**Program Specification for Diploma in Mechanical Engineering (Automation and Mechatronics)**

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| **Introduction:**  Mechatronics is the synergistic combination of precision mechanical engineering, electronics, control engineering and computer science. The key element in mechatronics is the integration of these areas through the design process starting from the identification of the design need. Mechatronic products require the integration of mechanisms, actuators, sensors, computational hardware and control algorithms. Distinguishing features of the mechatronic products are “the replacement of many mechanical functions with electronic ones, resulting in much greater flexibility; ease of re-design or reprogramming; the ability to implement distributed control in complex systems; and the ability to conduct automated data collection and reporting”. Due to these advantages of mechatronic design, the general trend in the industry is to make more and more intelligent products like intelligent dishwashers, washing machines and advanced automobiles. The new industry trend requires such a student profile that has some experience in mechatronics design and mechatronics philosophy.  Mechatronics engineers design and build computer controlled electro-mechanical systems and machines like hybrid walking vehicles, robots and Computer Integrated Manufacturing production systems(CIM).This Program specification provides a concise summary of the main features of the Master of science in mechatronics engineering at Benha University. The department has been based in the impressive Engineering, shared with Mechanical, Electrical, and Computer Engineering Systems. Our co-location promotes extensive collaboration between the three departments for the purposes of teaching, research, and providing support to our many [student design teams](https://uwaterloo.ca/mechanical-mechatronics-engineering/student-teams). |

1. **Basic Information**
2. **Awarding Institution : Benha University**
3. **Teaching Institution : Faculty of Engineering at Shoubra**
4. **Name of the Final Award: Diploma in Mechanical Engineering (Automation and Mechatronics)**
5. **Program Title: Automation and Mechatronics**
6. **Name of Department: Mechanical Engineering Department**
7. **Language of study: English**
8. **Date of production of Program Specification : June 2012**
9. **Relevant Benchmarks: Academic Standards NAQAAE (for Master Degree Programs), March 2012.**

**B: Professional Information**

* **Program Mission and Aims**

**1.1 Program Mission**

Mechatronics is the synergistic integration of mechanical engineering with electronics and intelligent computer control in the design and manufacture of products and processes. Mechatronics is also defined as an interdisciplinary field of engineering science, which characterizes the interconnections between mechanical engineering, electrical/electronic engineering and computer science such that these interconnections are the basis for an "intelligent" behavior of a machine. The common feature of mechatronics extracted from these definitions is mainly the application of computer-based digital control techniques, through various electrical and electronic interfaces to achieve efficient mechanical functions.

Mechatronics is considered in its broader sense as the name given to a special philosophy behind the design and development of microprocessor-based products. The mission of the Faculty of Engineering, Benha University, and Master of Science in Mechatronics Engineering is to meet these requirements fully. The curriculum and courses aim true hands-on experience in mechatronics engineering, with special emphasize on the engineering design of mechatronic products. The mission of the program is extended also to:

* To provide students with a technical basis in the key areas of the concurrent design and control of Mechatronics engineering profession through delivery of a theoretical information and practical applications of mechatronics engineering science.
* To develop in our students excellences in oral and written communications.

**1.2 Program Aims**

The program aims to enable suitably qualified postgraduate students from a range of engineering backgrounds to:

1. Provide study which will be informed by the forefront of both the academic and professional elements of the automation and mechatronics.
2. Provide scientific, technical and practical aspects of electronics, sensors, actuators, control, and related software.
3. Recognize the phenomena programming methods of automation and Mechatronics.
4. Introduce study of measuring physical quantities using sensors.
5. Explain needs for signal amplifications and filtration.
6. Provide study of controlling methods and its roll automation.
7. Provide study of actuators and its specification, installations, and controlling.
8. Produce professional automation and mechatronics engineers to work in the field of mechanical engineering.
9. Apply gained knowledge to day to day applications.
10. To provide a comprehensive knowledge of the core of the mechatronic engineering discipline, and closely related subjects and applications.
11. To enable postgraduate students to analyze, design, and evaluate a wide range of mechatronic circuits and systems.
12. To enable graduates to demonstrate creative and innovative ability in the synthesis of solutions to mechatronic engineering problems.
13. **Intended Learning Outcomes (ILOs)**

**Upon completion of the program the students should be able to:**

* 1. **Knowledge and Understanding**

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| **Program ILO’s** | **Teaching / learning methods and strategies** |
| * + 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. Demonstrate knowledge and understanding of applied mathematical principles necessary to underpin their education in mechatronic engineering and to enable them to apply mathematical methods.     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.     4. Demonstrate extensive knowledge and practical understanding of management and business practices, and their limitations, and how these maybe applied appropriately.     5. Demonstrate an awareness of developing technologies related to the applied mechatronic engineering.     6. Demonstrate understanding of the roles and responsibilities of the professional engineer in society, awareness of the framework of relevant legal requirements governing engineering activities.     7. Demonstrate a comprehensive knowledge and understanding of computer models relevant to mechatronic engineering, and an appreciation of their limitations.     8. Define the basics and the ethics of scientific research. | 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**  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. | |

* 1. **Intellectual Skills**

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| **Program ILO’s** | **Teaching / learning methods and strategies** |
| * + 1. Demonstrate understanding of engineering principles and apply them to analyze key mechatronic engineering processes.     2. Identify, classify, practice and describe the performance of mechatronic systems and components through the use of analytical methods and modelling techniques.     3. Apply quantitative methods and computer software relevant to mechatronic engineering, in order to solve engineering problems.     4. Demonstrate understanding of ability to apply a systems approach to engineering problems.     5. Investigate and define a mechatronics design problem and identify constraints including environmental and sustainability limitations.     6. Manage the design of mechatronic systems and components, taking account of customer and user needs, identify and manage cost drivers, and evaluate outcomes. | 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. |
| **Assessment**  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. | |

* 1. **Professional and Practical Skills**

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| **Program ILO’s** | **Teaching / learning methods and strategies** |
| * + 1. Demonstrate extensive practicing and understanding of a wide range of engineering control and components.     2. Demonstrate extensive practicing and understanding of robotics technology.     3. Demonstrate extensive practicing and understanding of a wide range of industrial automation and its components.     4. Plan and conduct laboratory and workshop tasks using a variety of equipment.     5. Write and evaluate professional reports.     6. Demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.).     7. Source, integrate and use effectively technical literature and other engineering information and data.     8. Demonstrate an awareness of the nature of intellectual property and contractual issues, appropriate codes of practice and industry standards, and quality issues.     9. Work with technical uncertainty.     10. Demonstrate a thorough understanding of current practice and its limitations, and some appreciation of likely new developments. | 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. |
| **Assessment**  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. | |

* 1. **General and Transferable Skills**

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| **Program ILO’s** | **Teaching / learning methods and strategies** |
| * + 1. Make effective and appropriate use of Information and Communications Technology skills.     2. Communicate effectively, both orally and in written form.     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.     4. Exercise planning, organizational, problem-solving, and time-management skills and effectively use available resources.     5. Use different sources for obtaining information and knowledge.     6. Set basis and standards to assess the performance of others.     7. Work in a group and Lead a team in familiar professional contexts     8. Conduct self-learning and continuous education practices. | 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**  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. **Academic Standards** 
   1. **External References for Standards (Benchmarks)**

Academic Reference Standards for Masters Degree Programs, **in general,** were prepared by the National Authority for Quality Assurance and Accreditation of Education, Egypt. **These standards were translated for preparing these program specifications.**

* 1. **Comparison of Provision to External References**

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| **Attributes of current program graduates** | **Attributes of program graduates as per NAQAAE Requirements for Master programs, in general** | **Corresponding ILO's in Current Program which satisfy the NAQAAE Requirements for Master programs, in general** | **Codes for Courses that Satisfy the ILO’s** |
| 1.1 Master the application of the fundamentals and methodologies of mechatronics engineering | 1.1 Master the application of the fundamentals and methodologies of scientific research and use its different tools. | **2.1.1**  **2.1.5** | MET602  MET604  MET605 |
| 1.2 Apply the analytic approach and use it in the mechatronics engineering. | 1.2 Apply the analytic approach and use it in the area of specialization. | **2.2.1**  **2.3.5**  **2.3.4** | MET601  MET603  MET605 |
| 1. 3 Apply specialized knowledge and combine it with relevant knowledge related to mechatronics engineering technology. | 1. 3 Apply specialized knowledge and combine it with relevant knowledge related to professional practice. | **2.2.3**  **2.2.4**  **2.2.2** | MET602  MET603  MET605  MEP602 |
| 1. 4 Show an awareness of current problems and modern perspectives in the mechatronics engineering. | 1. 4 Show an awareness of current problems and modern perspectives in the area of specialization. | **2.1.5**  **2.2.3**  **2.2.4**  **2.2.2**  **2.4.5** | MET602  MET603  MET604  MET605 |
| 1.5 Specify professional problems and find appropriate solutions for them. | 1.5 Specify professional problems and find solutions for them. | **2.4.5**  **2.2.5** | MET601  MET602 |
| 1.6 Show distinction in a proper range of specialized professional skills and use of appropriate technological means to serve his professional practice. | 1.6 Show distinction in a proper range of specialized professional skills and use of appropriate technological means to serve his professional practice. | **2.1.5**  **2.4.1** | MET605  MET606 |
| 1. 7 Communicate with them effectively and demonstrate ability to lead teams. | 1. 7 Communicate effectively and demonstrate ability to lead teams. | **2.2.6**  **2.3.5**  **2.4.2**  **2.4.6**  **2.4.7**  **2.4.8** | MET603  MET604  MET606 |
| 1. 8 Make decisions in various professional contexts. | 1. 8 Make decisions in various professional contexts. | **2.2.3**  **2.2.4**  **2.2.7**  **2.4.8** | MET601  MET603 |
| 1.9 Utilize available resources to maximize their benefit and keep resources maintained. | 1.9 Utilize available resources to maximize their benefit and keep resources maintained. | **2.1.5**  **2.1.6** | MET602  MET606 |
| 1.10 Display awareness of his/her role in community development and environmental conservation in light of global and regional variations. | 1.10 Display awareness of his/her role in community development and environmental conservation in light of global and regional variations. | **2.1.6**  **2.1.2**  **2.1.3**  **2.1.7**  **2.2.5**  **2.2.7** | MET606 |
| 1.11 Act in a way that reflects the commitment to integrity, credibility and in accordance with the rules of the profession. | 1.11 Act in a way that reflects the commitment to integrity, credibility and in accordance with the rules of the profession. | **2.1.4**  **2.1.8** | MET601 |
| 1.12 Develop him/herself academically and professionally and carry out continuous education. | 1.12 Develop him/herself academically and professionally and carry out continuous education. | **2.4.1**  **2.4.3**  **2.4.4**  **2.4.5**  **2.4.9** | MET604  MET606 |

1. **Program Structure and Award Requirements**
   1. **Curriculum**

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| **Test Time** | | **Total** | **Written Exam** | **Oral / Practical** | **Course Work** | **Credit Hours** | **Pre- requisites** | **Course Name** | **Course Code** | **Serial** |
| **Compulsory Courses** | | | | | | | | | | |
| 3 | 300 | | 180 | 60 | 60 | 3 | -- | Programmable Logic Controllers | MET 503 | 1 |
| 3 | 300 | | 180 | 60 | 60 | 3 | -- | CNC Machines and Their Economics | MED 503 | 2 |
| 3 | 300 | | 180 | 60 | 60 | 3 | -- | Engineering Software | MEP 509 | 3 |
| 3 | 300 | | 180 | 60 | 60 | 3 | -- | Project |  | 4 |
| **Elective Courses** | | | | | | | | | | |
| 3 | 300 | | 180 | 60 | 60 | 3 | -- | Computer Aided Manufacturing | MED 505 | 1 |
| 3 | 300 | | 180 | 60 | 60 | 3 | -- | Non-Conventional Machining | MED 508 | 2 |
| 3 | 300 | | 180 | 60 | 60 | 3 | -- | Embedded Control | MET 504 | 3 |
| 3 | 300 | | 180 | 60 | 60 | 3 | -- | Robotics and Automation | MET 505 | 4 |

* To join this program the student should complete a minimum of 9 credit hours of preparatory courses with a grade point average not less than (C+).
* Total number of required credit hours is 18 hours. The studied subjects should have a code 500. To obtain the diploma the student should complete all the required courses with grade point average not less than (C).
  1. **Criteria for Admission:**

The student should hold a (good) grade in the undergraduate Bsc. degree to join the Masters program. Alternatively, the student may join the Masters program if he/she holds a postgraduate Diploma. Further details of the admission criteria are outlined in the internal postgraduate prospectus for the Faculty of Engineering at Shoubra, issued 2000-2001 (in Arabic).

* 1. **Regulation for Progression and Program Completion**

Different rules pertaining to the progression and completion of the degrees are outlined in the internal postgraduate prospectus for the Faculty of Engineering at Shoubra, issued 2000-2001 (in Arabic).

* 1. **English Language Requirement:**

The English language proficiency of all students shall be tested in accordance with the university requirements.

* 1. **Role of External Examiner**

External examiners (from other universities and research institutes) are nominated by the main supervisor of the student and approved by the department. Their duties include revising the final manuscript of the student dissertation or thesis and indicating if the reported work is up to the standard. Subsequently a viva-voce examination is held where the examiner get the opportunity to question the student regarding his work**.**

* 1. **Support for Students and their Learning:**
* The postgraduate office staff-help the students with any inquiries regarding faculty regulations related to postgraduate programs.
* An open door policy is exercised whereby students can inform head of department of any complaints or requests either verbally or in writing.
* After completing the courses each student is assigned with a panel of supervisors (either faculty members or members of other faculties) to help the student with undertaking the research work.

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| **Course Code** | **Knowledge & Understanding** | | | | | | | | **Intellectual Skills** | | | | | | **Professional Skills** | | | | | | | | | | **General and Transferable Skills** | | | | | | | |
| **2.1.1** | **2.1.2** | **2.1.3** | **2.1.4** | **2.1.5** | **2.1.6** | **2.1.7** | **2.1.8** | **2.2.1** | **2.2.2** | **2.2.3** | **2.2.4** | **2.2.5** | **2.2.6** | **2.3.1** | **2.3.2** | **2.3.3** | **2.3.4** | **2.3.5** | **2.3.6** | **2.3.7** | **2.3.8** | **2.3.9** | **2.3.10** | **2.4.1** | **2.4.2** | **2.4.3** | **2.4.4** | **2.4.5** | **2.4.6** | **2.4.7** | **2.4.8** |
| **MEP509** | • |  | • |  |  |  |  |  |  | • | • | • |  |  | • | • |  | • | • |  |  |  |  |  | • | • | • |  |  |  | • |  |
| **MED503** | • | • | • |  |  |  |  |  | • |  |  | • |  |  |  | • |  |  | • |  |  |  |  |  |  | • |  |  | • | • |  |  |
| **MED505** | • |  | • |  |  |  |  |  |  | • | • | • |  |  | • | • |  |  |  |  |  |  | • |  | • |  |  | • |  | • |  |  |
| **MED508** | • | • | • |  |  |  |  | • | • |  |  | • |  | • |  |  |  | • | • | • |  |  | • |  |  |  |  |  | • | • |  | • |
| **MET 503** | • |  | • |  | • |  | • |  | • | • | • |  | • | • | • |  | • | • |  | • |  | • |  | • |  |  | • | • |  |  | • | • |
| **MET 504** | • |  | • |  | • |  | • |  | • | • | • |  | • | • | • |  | • | • |  | • |  | • |  | • |  |  | • | • |  |  | • | • |
| **MET 505** | • | • | • |  | • | • |  | • | • | • | • | • | • | • | • | • | • | • |  |  |  | • | • | • |  | • | • |  | • | • |  | • |