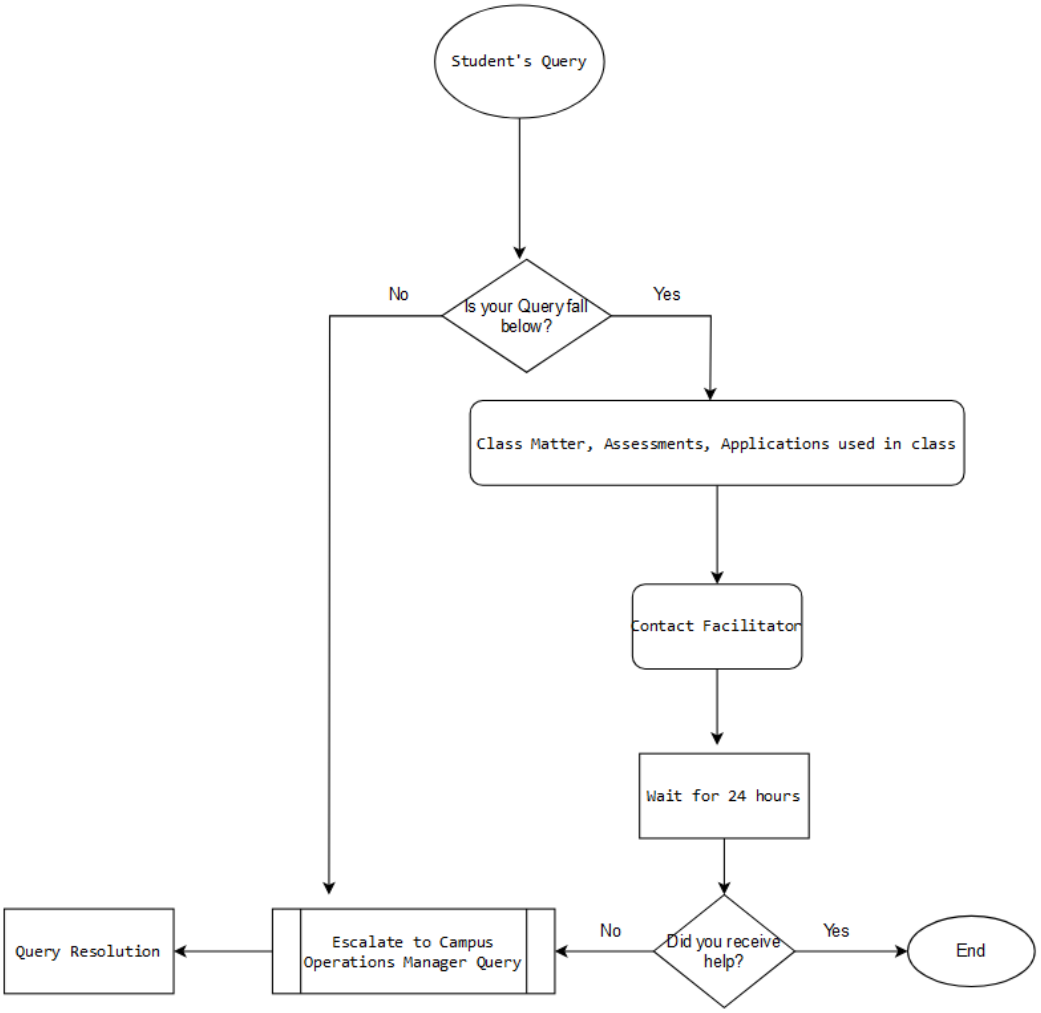
Introduction

Welcome to Robotic Development RD412 module. Robotics systems are a way of automating manufacturing applications while reducing the amount of labour and production costs and time associated with the process.

ICT Programming Department Information

The Programming Department is part of the School of Information Technology, which focuses on providing comprehensive and innovative ICT education, training, and research programs to benefit both the industry and society at large. Our department is committed to fostering Passion, Quality, and Professionalism in all aspects of programming and IT education.

Query Resolution Structure:



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Purpose of the module

The purpose of this module is to provide students with the fundamental and technical knowledge as well as the applicable skill set on robotic development. Further, the module introduces PLC programming language called ladder logic or ladder diagram (LD). The great thing about ladder logic is that it's much more visual than most programming languages, so people often find it a lot easier to learn.

Contact Hours and Indicative Student Workload

Proposed Roll Out Strategy	Credits	Total Notional Hours	Number of	Theory Hours	Practical Hours	Total Contact Sessions Total Hours per week	Formative Assessments (45%): Hours	Summative Assessments (15%): Total Hours
Semester	14	140	13	3	7	10	10	10

Teaching and Learning Methods

Lectures, Flipped Classroom, Webinars, Group and Research, practical classes (role play), and Gamification.

Module Resources

The module introduction with the facilitator will cover:

- Overview of the module, including tasks and activities – expectations
- Timetable
- The Learner Guide
- The Learner Electronic Portfolio of Evidence
- Practical's
- Research

- Group activities
- LABS
- International exams (if applicable)
- Assessments
- The importance of completing all tasks in the EPoE; the neat and orderly submission of evidence in the EPoE; all forms completed and signed
- WIL Component
- The Summative Assessment
- Programme Assessment timetable schedule
- Assessment Policy
- Self-Study time

Please note: Hand out and submission days are clearly indicated on the lesson planner. Students neglecting to submit projects by stated submission days will be penalized as per assessment policy

The semester is divided in sixteen (16) weeks of formal class time. Class sessions are divided into the theoretical, practical, group assignments and research sessions. As part of students' development, there will also be homework as given by the trainer

Prescribed Resources

Prescribed reading:

- Title: Programmable Logic Controller, 6th Edition
  ISBN: 9780128029299
- Title: The Arduino Inventor's Guide
  ISBN: 9781593276522

Recommended Additional Resources

Textbook(s)

- PLC Ladder Logic Programming Tutorial
- https://learning.oreilly.com/library/view/programmable-logic-controllers/9780128029299/
- https://learn.sparkfun.com/tutorials/sparkfun-inventors-kit-experiment-guide---v41

Video(s)

- https://learn.sparkfun.com/tutorials/sparkfun-inventors-kit-experiment-guide---v41

Software

- Tinkercad | Create 3D digital designs with online CAD | Tinkercad

Webinars

- N/A

Assessment Details

The students will need a pass mark of 80% on the Prelim exam to qualify for admission to the international certification exams.

Formative assessment breakdown

Formative 1	Formative 2	Formative 3
Weighting: 33%	Weighting: 33%	Weighting: 35%
Open Book	Open Book	Group Activities
Theory and Practical	Theory and Practical	Theory and Practical

Summative assessment:

Theory and Practical exam Closed Book
50%

Formative assessments (50%) + Summative assessment (50%) = Final mark

Assessment Preparation Guidelines

	Format of the Assessment	Resources required	Learning Units covered
Formative Assessment 1:	Theory and Practical oriented	Campus Online and O'Reilly Textbook	Unit1: Programmable Logic Controllers Unit2: Input/Output Devices Unit3: Digital Systems Unit4: I/O Processing Unit5: Ladder and Functional Block Programming
Formative Assessment 2:	Theory and Practical oriented	Campus Online and O'Reilly Textbook	Unit6: Redboard and Lights Unit7: Sound and Motion Unit8: Display and Robot
Summative Exam	Theory and Practical oriented	Campus Online and O'Reilly Textbook	From Unit 1 to Unit 8

Assessment Release and Submission Week

Formative assessment:	Release Week	Submission Week
Formative Assessment 1	Week 1	Week 2
Formative Assessment 2	Week 3	Week 5
Formative Assessment 3	Week 5	Week 7

International Exam:	Boot camp & Prelim	International
N/A	N/A	N/A

Summative assessment:	Release Week	Submission Week
Summative Assessment	Week 17	Week 18

Please note – There are two (2) steps in the submission process.

- Step 1: Required evidence in the specified formats are submitted on Campus Online to the designated assignment description.
- Step 2: Complete and submit document of authenticity for every formative and summative assessment submitted.

Assessment Strategy

The following assessment activities are applicable to each module:

- Knowledge assessments
- Practical / Research Assignments
- CCFOs (Critical Cross Field Outcomes) / Simulated case studies
- Work Integrated Logbooks

Progression

Students need to achieve a minimum final mark of 70%, to be deemed competent. A final mark of less than 70%, deems a student to fail and the student will be required to repeat the module in the following academic year.

Weekly Planner

Week	Learning Units to be covered	Resources required	Class activity
Week 1 to Week 6	UNIT 1: Programmable Logic Controllers UNIT 2: Input/Output Devices UNIT 3: Digital Systems UNIT 4: I/O Processing UNIT 5: Ladder and Functional Block Programming	Campus Online and Prescribed Textbook (O'Reilly)	Group Activities on Campus Online (GA1 and GA2)
Week 7 to Week 10	UNIT 6: RedBoard and Lights UNIT 7: Sound and Motion UNIT 8: Display and Robot	Campus Online and Prescribed Textbook (O'Reilly)	Group Activities on Campus Online (GA3 and GA4)
Week 11 to Week 12	From Unit 1 to Unit 8	Campus Online and Prescribed Textbook (O'Reilly)	Revision and Summative

Module Content

LU 1	***Programmable Logic Controllers***
	Learning Objectives: • Controllers • Hardware • PLC Architecture • PLC Systems • Programs
LU 2	***Input/Output Devices***

	Learning Objectives: • Input Devices • Output Devices • Examples of Applications
LU 3	***Digital Systems***
	Learning Objectives: • The Binary System • Octal and Hexadecimal • Binary Coded Decimals • Numbers in the Binary, Octal, Hex, and BCD Systems • Binary Arithmetic • PLC Data • Combinational Logic Systems • Sequential Logic Systems
LU 4	***I/O Processing***
	Learning Objectives: • Input/Output Units • Signal Conditioning • Remote Connections • Networks • Examples of Commercial Systems • Processing Inputs • I/O Addresses Combinational Logic Systems
LU 5	***Ladder and Functional Block Programming***
	Learning Objectives: • Ladder Diagrams • Logic Functions • Latching • Multiple Outputs • Entering Programs • Function Blocks • Program Examples
LU 6	***REDBOARD & LIGHT***
	Learning Objectives: • The RedBoard Platform • Baseplate Assembly • RedBoard Anatomy

	• Breadboard Anatomy • The Arduino IDE • Inventory of Parts • Circuit 1A: Blinking an LED • Circuit 1B: Potentiometer • Circuit 1C: Photoresistor • Circuit 1D: RGB Night-Light
LU 7	***SOUND & MOTION***
	Learning Objectives: • Circuit 2A: Buzzer • Circuit 2B: Digital Trumpet • Circuit 2C: "Simon Says" Game • Circuit 3A: Servo Motors • Circuit 3B: Distance Sensor • Circuit 3C: Motion Alarm
LU 8	***DISPLAY & ROBOT***
	Learning Objectives: • Circuit 4A: LCD "Hello, World!" • Circuit 4B: Temperature Sensor • Circuit 4C: "DIY Who Am I?" Game • Circuit 5A: Motor Basics • Circuit 5B: Remote-Controlled Robot • Circuit 5C: Autonomous Robot

Group Activity

Students will complete 4 group activities for this module. The group activities will be available on Campus Online and release in a set of 2. The first 2 will be released in week 1 together with formative assessment 2 and the last two will further be released in week 6 with formative assessment 2.

Exercise

1. List and explain the types of PLC 2 inputs & 3 Outputs?
2. What does a Power Supply used for in PLC.?
3. Explain and describe the basic elements in Ladder logic programming.
4. Which role does PLC play in automation?
5. Which general functions use PLC?
6. How do you test and commission a PLC system?
7. What are two types of PLC?
8. What is the main difference Between Fixed and Modular PLCs?
9. Convert the following binary numbers to denary numbers:
10. Convert the following denary numbers to binary numbers: (a) 100, (b) 146, (c) 255.

Revision

Revision will take place in Week 13 [All units to be covered]

Group Project

Briefly discuss the bellow:

1. Function Block Diagram?
2. Function Blocks
3. Bit Logic Function Blocks

4. OR Logic Operation
5. Assignment Operation
6. AND Logic Operation
7. Negation Operation
8. Exclusive OR Operation
9. NAND, NOR etc.
10. Bistable Function Blocks
11. Edge Detection
12. Timer Function Blocks

Bibliography

Huang, B., 2017. The Arduino Inventor's Guide: Learn Electronics by Making 10 Awesome Projects. No Starch Press.
Telagam, N., Nanjundan, M., Kandasamy, N. and Naidu, S., 2017. Cruise Control of Phase Irrigation Motor Using SparkFun Sensor. Int. J. Online Eng., 13(8), pp.192-198.