***Course Specifications of:***

***Embedded Systems* (MET504)**

**Program(s) on which the course is given:** Diploma in Automation and Mechatronics

**Compulsory or Elective element of program**: elective

**Department offering the program:** Mechanical engineering department

**Academic year / Level:** year/ 2014-2015

**Date of specification approval:** 10/05/2014

1. **Basic Information**

**Title: *Programmable logic controllers* Code: MET504**

**Credit Hours: 3 Lecture: 3**

**Tutorial: Practical: Total: 3**

**B- Professional Information**

1. **Overall aims of course:**

This course introduces students to:

- provide an in-depth knowledge of the principles of operation of various types of microcontrollers and increase the ability to program different microcontrollers families and microcontrollers interfacing

1. **Intended learning outcomes of course (ILOs)**

By completion of the course, the student should be able to:

**2.1 Knowledge and understanding**

2.1.1 Demonstrate knowledge and understanding of scientific principles and methodology necessary to underpin their education in mechatronic engineering, to enable appreciation of its scientific and engineering context, and to support their understanding of historical, current and future developments and technologies.

2.1.3 Demonstrate a comprehensive understanding of concepts from electronic mechanical and software engineering, as well as business and management studies and apply them effectively in engineering projects.

2.1.5 Demonstrate an awareness of developing technologies related to the applied mechatronic engineering.

2.1.7 Demonstrate a comprehensive knowledge and understanding of computer models relevant to mechatronic engineering, and an appreciation of their limitations.

**2.2 Intellectual skills**

2.2.1 Demonstrate understanding of engineering principles and apply them to analyze key mechatronic engineering processes.

2.2.2 Identify, classify, practice and describe the performance of mechatronic systems and components through the use of analytical methods and modelling techniques.

2.2.3 Apply quantitative methods and computer software relevant to mechatronic engineering, in order to solve engineering problems.

2.2.5 Investigate and define a mechatronics design problem and identify constraints including environmental and sustainability limitations.

2.2.6 Manage the design of mechatronic systems and components, taking account of customer and user needs, identify and manage cost drivers, and evaluate outcomes.

**2.3 Professional and practical skills**

2.3.1 Demonstrate extensive practicing and understanding of a wide range of engineering control and components.

2.3.3 Demonstrate extensive practicing and understanding of a wide range of industrial automation and its components.

2.3.4 Plan and conduct laboratory and workshop tasks using a variety of equipment.

2.3.6 Demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.).

2.3.8 Demonstrate an awareness of the nature of intellectual property and contractual issues, appropriate codes of practice and industry standards, and quality issues.

2.3.10 Demonstrate a thorough understanding of current practice and its limitations, and some appreciation of likely new developments.

**2.4 General and transferable skills**

2.4.3 Able to function effectively as a member of a team and use management skills to plan, organize and provide leadership in work groups and projects.

2.4.4 Exercise planning, organizational, problem-solving, and time-management skills and effectively use available resources.

2.4.7 Work in a group and Lead a team in familiar professional contexts

2.4.8 Conduct self-learning and continuous education practices.

1. **Contents**

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| --- | --- | --- | --- | --- |
| **No of weeks** | **Topic** | **No. of hours** | **Teaching / learning methods and strategies** | **Assessment method** |
| 1 | Introduction to microcontrollers and Embedded systems | 3 | Lecture, Class activity | - |
| 2 | Microcontrollers Von Neumann and Harvard architecture  Memory options. | 3 | Lecture./Assign, case study | Assignment 1 |
| 3 | Input/output units for different types of microcontrollers  Serial communication in microcontrollers | 3 | Lecture, Class activity | Assignment 1 |
| 4 | Timers and Counters in microcontrollers | 3 | Lecture, Class activity | Assignment 2 |
| 5 | Shift registers in microcontrollers | 3 | Lecture/Assign. | Assignment 2, Quiz |
| 6 | A/D and pulse width modulation in micro controllers | 3 | Lecture, Class activity | Assignment 3 |
| 7 | Programming instructions in microcontrollers | 3 | Lecture, Class activity | Assignment 3, Quiz |
| 8 | **Midterm exam** | | | |
| 9 | Proportional–integral–derivative 'controller''(PID) | 3 | Lecture /Assign. | Assignment 4 |
| 10 | Communication/read write wired in microcontrollers | 3 | Lecture, Class activity | Assignment 4, , Quiz |
| 11 | Programming of microcontrollers using High level language | 3 | Lecture/Assign. | Assignment 5 |
| 12 | Microcontrollers safety procedures | 3 | Lecture, Class activity | Assignment 5 |
| 13 | Connecting field devices to I/O cards of microcontrollers | 3 | Lecture, Class activity | Quiz |
| 14 | Proportional–integral–derivative 'controller''(PID) | 3 | Lecture, Case Study | Oral Exam |
| 15 | **Final exam** | | | |

1. **Course Matrix**

|  |  |  |
| --- | --- | --- |
| **ILO’s code number** | **Teaching/learning methods and strategies** | **Assessment methods and strategies** |
| 2.1.1  2.1.3  2.1.5  2.1.7 | Subject related qualities are acquired mainly through lectures, seminars, directed reading, videos, IT based resources, case studies and experiential learning. Exposure to the engineering environment is an important aspect of the teaching and learning methods as are projects. | Assessment will be through individual coursework assignments, quizzes, oral discussions and reports. In addition final written examinations are given. The grades distribution system is shown in the curriculum table below. |
| 2.2.1  2.2.2  2.2.3  2.2.5  2.2.6 | Analysis and problem‐solving skills are developed through tutorial/problem sheets and small group exercises.  Research skills are developed through the research project in the course of dissertation or thesis preparation. | Analysis and problem‐solving skills are assessed through oral and written examinations. Design and research skills are assessed through project write-ups, coursework and project reports, presentations and the final dissertation or thesis |
| 2.3.1  2.3.3  2.3.4  2.3.6  2.3.8  2.3.10 | The teaching and learning methods place emphasis on engineering workshop practice, visits to local engineering companies and the supervised industrial placement year. Experimental work, team projects and design assignments also contribute. | The supervised work experience is assessed with visits, reports and an oral presentation. Coursework assignments, workshop exercises, laboratory reports, project dissertations and student peer assessment also contribute to the assessment methods. |
| 2.4.3  2.4.4  2.4.7  2.4.8 | Transferable and key skills are delivered throughout the program, i.e. lectures, coursework assignments, laboratory work, industrial placement year and project dissertations. The IT skills are taught within the program structure. | Assessment is principally through coursework assignments, laboratory reports and project dissertations. Assessment of teamwork is through submission of teamwork tasks, student peer and self-assessment, and oral presentations. |

1. **Teaching and Learning Methods**

* Lectures

Practical training / laboratory

Seminar / workshop

* Class activity
* Case study
* Assignments / homework

Other \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. **Student Assessment Methods**

* Assignments to assess knowledge and intellectual skills.
* Quiz to assess knowledge, intellectual and professional skills.
* Mid-term exam to assess knowledge, intellectual, professional and general skills.
* Oral exam to assess knowledge and intellectual skills.
* Final exam to assess knowledge, intellectual, professional and general skills.
* Other: Practical exam to assess knowledge, intellectual, professional and general skills.

1. **Assessment schedule**

Assessment 1 Assignments on weeks 2, 3, 4, 5 , 6, 7 ,9, 10, 11, and 12

Assessment 2 Quizzes on weeks 5, 7, 10, and 13

Assessment 3 Mid-term exam on weeks 8

Assessment 3 Oral exam on week 14

Assessment 4 Final exam on week 15

1. **Weighting of assessments**

05% Home assignments

05% Quizzes

15% Mid-term examination

05% Oral examination

70% Final-term examination

100% Total

1. **List of References**

**9.1 Essential books (Text books)**

1- Embedded systems programming in C and assembler, Johon forest Brown, Van Nostrand Reinhold, ISBN 0-442-01817-7

2-Microcontroler technology, Peter Spasov, Prentice Hall, ISBN 0-13-583568-2

3- [Michael Barr](http://en.wikipedia.org/wiki/Michael_Barr_(software_engineer)). ["Embedded Systems Glossary"](http://www.netrino.com/Embedded-Systems/Glossary). Neutrino Technical Library. Retrieved 2007-04-21

4-[Jump up^](http://en.wikipedia.org/wiki/Embedded_system#cite_ref-2) Heath, Steve (2003). [Embedded systems design](http://books.google.com/books?id=BjNZXwH7HlkC&pg=PA2). EDN series for design engineers (2 ed.). Newnes. p. 2. [ISBN](http://en.wikipedia.org/wiki/International_Standard_Book_Number) [978-0-7506-5546-0](http://en.wikipedia.org/wiki/Special:BookSources/978-0-7506-5546-0). "An embedded system is a [microprocessor](http://en.wikipedia.org/wiki/Microprocessor) based system that is built to control a function or a range of functions."

**9.2 Recommended books;**

-[Jump up](http://en.wikipedia.org/wiki/Embedded_system#cite_ref-3)  Michael Barr; Anthony J. Massa (2006). ["Introduction"](http://books.google.com/books?id=nPZaPJrw_L0C&pg=PA1). Programming embedded systems: with C and GNU development tools. O'Reilly. pp. 1–2. [ISBN](http://en.wikipedia.org/wiki/International_Standard_Book_Number) [978-0-596-00983-0](http://en.wikipedia.org/wiki/Special:BookSources/978-0-596-00983-0).

**9.3 Periodicals & Websites**

-<http://shop.oreilly.com/product/9780596007553.do>

<http://www.renesas.com/support/books/index.jsp#t01>

http://[www.sciencedirect.com](http://www.sciencedirect.com)

1. **Facilities required for teaching and learning**

Lecture room equipped with overhead projector

Presentation board, computer and data show

Laboratory

**Course coordinator: Prof. Dr. Saber Abdrabbo**

**Course instructor: Date** 10 /10 /2015

**Heat of the department:** Osama Ezzat Abdellatif