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| IIUM_logo_bw_tinyINTERNATIONAL ISLAMIC UNIVERSITY MALAYSIACOURSE OUTLINE | | | | | | |
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| Kulliyyah / Institute | | | Engineering | | | |
| Department / Centre | | | Mechatronics Engineering | | | |
| Programme | | | B. Eng (Mechatronics) (Honours) | | | |
| **Name of Course / Mode** | | | Embedded Systems /Full time | | | |
| **Course Code** | | | MCT 4342 | | | |
| **Name (s) of Academic staff / Instructor(s)** | | | Dr. Amir Akramin Shafie | | | |
| **Rationale for the inclusion of the course / module in the programme** | | | Elective course for Mechatronics Engineering Programme | | | |
| **Semester and Year Offered** | | | Every Semester | | | |
| **Status** | | | Core | | | |
| **Level** | | | 4 | | | |
| **Proposed Start Date** | | | Sem 1 – 2016/2017 | | | |
| **Batch of Student to be Affected** | | |  | | | |
| **Total Student Learning Time (SLT)** | | | |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | **Face to Face** | | | **Assessments** | | Independent Learning | **Total Student Learning Time** | | Lecture | Tutorial | Practical | Midterm | Final | | 42 |  |  | 2 | 3 | 73 | **120** | | | | |
| **Credit Value / Hours** | | | 3/120 | | | |
| **Pre-requisites** *(if any)* | | | None | | | |
| **Co-requisites** *(if any)* | | | None | | | |
| **Course Objectives** | | | The objectives of this course are to:   1. Introduce the concept of embedded system in a mechatronic application and its related design issues. 2. Expose students to methods of writing embedded software system for mechatronics application. 3. Familiarize students with techniques to build the hardware element in an embedded system. 4. Expose students to usage of embedded system in mechatronic application in industry. 5. Foster the spirit of team work through design process. | | | |
| **Learning Outcomes** | | | Upon completion of the course students should be able to:   1. Explain the basic elements and major issues involved in developing embedded system for mechatronic systems. 2. Design embedded system based on a typical mechatronic application which includes interfaces with sensors and actuators 3. Develop program for targeted microcontroller application. 4. Select a specific embedded system based on specification for mechatronic application. | | | |
| **Transferable Skills:** | | | *Skills and how they are developed and assessed:*   |  |  |  | | --- | --- | --- | | **Skills** | **Development** | **Assessment** | | Technical | Lectures | Written Assessment | | Analytical | Projects | Report | |  |  |  | | | | |
| **Teaching-Learning and assessment strategy** | | | Lectures, Projects report and Quizzes | | | |
| **Course Synopsis** | | | Mechatronic applications and embedded system, PIC 18Fxx2, Assembly language programming : sign and unsigned operations, subroutines, stacks and pointers, C Languge programming: compilation, state machine programming, LED/switch, Inputs and outputs, parallel port operation, IO Channels, interrupt and timers, PWM, waveform generation, digital communication protocol, USB introduction, digital thermometer, autonomous robots. | | | |
| **Mode of Delivery** | | | Lecture, Tutorial | | | |
| **Assessment Methods and Type/Course Assessement**  State weightage of each type of assessment. | | | |  |  |  | | --- | --- | --- | | **LO** | **Method** | **%** | | 1,2,3,4 | Quiz | 20 | | 1,2,3,4,5 | Assignments | 10 | | 1,2,3 | Mid-term Examination | 30 | | 1,2,3,4 | Final Examination | 40 | | | | |
| **Mapping of course / module to the Programme Learning Outcomes** | | | | | | |
| |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Learning Outcome of the course | Programme Outcomes | | | | | | | | | | | | | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | | Explain the basic elements and major issues involved in developing embedded system for mechatronic systems. | ✓ |  |  |  |  |  |  |  |  |  |  |  | | Design embedded system based on a typical mechatronic application which includes interfaces with sensors and actuators | ✓ | ✓ | ✓ |  |  |  |  |  |  |  |  |  | | Develop program for targeted microcontroller application. | ✓ |  | ✓ |  | ✓ |  |  |  | ✓ |  |  |  | | Select a specific embedded system based on specification for mechatronic application. | ✓ |  | ✓ |  | ✓ |  |  |  |  |  |  |  | | | | | | | |
| **Content outline of the course / module and the SLT per topic** | | | | | | |
| **Weeks** |  | **Topics** | | | **Learning Hours** | **Task/Reading** |
| 1 | **Introduction:** Mechatronic Application and Embedded Systems, Review of Microprocessor Based System, Introduction to PIC 18Fxx2 | | | | 3 | Chapter1, Chapter 2 |
| 2 | **Assembly Language Programming:** 8-bit sign operations, | | | | 6 | Chapter 4, 5 |
| 3 | 8-bit Unsigned Operations, signed comparison, | | | | 6 | Chapter 4, 5 |
| 4 | subroutines, stacks, pointers and table reads | | | | 8 | Chapter 4, 5 |
| 5 | **C Language Programming:** C compilation, PIC18 Hardware Intro, | | | | 8 | Chapter 8 |
| 6 | Power Consumption, Watchdog Timer, SLEEP Mode, Datasheet, | | | | 8 | Chapter 8 |
| 7 | State Machine Programming, LED/Switch IO, LCD Module Interface | | | | 8 | Chapter 8 |
| 8 | **Inputs and Outputs:** Parallel port Operation, IO Channels, Synchronous Serial IO, | | | | 8 | Chapter 9 |
| 9 | Asynchronous Serial IO, I2C and Serial EEPROM | | | | 12 | Chapter 9 |
| 10 | **Interrupts and Timers:** PIC18 Interrupts, Software FIFO, Switch DebouncingTimer2- Periodic Interrupts: PWM, DC Motors Servos, O | | | | 12 | Chapter 10 |
| 11 | Waveform Generation, State Machine Programming for Interrupt Driven I | | | | 8 | Chapter 10 |
| 12 | **Embedded system: Communications systems;** Digital communication, protocol, communication interfaces, | | | | 8 | Chapter 15 |
| 13 | USB introduction, remote communication (infrared) | | | | 9 | Chapter 15 |
| 14 | **Embedded System in Mechatronic Applications (Case studies) :**Audio Record/Playback System, Home Monitoring System, Digital Thermometer, Autonomous Robot | | | | 11 | Chapter 14 |
| **Required references supporting the course** | | | | | | |
| *The reference lists shall be presented in accordance with APA bibliographic practices and in alphabetical order.*  **Reeser, R.B., (2010),** *Microprocessor From Assembly Language to C Using the PCI18Fxx2,* Da Vinci Engineering Press.  . | | | | | | |
| **Recommended references supporting the course** | | | | | | |
| **Braunl, T., (2006).** *Embedded Robotics: Mobile Robot Design and Applications with Embedded Systems,* Springer Verlag Berlin Jaidelberg.  **De Silva, C W**., (2005). *Mechatronics: An Integrated Approach*, CRC Press.  **Parab, J., Santoch, A.S., Vinod G.S., Rajanish K.K., & Gourish M.N,** (2008). *Practical Aspects of Embedded System Design using Microcontrollers*, Springer Science + Business Media. | | | | | | |
| **Prepared by:**  **Dr. Amir Akramin Shafie**  **Assistant Professor**  **Kulliyyah of Engineering** | | | **Checked by:**  **Dr. Tanveer Saleh**  **Head of Department**  **Kulliyyah of Engineering** | **Approved by:**  **Prof. Emeritus Dato' Wira Ir. Dr. Md Noor bin Salleh**  **Dean**  **Kulliyyah of Engineering** | | |

**Kulliyyah Programme Outcomes and the relation between KOE PO with outcomes from EAC, MQF domain, MOHE domain and Soft Skills.**

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| --- | --- | --- | --- | --- |
| **KOE PO** | **EAC** | **MQF Domain** | **MOHE Domain** | **Soft Skills** |
| **1. Engineering Knowledge (T)** - Apply knowledge of mathematics, sciences, engineering fundamentals and **specialization to solve complex engineering problems**. | 1 | 1 & 6 | 1 | - |
| **2. Problem Analysis (T)** – Identify, formulate, perform relevant literature review and **analyze complex engineering problems**, and reaching substantiated conclusions using **first principles of mathematics, natural sciences and engineering sciences**. | 2 | 1 & 6 | 1 | 1 |
| **3. Design/Development of Solutions (A)** – Design solutions whilst **exhibiting innovativeness**, for complex engineering problems and design systems, components or processes that meet specified needs; **with appropriate consideration of cost, sustainability issues, environmental impact, public health and safety, engineering ethics as well as cultural and social needs**. | 3 | 2, 3 & 6 | 2 | 1 |
| **4. Investigation (D) - C**onduct investigation on complex problems whilst **displaying creativity**, by using research-based knowledge and method, including design of experiments, **analysis and interpretation of data**, and synthesis of information to provide valid conclusions. | 4 | 2 & 6 | 2, 3 | 1 |
| **5. Modern Tool Usage (A & D) -** Create and apply appropriate techniques, resources and **modern engineering/IT tools**, which includes making prediction and modelling of the complex engineering activities with understanding of limitations. | 5 | 6 & 7 | 7 |  |
| **6. The Engineer and Society (ESSE)** - Apply reasoning based on contextual knowledge to **assess societal, health, safety, legal, cultural, contemporary issues**, and the consequent responsibilities relevant to professional engineering practices. | 6 | 3 & 4 | 5 | 4 |
| **7. Environment and Sustainability (ESSE)** - Understand the impact of professional engineering solutions in **societal, global, and environmental contexts** and demonstrate knowledge of and need for sustainable development. | 7 | 3 & 4 | 5 | 4 |
| **8. Ethics (ESSE)** –Apply professional ethics with **Islamic values** and commit to responsibilities and norms of professional engineering code of practices. | 8 | 3 & 4 | 6 | 4 |
| **9. Communication (S)** - **Communicate effectively within the engineering** community and with the society at large, which include but not limited to writing effective reports and documentation, **delivering effective presentation** as well as giving and receiving clear instructions. | 9 | 5 & 7 | 4, 7 | 2 |
| **10. Individual and Team Work (S) -** Able to function effectively both as an individual or member of a team, or a **leader in a diversified multi-disciplinary** team settings. | 10 | 5 & 8 | 5, 8 | 3 |
| **11. Life Long Learning (S) -**Recognize the need for, and have the preparation and ability to engage in independent and **life-long learning** in the broadest context of technological change. | 11 | 7 | 7 | 5 |
| **12. Project Management and Finance (S) -** Demonstrate and apply engineering management and financial principles into one’s work which include being **an effective member/leader in projects** with multidisciplinary settings and identify opportunities of **entrepreneurship**. | 12 | 8 | 5, 8, 9 | 6, 7 |

The program learning outcomes (PO) are grouped into 5 general areas to identify the nature of the skills and capability involved. These groups are:

1. Technical (T) – essential capabilities related to traditional scientific and engineering knowledge
2. Analysis (A) – creatively working with available data and engineering tools and fundamental knowledge to correctly solve basic problem
3. Design (D) – being able to perceive the best solution for both small scale and large scale project by involving all required basic problems
4. Ethics, Safety, Society and Environment (ESSE) - giving appropriate consideration to matters pertaining to professionalism and ethics, safety, local and global society and the environment
5. Work skills (S) – being and effective communicator and effective member of a team and to appreciate the need to continuously acquired skills and abilities.

**LEARNING OUTCOMES OF OTHER DOMAINS**

|  |  |  |
| --- | --- | --- |
| **MQF learning outcomes domains:** | **MOHE Domain Learning Outcomes** | |
| 1. knowledge 2. practical skills 3. social skills and responsibilities 4. values, attitudes and professionalism 5. communication, leadership and team skills, 6. problems solving and scientific skills 7. information management and lifelong learning skills; and 8. managerial and entrepreneurial skills | **MOHE learning outcomes domains:**   1. Knowledge in Specific Area-Content 2. Practical Skills 3. Critical Thinking and Scientific Skills 4. Communication Skills 5. Social Skills, Teamwork and Responsibilities 6. Values, Ethics, Moral and Professionalism 7. Information Management and Life Long Learning 8. Management and Entrepreneurship 9. Leadership Skills | **Soft Skills Learning Outcomes :**   1. Critical Thinking and Problem-solving Skills 2. Communication Skills 3. Teamwork Skills 4. Ethics & Moral Professionalism 5. Life-long Learning and Information Management 6. Entrepreneurial Skills 7. Leadership Skills |