Course Outline Template

Spring 2023

Course Name: Functional Analysis

Course Code: Math-407	**Course Type (elective)**	**Course Credits: 3**

Class Timings: M, W, F 9:00 am – 9:50 am S-410	**Section: A**	**Student Meeting Hours/ Office Hours:** **M W**: 11:00 am – 02:00 pm **F:** 11:00 am – 12:00 pm **T R**: 09:30 am – 10:30 am

Instructor Name: Imrana Shafique

A Note from the Instructor:
"I CAN" is 100 times more important than "I.Q"

Instructor Contact Details
Email: imranashafique@fccollege.edu.pk
Mobile: 0311-2826362
Guidelines for contacting instructor:
You may visit my office during office hours. In order to get some other time slot for meeting kindly email.
You may call on my number in between 9:00 am to 7:00 pm except Saturday and Sunday.

Course Description:
Pre-requisites: Math-311
This is a course describing pure Mathematics. Course content include the following: Normed spaces, Banach spaces, convex spaces, equivalent norms, quotient spaces, finite dimensional normed spaces, linear operators, continuous or bounded linear operators, dual spaces, inner product spaces, orthonormal sets and basis, Hilbert spaces, annihilators, projections and decomposition theorem in Hilbert spaces, linear functionals on Hilbert spaces and reflexivity of Hilbert spaces.

Main Mode of Instruction: On-Campus
Technology Requirements: Notes and soft copy of book will be shared through moodle.

Course Objectives or [Student Learning Outcomes](SLOs)
Upon successful completion of this course, students will be able to

- understand the key concepts such as norm, normed spaces, Banach spaces etc.

- discuss convergence in normed spaces,

- recognize inner product spaces,

- identify dual spaces of normed spaces,

- understand functionals,

- explain some properties of Hilbert spaces,

- deal with abstract Mathematics,

- connect Topology and Metric spaces with Functional analysis,
- participate effectively in group activities,
- present confidently.

Course Content, Learning Material & Activities Schedule

Week	Topics	Assessment
1	Discussion of Course Plan: course introduction, policies, requirements and grading criteria. A brief review of vector spaces and metric spaces. **Normed spaces:** Norm.	
2	Normed spaces and its examples.	
3	Banach spaces and its examples. Convergence in normed space and its basis.	Quiz- 1
4	Convergence in normed space and its basis (cont.)	
5	Convex set.	Assignment 1
6	Quotient spaces, Equivalent norms.	
7	Finite dimensional normed spaces. **Linear Operators:** Linear operators, inverse of linear operators.	Quiz 2
8	Continuous or bounded linear operators.	**Mid Term**
9	Linear functionals.	
10	Dual spaces of a normed space. **Hilbert Spaces:** Inner product spaces,	
11	Cauchy Schwarz Inequality, Theorems on inner product spaces,	Quiz-3
12	inner product spaces as metric spaces.	
13	Orthogonal and Orthonormal systems. Orthogonalisation theorem.	Assignment 2
14	**Decomposition Theorems in Hilbert Spaces:** Annihilators.	Quiz 4

15	Projections in Hilbert spaces.	
	Linear functionals on Hilbert spaces.	Presentation
	FINAL EXAM	**As announced by university**

'Out-of-class'
Students are expected to learn the attended lecture regularly. Coming to the class with a prior idea of lecture will be beneficial for the student.

Textbooks, Materials, Supplies, and other Resources
Introductory Functional Analysis with Applications,

By Erwin Kreyszig

Elements of Topology and Functional Analysis,

By Dr. Abdul Majeed

Course Requirements:
Class Participation
Attending a lecture is not enough, for maximizing the learning students need to participate in class as well that includes discussions and participation in the class activities.
Assignment
After due date, assignment will be marked as zero.
Presentation
In presentation, students are expected to present assigned topic, answering the questions asked by their class fellows or instructor. They may use their hand-written notes during presentation.

Average score of assignment and presentation will cover 15% of total score.
Quiz and Exam
There will be no make-up quiz. Three best of four quizzes will be counted towards your total score.
Only make up of mid-term or final can be considered if solid proof will be provided **within three days after exam**. In case of make-up exam there will be a **0-20% deduction** in marks depending upon case to case basis. Academic dishonesty or cheating will result in zero points (grade F) and will be referred to AIC (Academic Integrity Committee) at FCC for necessary action.
Mobile phones are not allowed.

The breakup is as follows:
Assignment and presentation   **15%**
Quizzes   **20%**
Mid Term   **30%**
Final Exam   **35%**
Total   **100%**

Attendance Policy:
If a student arrives 10 minutes late, he/she will not be marked as present. *Minimum 70% attendance is required to appear in the final term exam*.

Classroom Participation:
Classroom Participation:
Students must behave well in class. Participate in discussions, class activities and **bonus activities**.

Grade Determination & Course Assessment as per FCC Policy:
No make up of quizzes,
Late submitted assignments will be marked as zero,
Missed presentation will be marked as zero.
Grading Legend
Below is the grading legend of FCCU (published in all catalogs and available on the FCCU website) as approved by the Academic Council

Grade	Point Value	Numerical Value	Meaning
A	4.00	93-100	Superior
A-	3.70	90-92	
B+	3.30	87-89	Good
B	3.00	83-86	
B-	2.70	80-82	
C+	2.30	77-79	Satisfactory
C	2.00	73-76	
C-	1.70	70-72	
D+	1.30	67-69	Passing
D	1.00	60-66	
F	0.00	59 or below	Failing

Student Conduct & Other Issues:
- Consider including ground rules for appropriate classroom interactions, as well as a clear statement of expectations that classroom interactions will remain civil, respectful, and supportive.
- If any student faces any issues or has any concerns regarding the classroom climate and interactions, please feel free to contact VR office ___ gloriacalib@fccollege.edu.pk

Changes to the Syllabus:
This syllabus was designed to convey course information and requirements as accurately as possible. It is important to note however that it **may** be subject to change during the course depending on the needs of the class and other situational factors. Such changes would be for your benefit and you will be notified of them as soon as possible.

Student Support Services

Student Counseling Services. Students can contact the Campus Counseling Center at 0331-444-1518 or email ccc@fccollege.edu.pk.

Writing Center
Mercy Health Center

Other Useful FCCU Policy Documents:

Sexual Harassment Policy
Anti-Corruption Policy
Academic integrity
Plagiarism Policy
Academic Calendar

Additional Communication:

1. Honor FCC Core Values:
   I expect that you will strictly follow the core values of FCCU and put your entire effort to learn as per the course requirements, attend classes, read the textbook(s)/other assigned reading material and do the assignments in the stipulated time period
2. Expectations for Teacher Response to students:
   I generally respond to emails between the hours of 9 AM and 9 PM. If I do not respond within 48 hours, feel free to send a follow-up email.
   This class is available 24/7 but the instructor is not. I will respond to an email Monday through Friday (until 3 pm) unless it is a holiday or extenuating circumstances intervene. During the workweek, you can expect a response within 24 hours, and I expect the same courtesy from my students."