Course Outline

Course Name: Statistical Learning		
Course Code: STAT-414	**Course Type:** Core	**Course Credits:** 3
Class Timings: 10:00-10:50 PM	**Section:** A	**Student Meeting Hours/ Office Hours:** Monday to Friday: 11:00-12.00
Instructor Name: Dr. Nadia Mushtaq, Assistant Professor Department of Statistics, FCCU		

A Note from the Instructor:

- Lectures will be delivered in class face to face
- Lecture and reading Material will be uploaded on Moodle
- Quizzes will be performed during class time.
- Assignment documents will be uploaded on Moodle and their submissions will be considered as in hard copy during class timings
- For all assessments, dates will be announced in classes.

Instructor Contact Details

Email: nadiamushtaq@fccollege.edu.pk
Office: S-418
Office Hours: 11.00 a.m.-12.00a.m.
Guidelines for contacting instructor: Students can contact me during office hours or make an appointment via email during weekdays and wait until I respond.

Course Description:

Pre-requisites if any: STAT-206
Overview of the field of statistical learning. Topics include application knowledge of linear, polynomial regression, logistic regression, classification and linear discriminant analysis. A model validation technique cross validation and resampling method bootstrap, model selection and regularization methods (ridge and lasso). This course also covers non-linear models, splines and generalized additive models, tree-based methods, support vector machines, and clustering methods. We will cover many aspects of these approaches including conceptual, theoretical, and applied aspects. Approaches will be illustrated and implemented in R.

Technology Requirements:

- R and RStudio are required software for this course. R is a freely available language and environment for statistical computing and graphics. RStudio is a free and open-source integrated development environment for R.
- *Main Mode of Instruction*: In-class lectures, reading material, assignment documents will be uploaded on Moodle

Course Objectives:

The goal of this course is to teach the theoretical, advanced and commonly used statistical learning techniques. We will review classical statistical techniques such as linear and logistic regression before covering more advanced statistical techniques such as classification, regularization, nonlinear regression, and other machine learning approaches. The implementation of all approaches in the R statistical software will be taught throughout. By the end of the course, students should be familiar with a wide range of statistical methodologies that are widely used in practice and should be able to apply these approaches to data sets.

Student Learning Outcomes:

At the end of the course the student will:

1) Understand the basic concepts of Statistical learning.
2) Apply supervised (regression and classification) and unsupervised (clustering) techniques of Statistical learning.
3) Choose effective methods to use in solving various learning problem.
4) understand the fundamental theory behind statistical learning methods.
5) implement the statistical learning methods in practice using a statistical computing environment.

Course contents, Learning Material & Activities Schedule

Week #	Topic/ Title	Instructional Material	Assessment
1.	Introduction to Statistical Learning	PowerPoint Presentations, worksheet, activities and Reading Material	
2.	Review of linear regression		Assignment #1
3.	Logistic regression, classification		
4.	Linear discriminant analysis - Quadratic discriminant analysis		Assignment #2
5.	Resampling methods - Cross-validation		
6.	Linear model selection and regularization - Subset selection		Assignment #3 Quiz#1
7.	Shrinkage methods - Ridge regression		

8.	The Lasso	PowerPoint Presentations, worksheet, activities, and Reading Material	Assignment # 4
MID TERM			
9.	Dimension reduce methods, principle component regression	PowerPoint Presentations, worksheet, activities, and Reading Material	
10.	principle component analysis		Assignment #5
11.	Clustering (k-means)		
12.	Clustering (Hierarchical)		Quiz #2
13.	- Random forests - Boosting		
14.	Tree based method		Assignment #6
15.	Support vector machines		Project
16.	Final Project Presentations		
Final Exam			

Textbooks, Materials, Supplies, and Other Resources

Required Text:

- Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, An Introduction to Statistical Learning with Applications in R. Springer

Supplemental:

- Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning: Data Mining, Inference, and Prediction.
- David Dalpiaz, R for Statistical Learning.
- Max Kuhn and Kjell Johnson , Applied Predictive Modeling.
- Cosma Rohilla Shalizi, Advanced Data Analysis from an Elementary Point of View.

Course Requirements:

Class Participation: Class attendance; participation in-class activities and discussions

Assigned Readings

Practice Worksheets/ questions and reading documents

Assignments, Quizzes, Exams and Project.

Grading Legend

Below is the grading legend of FCCU (published in all catalogues and available on the FCCU website) as approved by the Academic Council

Grades	Quality Points	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
NS	0.00	0.00	Did not show up in class

W	-	-	Officially Withdrawn
AW	-	-	Administrative Withdrawal/Dismissal
AU	-	-	Audit/Listener Status
I	-	-	Incomplete
T	-	-	Transferred credit

The entire course is worth 100%, the breakup is as follows (for example):

Class Participation	5%
Assignments:	30%
Quizzes:	10%
Midterm exam:	20%
Final term exam:	20%
Final Project	15%
TOTAL	**100%**

Missed Assignments/Make-Ups/Extra Credit

- NO delayed assignments. There will be 50% deduction of marks for late submission after due date.
- NO Make-up mid/final exam
- NO retake mid/final exam

]

Attendance Policy:
If a student does not attend a minimum of 70% of total classes, he/she will not be permitted to take the final examination in the course.

Classroom Participation:

Students must participate in the classroom for class activities and may ask questions related to the lesson taught. Class participation is also included in your grade

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

- Students can contact the Campus Counseling Center at 0331-444-1518 or ccc@fccollege.edu.pk.
- Writing Center
- Mercy Health Center

Other Useful Links:

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

I expect that you will strictly follow the core values of FCCU and put your entire efforts 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,