**Master of Science In Engineering Mathematics**

**Introduction:**

This Program specification provides a concise summary of the main features of the M. Sc. Engineering Mathematics at Benha University. The Program Intended Learning Outcomes ILO’s are those that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. This specification provides a source of information for students seeking an understanding of the nature of the program, and to all other interested parties.

1. **Basic Information**
2. **Awarding Institution :**  Benha University
3. **Teaching Institution :** Faculty of Engineering at Shoubra
4. **Name of the Final Award:** M.Sc. In Engineering Mathematics
5. **Program Title:** M.Sc. In Engineering Mathematics
6. **Name of Department:** Engineering Mathematics and Physics
7. **Coordinator:** Prof. Dr. Mohamed Ismail Hussien
8. **Language of study:** English
9. **Date of approval of Program Specification:** December 2015
10. **Relevant Benchmarks:** Academic Standards NAQAAE (for Master programs) March 2009.

**B. Professional Information**

1. **Program Mission and Aims**
	1. **Program Mission**
* To prepare students to undertake research in an advanced topic in mathematics.
* To develop in our students excellences in oral and written communication.
* To produce engineers to work in/with important national collections.
	1. **Program Aims**
* Master the application of the fundamentals and methodologies of scientific research in the field of mathematics and use its different tools and rules.
* Apply the analytic approach and use it in applied mathematics.
* Apply mathematical knowledge and combine it with relevant knowledge related to formulate and solve practical problems.
* Show awareness of current problems and modern perspectives in branches of mathematics.
* Specify mathematical models of real problems and find algorithms for solving them.
* Show distinction in a proper range of specialized professional skills and use of appropriate technological means to serve his professional practice.
* Communicate effectively and demonstrate ability to lead teams for treating large scale problems
* Make decisions in the light of available data and information to solve real problems.
* Utilize available data and information to solve problems and analyze solutions of real problems.
* Display awareness of his/her role in community development and environmental conservation in light of global and regional variations.
* Act in a way that reflects the commitment to integrity, credibility and in accordance with the rules of the profession.
* Develop him/her self academically and carry out continuous education.

 **2. Intended Learning Outcomes (ILOs)**

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

 **2.1- Knowledge and Understanding**

|  |  |
| --- | --- |
| **Program ILO’s** | **Teaching / learning methods and strategies** |
| 1. Identify theories, fundamentals and specialized knowledge in mathematics.
2. Describe the two way impact of the relation between professional practice and its effect on the environment.
3. Outline the scientific developments in mathematics.
4. Summarize the moral and legal principles of professional practice in mathematics.
5. List the principles and fundamentals of proof of theorems and mathematical relations.
6. Define the basics and the ethics of scientific research.
 | Acquisition of core knowledge and understanding is achieved mainly through lectures, seminars, tutorials, directed reading, project work and independent study. |
| **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. |

 **2.2- Intellectual Skills**

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| **Program ILO’s**  | **Teaching / learning methods and strategies** |
| 1. Analyze and assess information in pure mathematics and applied mathematics and draw analogies for modeling and solving them.
2. Solve problems in spite of the lack of some data.
3. Link different knowledge sources to prove theorems and solve problems.
4. Conduct a research study and/or write a scientific essay about a research problem.
5. Assess solutions to real and practical problems.
6. Plan for performance development in the field of mathematics.
7. Make professional decisions in various professional contexts.
 | 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. |

**2.3- Professional and Practical Skills**

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| --- | --- |
| **Program ILO’s** | **Teaching / learning methods and strategies** |
| 1. Master basic professional and modern skills in the area of specialization.
2. Write and evaluate professional reports via mathematical logic.
3. Assess methods and current tools for treating practical problems in engineering mathematically.
 |  Work on the final dissertation or thesis. |
| **Assessment** | Practical skills are assessed through write-ups, coursework exercises and reports, project reports and presentations and finally on the methodology demonstrated in the work for the dissertation or thesis.  |

 **2.4 - General and Transferable Skills**

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| **Program ILO’s** | **Teaching / learning methods and strategies** |
| 1. Communicate effectively using different means.
2. Use information technology in order to serve the development of professional practice.
3. Assess him/her self and identify his/her own personal learning needs.
4. Use different sources for obtaining information and knowledge.
5. Set basis and standards to assess the performance of others.
6. Work in a group and Lead a team in familiar professional contexts.
7. Manage time effectively.
8. Conduct self learning and continuous education practices.
 | Presentations in annual seminars (compulsory to be attended by a panel of departmental staff and other students).Attendance of workshops or conferences or internal seminars.Writing scientific paper/s (compulsory before obtaining the degree).Thesis or dissertation preparation |

* 1. **Academic Standards**

 **3a- 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.

 **3b-** **Comparison of Provision to External References**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   | **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 scientific research in the field of mathematics and use its different tools and rules. | * 1. Master the application

of the fundamentals and methodologies of scientific research and use its different tools. | 2.1.62.2.72.3.1 | As shown in Map |
|  | 1.2 Apply the analytic approach and use it in applied mathematics. | 1.2 Apply the analytic approach and use it in the area of specialization. | 2.1.32.2.12.2.2 | As shown in Map |
|  | 1. 3 Apply mathematical knowledge and combine it with relevant knowledge related to formulate and solve practical problems. | 1. 3 Apply specialized knowledge and combine it with relevant knowledge related to professional practice. | 2.1.42.2.3 | As shown in Map |
|  | 1. 4 Show awareness of current problems and modern perspectives in branches of mathematics. | 1. 4 Show an awareness of current problems and modern perspectives in the area of specialization. | 2.1.12.1.22.4.3 | As shown in Map |
|  | 1.5 Specify mathematical models of real problems and find algorithms for solving them. | 1.5 Specify professional problems and find solutions for them. | 2.2.22.2.4 | As shown in Map |
|  | 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. | 2.1.52.4.2 | As shown in Map |
|  | 1. 7 Communicate effectively and demonstrate ability to lead teams for treating large scale problems | 1. 7 Communicate effectively and demonstrate ability to lead teams. | 2.4.12.4.6 | As shown in Map |
|  | 1. 8 Make decisions in the light of available data and information to solve real problems. | 1. 8 Make decisions in various professional contexts. | 2.2.72.3.3 | As shown in Map |
|  | 1.9 Utilize available data and information to solve problems and analyze solutions of real problems. | 1.9 Utilize available resources to maximize their benefit and keep resources maintained. | 2.2.62.4.4 | As shown in Map |
|  | 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. | 2.2.52.3.2 | As shown in Map |
|  | 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. | 2.2.72.4.52.4.7 | As shown in Map |
|  | 1.12 Develop him/her self  academically and carry out continuous education. | 1.12 Develop him/her self academically and professionally and carry out continuous education. | 2.4.42.4.8 | As shown in Map |

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

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test Time** | **Total** | **Written Exam** | **Oral / Practical** | **Course Work** | **Credit Hours**  | **Course Name** | **Course Code** | **Serial** |
| **Compulsory Courses** |
| 3 | 300 | 200 | --- | 100 | 2 | Ordinary and Partial Differential Equations | EMM 401 | 1 |
| 3 | 300 | 200 | --- | 100 | 2 | Linear Algebra | EMM 402 | 2 |
| 3 | 300 | 200 | --- | 100 | 2 | Mathematical Analysis | EMM 403 | 3 |
| 3 | 300 | 200 | --- | 100 | 2 | Numerical Analysis | EMM 404 | 4 |
| 3 | 300 | 200 | --- | 100 | 2 | Statistics and Probability | EMM 405 | 5 |
| 3 | 300 | 200 | --- | 100 | 2 | Operations Research  | EMM 406 | 6 |
| 3 | 300 | 200 | --- | 100 | 2 | Analytical Mechanics  | EMM 407 | 7 |
| 3 | 300 | 200 | --- | 100 | 2 | Complex Variable | EMM 408 | 8 |
| **Elective Courses** |
| 3 | 300 | 200 | --- | 100 | 2 | Fluid Mechanics | EMM 409 | 1 |
| 3 | 300 | 200 | --- | 100 | 2 | Abstract Algebra | EMM 410 | 2 |
| 3 | 300 | 200 | --- | 100 | 2 | Transformations and Integral Equations | EMM 411 | 3 |
| 3 | 300 | 200 | --- | 100 | 2 | Mathematical Statistics | EMM 412 | 4 |
| 3 | 300 | 200 | --- | 100 | 2 | Topology | EMM 413 | 5 |
| 3 | 300 | 200 | --- | 100 | 2 | Theory of Elasticity  | EMM 414 | 6 |

* **Preparatory Courses**

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| --- | --- | --- | --- | --- | --- |
| Test Time | Grades | Credit Hours | Course Name | Course Code | Serial |
| Total | Written Exam | Oral or Practical | Course Work |
| **Compulsory Courses** |
| 3 | 300 | 200 | --- | 100 | 3 | Advanced Engineering Mathematics | ENG 501 | 1 |
| 3 | 300 | 200 | --- | 100 | 3 | Statistics and Random Processes | ENG 506 | 2 |
| **Elective Courses** |
| 3 | 300 | 200 | --- | 100 | 3 | Selected Topics | EMM 501 | 1 |
| 3 | 300 | 200 | --- | 100 | 3 | Linear Algebra and Linear Transformations | EMM 502 | 2 |
| 3 | 300 | 200 | --- | 100 | 3 | Mathematical Programming | EMM 503 | 3 |
| 3 | 300 | 200 | --- | 100 | 3 | Applied Mathematics | EMM 504 | 4 |

* **Master Courses**

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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 | 200 | -- | 100 | 3 | -- | Functional Analysis  | EMM 601 | 1 |
| 3 | 300 | 200 | -- | 100 | 3 | -- | Advanced Topics in Numerical Analysis | EMM 602 | 2 |
| -- | -- | -- | -- | -- | 18  | -- | M. Sc Thesis |  | 3 |
| **Elective Courses**  |
| 3 | 300 | 200 | -- | 100 | 3 | -- | Real Analysis | EMM 603 | 1 |
| 3 | 300 | 200 | -- | 100 | 3 | -- | Differential Equations -Methods and Applications | EMM 604 | 2 |
| 3 | 300 | 200 | -- | 100 | 3 | EMM 503 | Optimization and Expert Systems | EMM 605 | 3 |
| 3 | 300 | 200 | -- | 100 | 3 | -- | Advanced Topics in Statistics and Probability | EMM 606 | 4 |
| 3 | 300 | 200 | -- | 100 | 3 | EMM 504 | Advanced Topics in Applied Mathematics | EMM 607 | 5 |

 **2. Criteria for Admission:**

The student should hold a (good) grade in the undergraduate B. Sc. degree to join the Master 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 - Shoubra, issued 2012.

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

The student should complete 12 credit hours of preparatory studies with a grade point average of at least (C+). Total number of required credit hours is 18 hours from courses of level 600. The student should prepare master thesis (18 credit hours) and the viva is held after the student passes all courses of this phase with a grade point average of at least (C). 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 2012.

 **4. English Language Requirement:**

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

 **5. 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
1. **Map**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **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 | 2.2.1 | 2.2.2 | 2.2.3 | 2.2.4 | 2.2.5 | 2.2.6 | 2.2.7 | 2.3.1 | 2.3.2 | 2.3.3 | 2.4.1 | 2.4.2 | 2.4.3 | 2.4.4 | 2.4.5 | 2.4.6 | 2.4.7 | 2.4.8 |
| EMM 401 | √ |  | √ | √ |  |  |  |  |  |  | √ |  |  | √ |  |  | √ |  |  |  | √ | √ |  |  |
| EMM 402 | √ | √ |  |  |  |  |  |  | √ |  |  |  | √ |  | √ |  | √ |  | √ |  |  |  |  |  |
| EMM 403 | √ |  | √ | √ |  |  |  |  |  |  | √ |  |  | √ |  |  | √ |  |  |  | √ | √ |  |  |
| EMM 404 | √ |  | √ | √ |  |  |  |  |  |  | √ |  |  | √ |  |  | √ |  |  |  | √ | √ |  |  |
| EMM 405 |  |  |  |  | √ | √ | √ | √ |  |  |  |  |  |  | √ | √ |  | √ |  |  |  |  |  | √ |
| EMM 406 | √ | √ |  |  |  |  |  |  |  | √ |  | √ |  |  | √ | √ |  |  |  | √ |  |  | √ |  |
| EMM 407 |  |  |  |  | √ | √ |  |  | √ | √ |  |  |  | √ | √ |  |  | √ | √ |  |  |  |  |  |
| EMM 408 |  | √ | √ |  |  |  | √ | √ |  |  |  |  |  |  |  | √ |  |  |  | √ |  |  |  | √ |
| EMM 409 |  | √ |  |  |  | √ | √ | √ |  |  |  |  |  | √ |  |  |  |  | √ | √ |  |  |  |  |
| EMM 410 |  |  |  |  | √ | √ |  |  |  |  | √ | √ |  |  | √ |  |  |  |  |  |  |  | √ | √ |
| EMM 411 | √ |  |  |  |  |  |  | √ |  |  |  |  | √ |  |  | √ |  |  |  | √ |  |  |  |  |
| EMM 412 |  |  |  | √ | √ |  |  |  | √ |  |  |  | √ |  | √ |  |  | √ | √ |  |  |  |  |  |
| EMM 413 | √ |  | √ | √ |  |  |  |  |  |  | √ |  |  | √ |  |  | √ |  |  |  | √ | √ |  |  |
| EMM 414 |  |  |  |  | √ |  |  |  |  |  | √ |  |  | √ |  |  |  |  |  | √ |  |  |  |  |
| ENG 501 | √ |  | √ | √ |  |  |  |  |  |  | √ |  |  | √ |  |  | √ |  |  |  | √ | √ |  |  |
| ENG 506 |  |  |  |  | √ | √ | √ | √ |  |  |  |  |  |  | √ | √ |  | √ |  |  |  |  |  | √ |
| EMM 501 | √ |  |  |  | √ |  | √ |  | √ |  |  |  |  | √ |  |  | √ |  | √ | √ |  |  |  |  |
| EMM 502 | √ | √ |  |  |  |  |  |  | √ |  |  |  | √ |  | √ |  | √ |  | √ |  |  |  |  |  |
| EMM 503 | √ | √ |  |  |  |  |  |  | √ | √ |  |  |  |  | √ |  | √ | √ |  |  |  |  |  |  |
| EMM 504 |  |  |  |  | √ | √ |  |  | √ | √ |  |  |  | √ | √ |  |  | √ | √ |  |  | √ |  |  |
| EMM 601 | √ |  | √ | √ |  |  |  |  |  |  | √ |  |  | √ |  |  | √ |  |  |  | √ | √ |  |  |
| EMM 602 | √ |  |  |  |  |  |  | √ |  |  | √ |  |  | √ |  |  |  |  | √ |  |  | √ |  |  |
| EMM 603 | √ |  | √ | √ |  |  |  |  |  |  | √ |  |  | √ |  |  | √ |  |  |  | √ | √ |  |  |
| EMM 604 |  |  | √ | √ |  |  |  |  |  | √ |  |  |  |  |  | √ |  | √ |  |  |  |  |  |  |
| EMM 605 | √ | √ |  |  |  |  |  |  | √ |  |  |  |  |  | √ |  | √ |  | √ |  |  |  |  |  |
| EMM 606 |  |  |  |  |  | √ |  |  | √ |  | √ |  |  | √ |  |  |  |  |  | √ |  |  |  |  |
| EMM 607 |  |  |  |  | √ |  | √ |  |  |  |  |  |  |  |  | √ |  |  |  | √ |  |  |  |  |

**Program coordinator:**  Prof. Dr. Mohamed Ismail Hussien

**Head of department: Prof. Dr.** Said Abdallah **Date: 28 / 7 / 2015**