

4/1/4. Course Specification:

COURSE SPECIFICATIONS

Form

Course Title: Operator Theory

Course Code: 4045103-4

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: Operator Theory 4046103-4			
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. Mohamed Mabrouk			
5. Level/year at which this course is offered: Second Year			
6. Pre-requisites for this course (if any): Introduction to functional analysis (4046101-4) Measure and Integration (4044105-3)			
7. Co-requisites for this course (if any): General Topology (4046601-4)			
8. Location if not on main campus: Al-Abdia and Al-Zahir Campuses			
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 aim of this course is to introduce some of the fundamental tools of the operator theory.
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)
 - Updating references used in teaching process.
 - Using e-learning facilities more efficiently.
 - 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.	
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1. Topics to be Covered		
List of Topics	No. of Weeks	Contact hours
Basic theory of Hilbert spaces: Inner product spaces, geometric and metric properties of Hilbert spaces	2	8
Orthogonal complements and direct sums, Orthonormal sets and sequences, Bessel inequality, Total sets and Total Orthonormal sets, Separable Hilbert spaces, Projection on a closed convex set. Functional on Hilbert spaces and Riesz' s theorem.	2	8
Adjoint of an operator, Spectrum of a self-adjoint operator, Spectral properties of self-adjoint operator, Functional Calculus for a self-adjoint operator	3	12
Compact operators: Definition and properties, Finite rank operators, Spectral properties of Compact operators	3	12
Self-adjoint compact operators: Spectral decomposition of finite rank operators and self-adjoint compact operators.	3	12

Application to Sturm-Liouville system; Fredholm alternatives; Integral equations.	2	8
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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
3. Additional private study/learning hours expected for students per week. Four hours weekly for homework and revision						

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategy

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	Knowledge: After successful completion of the course, the student should be able to		
1.1	1) Know the basic the spectrum of operator 2) Determine the spectrum of well-known operators. 3) The spectral theorem for bounded operators, Continuous functional calculus for self-adjoint operators 4) Spectral measures, The spectral theorem for self-adjoint operator	Lectures Tutorials Discussion Problem Solving	Exams Home work.
2.0	Cognitive Skills		
2.1	5) Planning rigorous proofs of different propositions and assertions in this context.	Lectures	Periodic written and oral tests. Discussion.

	6) Investigate examples to which the theories under concern can be applied. 7) Use lecture notes and other texts to solve challenging problems.		Observation.
3.0	Interpersonal Skills & Responsibility		
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.		
4.0	Communication, Information Technology, Numerical		
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
5.0	Psychomotor		
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.

E Learning Resources

1. List Required Textbooks <ul style="list-style-type: none"> Conway, J. B.: A Course in Functional Analysis, 2nd edition, Springer-Verlag, 1994, ISBN 0-387-97245-5 Rabindranath Sen, A first course in functional analysis: theory and applications, Anthem press, 2013
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

1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching: <ul style="list-style-type: none"> Student feedback through electronic survey organized by the deanship of registration and acceptance.
2 Other Strategies for Evaluation of Teaching by the Instructor or by the Department <ul style="list-style-type: none"> Evaluation of the teachers by internal & external faculty members. Visiting to the classrooms. Mutual visits between colleagues and giving advices to each other after each lecture

3 Processes for Improvement of Teaching

- Analysis of student course evaluation and feedback
- Peer evaluation and feedback
- Review of course portfolios
- Workshops on pedagogical methods

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)

- Analysis of course assessments by other reviewers on a periodic basis.

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. Mohamed Mabrouk

Signature: _____ Date Specification Completed: April 15, 2018

Program Coordinator: _____

Signature: _____ Date Received: _____