Course specifications

Programme(s) on which the course is given M.Sc. Mathematics, Pure mathematics

Major or minor element of programs	Major
Department offering the program	Mathematics
Department offering the course	Mathematics
Date of specification approval	September 2008

A- Basic Information

Title: Functional analysis Code: M6117
Credit Hours: 2 Lecture: 2
Tutorial: 0 Practical: 0 Total: 2
Teaching Staff Prof. Dr. Abd El-Shakoor Sarhan

B- Professional Information

1 – Overall aims of course

To develop understanding of fundamental concepts and techniques of Functional analysis,

this course discusses briefly the basic Inner product spaces, Hilbert spaces, and orthonormal systems, This is followed by discussions of strong and weak convergence, orthogonal comple-ments and projection theorems, linear functionals, and the Riesz representation theorem. A big part of this course is devoted to the theory of linear operators on Hilbert spaces with special emphasis on different kinds of operators and their basic properties. Bi linear functionals and quadratic forms leading to the Lax–Milgram theorem are discussed. In addition, eigenvalues and eigenvectors of linear operators are studied in some detail.

On successful completion of this course unit students will

- be familiar enough with functional analysis that can effectively use the tools and ideas of these fundamental subjects in a variety of applications,

- understand the importance of the convergence, linear functionals, the linear operators on Hilbert spaces.
- understand the concept of the bilinear functionals, and the quadratic forms,
- understand the concept of the eigenvalues and eigenvectors of linear operators.

2 – Intended learning outcomes of course (ILOs)

a- Knowledge and understanding:

a1-Understand the Hilbert space, orthonormal systems, This strong and weak convergence, orthogonal complements and projection theorem.

a2- Know the linear functionals, the Riesz representation theorem, linear operators on Hilbert spaces

a3-Understand the Bi-linear functionals and quadratic forms leading to the Lax–Milgram theorem

b- Intellectual skills

b1- Identify the difference between different kinds of operators on Hilbert spaces

b2- Think perfectly to check for linear and bi-linear functionals.

c- Professional and practical skills

c1-apply the understanding of the Hilbert spaces in further related mathematical courses .

c2- use the knowledge and understanding of strong and weak convergence, orthogonal complements and projection in practice for other related courses.

c3- use the knowledge and understanding of computing the eigenvalue and eigenvectors of linear operators

d- General and transferable skills

d1- creative thinking to use the concepts and principles learned from this course.

d2- able to develop his skills in this area of study.

3- Contents

Topic	No. of	Lecture
Inner product spaces Hilbert spaces	6	3
Linear functionals and Riesz representations theorem	6	3
Adjoint and self adjoint operators Positive operators	6	3
Eigen values and eigen vectors Spectral decomposition	6	3

4– Teaching and learning methods

4.1- Lectures

4.2- Working on hand in assignments

4.3- Attainting practical classes

5- Student assessment methods

5.1 Mid term written exam… to assess understanding competencies

5.2 Semester hand in assignments to assess attendance and interesting

5.3Final term written Exam to assess
Learning outcomes and understanding .

Assessment schedule

Assessment 1… Mid term……. Week 4 and 7 …….

Assessment 2 …semester activities…… Week 5 and 8 …….

Assessment 3…Final term oral exam…… Week 13…….

Assessment 4…final term written exam……. Week 14…….

Weighting of assessments

Mid-Term Examination	20%
Final-term Examination	60%
Oral Examination.	00%
Semester Work	20%
Total	100%

Any formative only assessments

6- List of references

6.1- Course notes

Collected and prepared notes that cover the main topics

6.2- Essential books (text books)

Linear Algebra , Vol.2, Eagle Mathematics series , Michael O' Nan, 1971

6.3- Recommended books

ISBN Number	Author	Date	Title	Publisher
0-12-208438-1	Lokenath Debnath and Piotr Mikusi ´ nski	2005	Hilbert Spaces with Applications	Elsevier Inc.
978-81-85931-89-0	Rajendra Bhatia	2009	Notes on Functional Analysis	Hindustan Book Agency (India)
0-471-50731-8	Erwin Kreyszig	1978	Introductory Functional analysis With applications	John Wiley & Sons. Inc.

6.4- Periodicals, Web sites, … etc

None

7- Facilities required for teaching and learning

Non

Course coordinator: Prof. Dr. Abd El-Shakoor Sarhan , Dr. Manar Abdel-Allh

Head of Department: Prof. Dr. Mohamed A. Ramadan

Date: / /