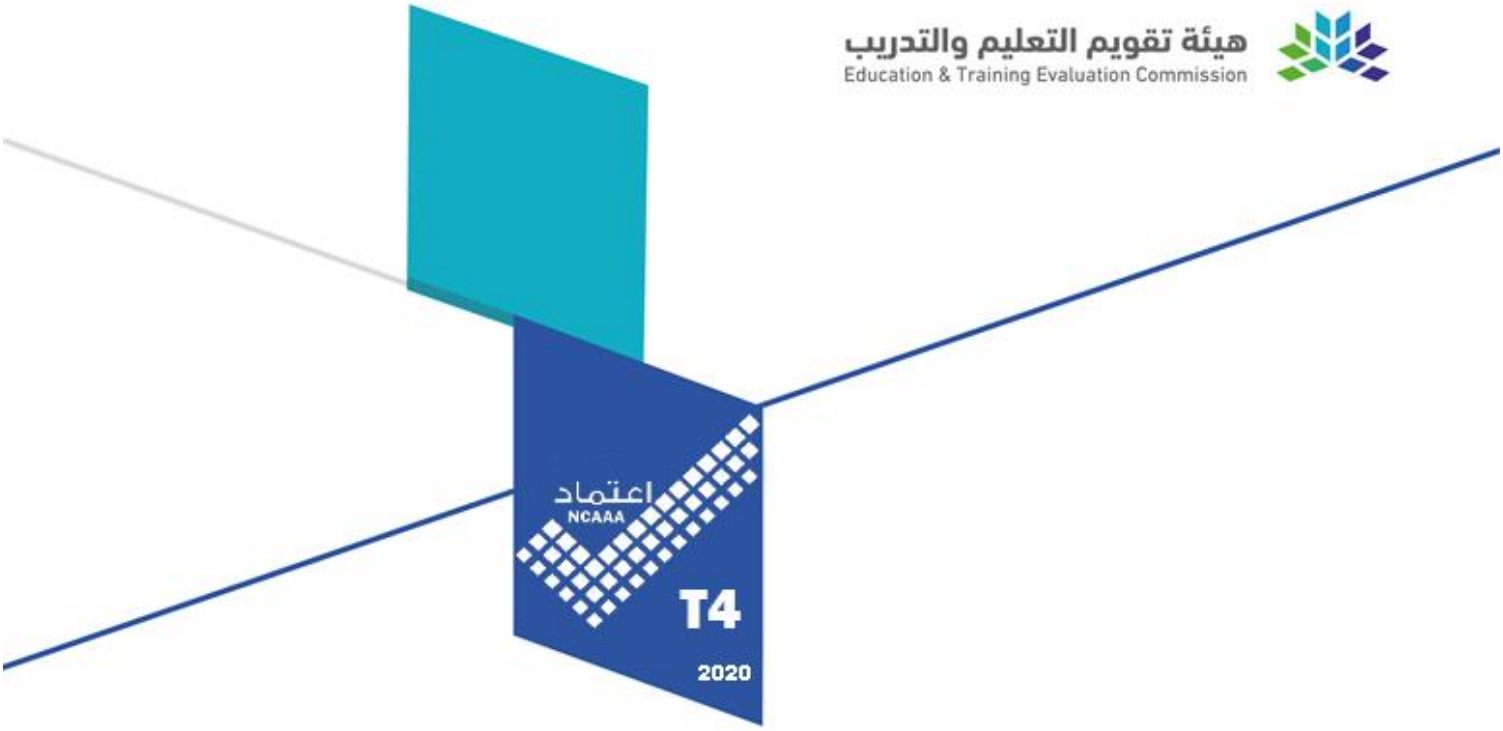
هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission



Course Specifications

Course Title:	**Functional Analysis**
Course Code:	**MATH 4420**
Program:	**Bachelor of Science in Mathematics**
Department:	**Mathematics**
College:	**College of Science and Humanities Alkharj**
Institution:	**PRINCE SATTAM BIN ABDUALZIZ UNIVERSITY**

Table of Contents

A. Course Identification

1. Credit hours:	**04**
2. Course type	
a.	University ☐ College ☐ Department ☑ Others ☐
b.	Required ☑ Elective ☐
3. Level/year at which this course is offered:	Elective
4. Pre-requisites for this course (if any)**:**	Math 3280, Math 3460
5. Co-requisites for this course (if any)**:**	None

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	04 hrs a week	100%
2	**Blended**		
3	**E-learning**		
4	**Distance learning**		
5	**Other**		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	48
2	**Laboratory/Studio**	0
3	**Tutorial**	0
4	**Others** (specify) – (5 Office Hours in a week)	60
	Total	108

B. Course Objectives and Learning Outcomes

1. Course Description

Normed spaces and Banach spaces
Linear operators on a normed space
Linear functionals and Hahn-Banach Theorem
The uniform boundedness principle, Open mapping Theorem and Closed Graph Theorem
Hilbert spaces
Linear operators on Hilbert spaces

2. Course Main Objective

- To make the students familiar with the basic concepts of normed spaces and Banach spaces, of linear operators and linear functionals; Hahn-Banach Theorem and its applications; the uniform boundedness principle, Open mapping Theorem and Closed Graph Theorem; inner product spaces; To accustom the theory of operators on Hilbert spaces

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	Understand basic Concepts of normed spaces and Banach spaces., inner product spaces, Hilbert Spaces and its operators etc/	K1
1.2	To be familiar with basic theory of linear operators and linear functionals and associated theories	K2
2	**Skills :**	
2.1	Select and apply appropriate mathematical method and arguments to solve problems	S1
2.2	Write simple proof and make presentations	S2

C. Course Content

No	List of Topics	Contact Hours
1	Normed spaces and Banach spaces	14
2	Linear operators on a normed space	8
3	Linear functionals and Hahn-Banach Theorem	8
4	The uniform boundedness principle, Open mapping Theorem and Closed Graph Theorem	6
5	Hilbert spaces	3
6	Linear operators on Hilbert spaces	6
Total		45

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
1.0	**Knowledge and Understanding**		
1.1	Understand basic Concepts of normed spaces and Banach spaces., inner product spaces, Hilbert Spaces and its operators etc/	1. Class Room Lectures 2. Interactive sessions 3. Exclusive Office Hours for clearing doubts in small groups	1. Two Internal Exams 2. At least two Quiz 3. End Semester Exam
1.2	To be familiar with basic theory of linear operators and linear functionals and associated theories		
2.0	**Skills**		
2.1	Select and apply appropriate mathematical method and arguments to solve problems	1. Application oriented exercises 2. Homework to improve the analytical skills	1. Homework 2. Assignments 3. Quiz 4. Exams
2.2	Write simple proof and make presentations		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Mid Term Exam I	6	20%
2	Quiz	4 & 10	5%
3	Mid Term Exam II	13	20%
4	Continuous Assessment – Homework, Assignment, Attendance etc.	--	5%
5	End Semester Exam (Practical 10%, Theory 40%)	15	50%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

1. Exclusive Office Hours – 5 Hours per week
2. Academic Advising for Students – 1 Hour per week

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Giles J. R., "Introduction to the Analysis of Normed Linear Spaces", Cambridge University, Press (2000)..
Essential References Materials	- Introduction to Functional Analysis with Applications , E.Kreyzing, John Wiley and Sons, New York (1978). - Functional Analysis, Sobolev Spaces and Partial Differential Equations , Haim Brezis, Universitext (2011). - Applied Functional Analysis , D.H. Griffel, (Dover Books on Mathemtics)
Electronic Materials	
Other Learning Materials	Lecture Notes Prepared by the Department of Mathematics

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Classrooms with Smart boards with seating facilities for at least 30 students
Technology Resources (AV, data show, Smart Board, software, etc.)	Smartboard, Internet Connection for Blackboard Computer Lab with software packages such as Excel etc.

Item	Resources
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	Nil

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Course Evaluation	Quality Assurance Committee of the Department	Review all the course documents and course report
Peer Review	Senior Faculty Members / HoD	Attend the lecture and fill in a form
End Semester online survey	students	online survey

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes,Quality oflearning resources, etc.)
Evaluators (Students,Faculty, Program Leaders,Peer Reviewer, Others (specify)
Assessment Methods(Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	