

4/1/4. Course Specification:

## COURSE SPECIFICATIONS Form

Course Title: Introduction to Functional Analysis

Course Code: 4046101-4

## Course Specifications

Institution: Umm Al-Qura University	Date: March 31, 2018
College/Department : Faculty of Applied Science – Department of Mathematical Sciences	

### A. Course Identification and General Information

1. Course title and code: Introduction to Functional Analysis (4046101-4)			
2. Credit hours: 4 Hours			
3. Program(s) in which the course is offered. (If general elective available in many programs indicate this rather than list programs) Master in Mathematics			
4. Name of faculty member responsible for the course		Dr. A. Alahmari	
5. Level/year at which this course is offered: First Year, level 1			
6. Pre-requisites for this course (if any): Measure and Integration (4044105-3)			
7. Co-requisites for this course (if any):			
8. Location if not on main campus: Al-Abdia Campus and Al-Zahir campus			
9. Mode of Instruction (mark all that apply):			
a. traditional classroom	<input checked="" type="checkbox"/>	What percentage?	<input type="text" value="100"/>
b. blended (traditional and online)	<input type="checkbox"/>	What percentage?	<input type="text"/>
c. e-learning	<input type="checkbox"/>	What percentage?	<input type="text"/>
d. correspondence	<input type="checkbox"/>	What percentage?	<input type="text"/>
f. other	<input type="checkbox"/>	What percentage?	<input type="text"/>
Comments:			

## B Objectives

1. What is the main purpose for this course?

The main purpose of this course is to introduce the student to the of functional analysis. The theory includes operators on Banach spaces. The four big theorems in functional analysis, namely, Hahn-Banach theorem, uniform boundedness theorem, open mapping theorem and Banach-Steinhaus theorem will be covered.

2. Briefly describe any plans for developing and improving the course that are being implemented. (e.g. increased use of IT or web-based reference material, changes in content as a result of new research in the field)

- 1) Updating references used in teaching process.
- 2) Using e-learning facilities more efficiently.
- 3) Encouraging students to collect problems from web-based reference material and supervise classroom discussions.

## C. Course Description (Note: General description in the form used in Bulletin or handbook)

Course Description:

This is a 4 credit hours course comprising approximately 60 hours of lectures.

### 1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
Normed linear spaces and Banach spaces. Linear operators on Banach spaces. Linear functionals	4	16
Hanh-Banach Theorem. Open Mapping Theorem. Uniform. Boundedness Principle. Banach-Steinhaus Theorem, Closed Graph Theorem	4	16
Weak Topologies: Duality, The classical Banach spaces: $\ell^p$ , $L^p$ , $C(K)$ Alaoglu's Theorem, Reflexivity, Separability. The Krein-Milman Theorem.	4	16
The Adjoint of a Linear Operator, Compact operators, finite rank operators Weakly compact operators.	3	12

### 2. Course components (total contact hours and credits per semester):

	Lecture	Tutorial	Laboratory/ Studio	Practical	Other:	Total
Contact Hours	60	0				60

Credit	4	0		4
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3. Additional private study/learning hours expected for students per week. Four hours weekly for homework and revision
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4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategy
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**On the table below are the five NQF Learning Domains, numbered in the left column.**  
**First**, insert the suitable and measurable course learning outcomes required in the appropriate learning domains (see suggestions below the table). **Second**, insert supporting teaching strategies that fit and align with the assessment methods and intended learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy ought to reasonably fit and flow together as an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	<b>Knowledge:</b> After successful completion of the course, the student should be able to		
1.1	1) Apply the fundamental theorems of functional 2) Apply Riez theorem to understand the dual of the algebra $B(H)$ . 3) Employ the Gram-Schmidt process. 4) Apply some results on Hilbert spaces to (partial) differential Equations.	Lectures Tutorials Discussion Problem Solving	Exams Home work.
2.0	<b>Cognitive Skills</b>		
2.1	5) Planning rigorous proofs of different propositions and assertions in this context. 6) Apply basic theorems for Banach spaces. 7) Investigate examples to which the theories under concern can be applied.	Lectures	Periodic written and oral tests. Discussion. Observation.
3.0	<b>Interpersonal Skills &amp; Responsibility</b>		
3.1	1) Punctual attendance of classes is required. 2) Students should demonstrate their sense of responsibility for learning by completing both reading and writing		

	assignments in due time. 3) Students learn to manage their time. 4) Students should act responsibly and ethically in carrying.		
<b>4.0</b>	<b>Communication, Information Technology, Numerical</b>		
4.1	Work effectively in groups and independently.	Tasks assigned and homework.	Marking the assignments
4.2	Solve problems concerning the topics of the course.	Home work	Evaluating the homework
<b>5.0</b>	<b>Psychomotor</b>		
5.1	Not applicable	Not applicable	Not applicable
5.2	Not applicable	Not applicable	Not applicable

5. Schedule of Assessment Tasks for Students During the Semester			
	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	First periodic exam	6	20
2	Second periodic exam	10	20
4	Homework + reports + Quizzes	Over all weeks	20
5	Final exam	End	40

#### D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice. (include amount of time teaching staff are expected to be available each week) 1- Office hours per week in the lecturer schedule (4 hours per week). 2- Contact with students by e-mail, SMS, and e-learning facilities.
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#### E Learning Resources

1. List Required Textbooks Conway, J. B.: A Course in Functional Analysis, 2nd edition, Springer-Verlag, 1994, ISBN 0-387-97245-5
2. List Essential References Materials (Journals, Reports, etc.) R.F. Curtain and A.J. Pritchard, Functional Analysis in Modern Applied Mathematics, Academic Press (1977).
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.
4. Other learning material such as computer-based programs/CD, professional standards or regulations and software. Microsoft Word, Latex

#### F. Facilities Required

Indicate requirements for the course including size of classrooms and laboratories (i.e. number of seats in classrooms and laboratories, extent of computer access, etc.)
1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.) Classroom with capacity of 30-students. - Library.
2. Technology resources (AV, data show, Smart Board, software, etc.)
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)  None

## G Course Evaluation and Improvement Processes

<p><b>1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching:</b></p> <ul style="list-style-type: none"> <li>• Student feedback through electronic survey organized by the deanship of registration and acceptance.</li> </ul>
<p><b>2 Other Strategies for Evaluation of Teaching by the Instructor or by the Department</b></p> <ul style="list-style-type: none"> <li>• Evaluation of the teachers by internal &amp; external faculty members .</li> <li>• Visiting to the classrooms .</li> <li>• Mutual visits between colleagues and giving advices to each other after each lecture</li> </ul>
<p><b>3 Processes for Improvement of Teaching</b></p> <ul style="list-style-type: none"> <li>• Analysis of student course evaluation and feedback</li> <li>• Peer evaluation and feedback</li> <li>• Review of course portfolios</li> <li>• Workshops on pedagogical methods</li> </ul>
<p><b>4. Processes for Verifying Standards of Student Achievement (eg. check marking by an independent member teaching staff of a sample of student work, periodic exchange and remarking of tests or a sample of assignments with staff at another institution)</b></p> <ul style="list-style-type: none"> <li>• Analysis of course assessments by other reviewers on a periodic basis.</li> </ul>

**5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.**

- Material and learning outcomes are periodically reviewed internally and externally .
- Comparing course content and teaching methodologies with similar courses offered at other departments and universities .
- Studying the outcomes of the students' evaluations of the course and use it to improve teaching strategies .

Name of Course Instructor: Dr. A. Alahmari

Signature: \_\_\_\_\_ Date Specification Completed: April 15, 2018

Program Coordinator: \_\_\_\_\_

Signature: \_\_\_\_\_ Date Received: \_\_\_\_\_