**Benha University Course Specifications (2014 - 2015) Faculty of Engineering**

1. **Basic Information**

**Course Title**: Functional Analysis **Code**: **EMM 601 Units: 3**

**Lecture**: 3 **Tutorial**: - **Practical**: - **Total:** 3

**Program on which the course is given:** Master of Science in Engineering Mathematics

**Major or minor element of program:** Major

**Department offering the program:** Department of Engineering Mathematics and Physics

**Department offering the course:** Department of Engineering Mathematics and Physics

**Academic year / level:** Academic year2014 / 2015 Second Semester

**Date of specifications approval:**  December 2015

1. **Professional Information**
2. **Overall aims of course**

By the end of the course the students will be able to:

* Recognize discrete mathematics for functional analysis
* Identify Mathematical definitions and proofs as well as on applicable methods.
* Deal with Topics: formal logic notation, proof methods; induction, well-ordering; sets, relations
* Review of Engineering Mathematics and Computers in the last 10 years.

1. **Intended Learning outcomes of Course (ILOs)**
2. **Knowledge and Understanding:**

2.1.1 Identify theories and fundamentals of functional analysis.

2.1.3 Outline the scientific developments in linear spaces.

2.1.4 Summarize the moral and legal principles of different normed spaces.

1. **Intellectual Skills**

2.2.5 Assess Topological spaces to analyze problems.

1. **Professional and Practical Skills**

2.3.1 Master basic professional and modern skills in general functional analysis.

1. **General and Transferable Skills**

2.4.1 Communicate effectively using researches of new topics about linear spaces, metric space and normed spaces

2.4.5 Assess the performance of linear operators

2.4.6 Work in a group and manage time effectively

1. **Contents**

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| **No** | **Topic** | **No. of hours** | **ILOs** | **Teaching / learning methods and strategies** | **Assessment method** |
| 1 | Linear spaces | 3 | 2.1.1, 2.1.3 | Lectures | Assignments |
| 2 | Normed spaces | 3 | 2.1.1, 2.1.4 | Lectures | Assignments |
| 3 | Hilbert spaces | 3 | 2.1.3, 2.2.5 | Lectures | Mid-term exam, Final exam |
| 4 | Dual spaces | 3 | 2.3.1, 2.4.5 | Lectures | Quiz  Mid-term exam, Final exam |
| 5 | Linear operators | 3 | 2.4.1, 2.2.5 | Class activity, Tutorial | Assignments  Mid-term exam, Final exam |
| 6 | Bounded linear operators | 3 | 2.4.6, 2.3.1, 2.4.1 | Lectures, Tutorial | Mid-term exam, Final exam |
| 7 | Spectral theory | 3 | 2.4.6, 2.3.1 | Lectures | Assignments  Mid-term exam, Final exam |
| 8 | Mid-term Exam | 3 |  | -- | Mid-Term exam |
| 9 | Dual Operators | 3 | 2.1.4, 2.4.6 | Lectures | Quiz, Final exam |
| 10 | Self-adjoint bounded | 3 | 2.1.4, 2.4.6 | Lectures | Assignments, Final exam |
| 11 | Operators | 3 | 2.1.4, 2.4.6 | Lectures | Quiz, Final exam |
| 12 | Normed operators | 3 | 2.1.4, 2.4.6 | Lectures, Tutorial | Assignments, Final exam |
| 13 | Unitary operators | 3 | 2.4.1, 2.4.5 | Lectures, Tutorial | Quiz, Final exam |
| 14 | Banach algebras – Symmetric operators | 3 | 2.4.1, 2.4.5 | Class activity, Tutorial | Assignments, Final exam |
| 15 | Final Exam |  |  |  |  |

1. **Teaching and Learning Methods**
   1. Lectures
   2. Class activity
   3. Self study 
   4. Research assignments and the use of internet. 
2. **Student Assessment Methods**
   1. Homework assignments and others
   2. Quiz to assess student’s creativity and problem assessments.
   3. Final exam to assess understanding and scientific knowledge. 

Assignments to assess 2.1.1, 2.1.3, 2.1.4 2.2.5, 2.3.1, 2.4.1, 2.4.5, 2.4.6

Quiz to assess 2.1.1, 2.1.3, 2.1.4 2.2.5, 2.3.1

Mid-Year exam to assess 2.1.1, 2.1.3, 2.1.4 2.2.5, 2.3.1

Final exam to assess 2.1.1, 2.1.3, 2.1.4 2.2.5, 2.3.1,

1. **Assessment schedule**

Assessment 1 All weeks 

Assessment 2 Quizzes

Assessment 3 Final exam on the 15thweek

1. **Weighting of Assessments**

Final- Term Examination 67 %

Oral Examination 00 %

Practical Examination 00 %

Year Work 33 %

Other 00 %

Total 100 %

1. **List of References**
   1. Course Notes

* Lecture material and training sheets
  1. Essential Books (Text Books)
* Functional Analysis By Frigyes Riesz
  1. Recommended Books
  + Exercises in Functional Analysis Texts in the Mathematical Sciences
  + Introduction to Functional Analysis Oxford Graduate Texts in Mathematics By Reinhold Meise, Dietmar Vogt, M.S. Ramanujan
  1. Periodicals Web sites, etc
* [www.Google.com](http://www.Google.com)

1. **Facilities Required for Teaching and learning**

White board, prepared notes, Sheets and solving problems.

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| **Course coordinator:** Prof. Dr. Mohamed Ismail |  |
| **Course instructor:** Prof. Dr. Mohamed Ismail |

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