NATIONAL UNIVERSITY
of Computer & Emerging Sciences, Lahore

Department of Computer Science

CL 117 – Intro. To information and communication technologies (BCS-1A)

FALL 2019

Instructor Name: Muhammad Waqas Manzoor **TA Name (if any):** NA
Email address: waqas.manzoor@nu.edu.pk **Email address:** NA
Office Location/Number: Liberty lab 237 **Office Location/Number:** NA
Office Hours: After Class **Office Hours:** NA

Course Information

Program: BS **Credit Hours:** 1 **Type:** Core
Pre-requisites (if any): NO
Course Website (if any) : NA
Class Meeting Time: After Class
Class Venue: CS LAB 6

Course Description/Objectives/Goals?

Objective of this course is to give fundamental understanding of Information and Communication technologies and related applications. Basic concepts of Computer architecture and organization, number system (binary, hexadecimal, decimal), application and importance of mathematics in computer science, operating system, database management and relational database concepts, big data, computer networks and communication, internet and world wide web, artificial intelligence, graphics.

Course Learning Outcomes (CLOs):		
At the end of the course students will be able to:	**Domain**	**BT* Level**
Convert one number from one number system to another and understand the importance of mathematics in CS.	C	1
Understand the basic architecture of a computer system and have a basic know how of various operating systems.	C	1
Have a fundamental understanding of data management and its applications and know a few applications of big data.	C	1
Understand the basic components of a communication system	C	1
Understand the basics of web development and should be able to develop a web page	C	3

Have a basic know how of various AI applications	C	1
Understand the basics of graphics and be able to use a tool for graphics or animations	C	3

* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain.

Bloom's taxonomy Levels: 1. Knowledge, 2. Comprehension, 3. Application, 4. Analysis, 5. Synthesis, 6. Evaluation

Tentative Weekly Schedule

Week	Topic	Lecture & Activity
1	Introduction	History and evolution of computing devices. Modern applications of computer Science
2	Number System	Representation of data in binary + conversions in decimal and binary number system representation of signed/unsigned numbers
3	Computer Organization	High level architecture of computer system Basic components of processor and memory
4	Mathematics in Computer Science	Importance of mathematics in computer science and its applications Introduction to the concepts of optimization, graphs, functions and basic counting techniques with reference to their application in mathematics
5	Operating systems	Concept of resources and management of shared resources. Introduction to various operating systems (windows, Linux, Android)
6	Data Management and its applications	Role of data in computer science, types of data (structured, semi structured, unstructured), Introduction to database systems
7	Computer Graphics	Introduction to the field + Use of simple animation tools
8	Communication	Introduction to the basic components of communication system Brief overview of working of computer communication
9	Web development	Introduction to html and its basic tags Exercise to develop a static 3-4 page website
10	Artificial Intelligence	Basic introduction to the field and its commonly used applications One detailed application like autonomous cars
11	Big data	Big data and its applications + challenges A case study like friend/product recommendation in facebook
12, 13, 14	Student Presentations	

	FINAL EXAM

(Tentative) Grading Criteria

1. 9-10 Class Activities (25%)
2. Group Presentations (25%)
3. Final Exam (50%)

Course Policies

1. Quizzes may be un-announced.
2. No makeup for missed quiz or class activity or group presentation.
3. 80% attendance

Grading Model

Absolute

NATIONAL UNIVERSITY
of Computer & Emerging Sciences, Lahore

Department of Computer Science

CS118 – Programming Fundamentals
FALL 2019

Instructor Name: Tazeem Haider
Email address: Tazeem.haider@nu.edu.pk
Office Location/Number: Exam Hall
Office Hours: Tue, Thur 11:30 – 12:30

TA Name: Muhammad Shmoon
Email address: l192295@lhr.nu.edu.pk

Course Information

Program: BS (CS) **Credit Hours:** 3 + 1 (Lab) **Course Type:** Core

Class Meeting Time: Section A: M/W 11:30 – 01:00 PM
Section B: M/W 01:00 – 02:30 PM

Class Venue: CS-10

Course Description/Objectives/Goals:

- To introduce the notion of algorithms.
- To develop problem solving and logic building skills in students.
- To introduce the basic concepts of programming in C++, including basic data types, expressions, iterations, functions and arrays.

Course Learning Outcomes (CLOs):

At the end of the course students will be able to:	**Domain**	**BT* Level**
Understand basic problem solving steps and logic constructs	C	2
Apply basic programming concepts	C	3
Design and implement algorithms to solve real world problems and should be able to translate a problem statement into pseudo−code/C++ code	C	3
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain **Bloom's taxonomy Levels:** 1. Knowledge, 2. Comprehension, 3. Application, 4. Analysis, 5. Synthesis, 6. Evaluation		

Course Textbook

1. C++ Programming: Program Design Including Data Structures, by D. S. Malik (8th Edition)
2. C++: How to Program? by Deitel & Deitel (9th Edition)

Additional references and books related to the course:

1. Theory and Problems of Programming with C++ by John R. Hubbard, 2nd Edition
2. Programming and Problem Solving with C++, Nell Dale
3. www.learncpp.com

Tentative Weekly Schedule

Week 1 Problem Solving and Programming Introduction	**Lecture 1** Course introduction and logistics Introduction to Computers, Basic Computer architecture with an overview of memory as consisting of addressable storage locations for keeping data and program. A program as a sequence of instructions and the Fetch−Decode−Execute cycle Fundamental arithmetic and logical operations provided by a typical machine. Some interesting programs like spreadsheets, databases and intelligent game playing programs etc.	**Lecture 2** A brief introduction of programming languages and the idea of compiling, linking and loading. Introduction of some fundamental operations provided by a Basic/C++ like programming language with/without getting into exact C++ program structure details. These include • Idea of a variable with an understanding that a variable is a place in memory without discussing the internal representation of data. • Assignment of values to variable • Basic arithmetic and logical operations performed on variables. • Input and Output operations Writing some simple programs for performing calculations using the fundamental operations.
Week 2 Simple C++ Programs	**Lecture 3** The structure of a C++ program with a single main function and very brief explanation of #include and named spaces. A high level description of some built in C++ datatypes (int, float, double, char, bool), variables declaration, assignment operator, input, output. Writing the programs introduced in the first week using the C++ syntax. Compiling and running the program	**Lecture 4** A review of Lecture 2 and the Introduction of logical operations and the use of logical operation for conditional execution (IF statements). C++ Operators (Arithmetic, Logical, and Relational) Use of operators for different datatypes. Translating programs written using pseudocode or a flowchart into working C++code.
Week 3 Simple C++ Programs	**Lecture 5** Translating programs written using pseudocode or a flowchart into working C++code continued. A basic introduction of operator precedence and writing complex expressions as a sequence of simple intermediate expressions.	**Lecture 6** Programming exercises. Writing clean code using indentation and comments.
Week 4 Simple C++ Programs If/Else	**Lecture 7** Using a Nested selection structure. Programs with if/else statements	**Lecture 8** Programs with nested if/else statements
MID-I		

Week 5 Repetition Structures(Loops)	**Lecture 9** Repetitions using while, for and do while	**Lecture 10** Problem solving using repetition structures
Week 6 Nested Control Structures	**Lecture 11** Problem solving nested repetition structures	**Lecture 12** Problem solving using nested repetition structures
Week 7 **Functions**	**Lecture 13** Function definition and calling: parameters and return types; Global and local variables scope and life time.	**Lecture 14** Function Parameters: Pass by value and pass by reference. Stack rolling and unrolling**.**
Week 8 **Functions**	**Lecture 15** Top−Down Design of a program and its implementation using functions Built−in functions	**Lecture 16** Function Overloading. Functions with Default Parameters.
Week 9 **File Handling**	**Lecture 17** I/O from simple text Files	
Week 9 **Arrays Introduction and Repetition structure**	**Lecture 18** Define and use fixed sized arrays**.** Array organization in memory and element access using Array name and index. Initialization using member initializer list, and by using loops.	
Week 10 **Arrays Processing**	**Lecture 19** Printing data, taking input, Processing by index and by elements Find Min, Max, Avg, Equilibrium Index Reverse: All Elements, odd/eve elements and indices Search: Linear and Binary	**Lecture 20** Passing arrays to functions. Design different functions for input, output, search, reverse, Shifting and Rotation of elements: right and left Insert and delete elements from ordered list using shifting.
Week 11 **Arrays Processing**	**Lecture 21** Passing arrays to functions use of const. Sorting: Bubble Sort, Selection Sort	**Lecture 22** Sorting: Insertion Sort, Even/odd Sort Merging sorted arrays. Application: Sets, Union, Intersection, difference.
Week 12 **CStrings and character Arrays Processing**	**Lecture 23** I/O from simple text Files in arrays. Difference between Null terminated CStrings and character arrays. Storage of CStrings in character arrays and aggregate I/O.	**Lecture 24** Functions design: Find String length, Compare strings, Find substring and replace, Calculate frequency of specific characters Remove specific characters.
Week 13 **2D Arrays Processing**	**Lecture 25** Using built in CSrting functions. Use of built−in rand () function. 2−Dimensional Array and how it is organized in memory in row/col major order. Initialization using member initializer list, and by using loops. I/O and processing of elements in row/col major order.	**Lecture 26** Application: Store and process Students Quiz marks. Find Min, Max, Avg, column and row wise. Sorting: row wise or column wise, complete array by specific column or row.
Week 14 **2D Arrays Processing**	**Lecture 27** Passing 2D arrays to functions: Complete, individual rows, or elements. Processing diagonals: reverse elements, print data of whole array.	**Lecture 28** Application: Matrices storage and processing Addition, Subtraction, Multiplication, Transpose, Check for Upper and lower triangular.

		Use of graphic libraries functions. Designing header files for user defined functions.
Week 15 **2D CStrings Processing**	**Lecture 29** Storage and processing of CStrings in 2D Arrays. Bitwise operators Binary files I/O **Application: Data compression.**	
Final Exam		

(Tentative) Grading Criteria:

Assignments	**(10%)**	Quiz	**(10 %)**	Midterms	**(25 %)**
Project	**(10%)**	Final Exam	**(45 %)**		

Course Policies:

- Quizzes may be announced or surprise.
- All assignments and course work must be done individually.
- **Plagiarism** in any work (Labs, Quiz, Assignment, Midterms, and Final Exam) from any source, Internet or a Student may result in **F** grade or deduction of absolute marks.
- No Late Submissions
- No Makeup Quizzes.
- 80% attendance is required for appearing in the Final exams.

Passing criteria:

Minimum requirement to pass this course is to obtain at least 50% marks under application of CS department's grading policies. Grading scheme for this course is **Absolute**.

Department	Department of Computer Science	**Semester**	Fall 2019
Course Title	Applied Physics	**Course Code**	EE117
Pre-requisite	-	**Credit Hrs.**	3
Course Coordinator	Dr. Saman Shahid (saman.shahid@nu.edu.pk)	**Semester**	1st
Course Objectives:	To introduce the concepts of basic Physics topics of electricity & magnetism and digital systems to BS computer science, data science and software engineering students. To prepare students to take "Digital Logic Design" course in future.		
Course Learning Objectives (CLOs)	At the end of the course, the students will be able: 1. Find position, displacement, velocity, acceleration in 1, 2 & 3 dimensions in numerical problems or MATLAB simulation code/programming. 2. Learn projectile motion with the application of vector analysis to calculate horizontal/vertical motions, equation of the path and horizontal range to apply in numerical problems or MATLAB simulation code/programming. 3. Apply Newton's Laws along with vector notations to evaluate different types of forces: gravitational/weight/normal/tension/friction to apply in numerical problems or MATLAB simulation code/programming. 4. Verify SHM in learning different oscillations (simple, angular, uniform circular motion) for different pendulums/oscillators (torsional, simple). 5. Lean Different Types of Waves (Transverse & Longitudinal), Sinusoidal Waves and their respective parameters: Wavelength, Frequency, Angular Frequency, Wave number, Speed of wave. 6. To understand electric charge, electric current, resistance, resistivity and electric field with different applications through associated laws (i.e., Ohm's Law, Coulomb's law & Gauss' Law) and implement them to calculate related physical quantities in numerical problems or MATLAB simulation code/programming. 7. To understand different types (parallel plate, cylindrical, spherical) & combinations (parallel/series) of capacitances to calculate capacitances along with the other associated physical quantities (e.g. potential difference) in numerical problems. 8. To understand magnetic fields & magnetic forces, their application as current carrying wire, Hall's effect and in circulating charges to calculate related physical quantities to solve numerical problems or MATLAB simulation codes. 9. To understand magnetic fields generated due to currents by Ampere's law to calculate magnetic fields due to different conditions and geometries (e.g. Solenoids and Toroids) and calculate related physical quantities to apply in numerical problems or MATLAB simulation.		

Text Book(s)	**Title**	***Halliday & Resnick* Fundamentals of Physics (Extended 10th Edition)**
	Author(s)	Jearl Walker
	Publisher	© 2013 by John Wiley & Sons Inc.
Ref. Book(s)	**Title**	**Physics for Scientists and Engineers with Modern Physics (6th Edition)**
	Author(s)	Raymond A. Serway & John W. Jewett
	Publisher	© 2004 Thomson books/cole US
	Title	**Physics for Scientists and Engineers (6th Edition)**
	Author(s)	Paul A Tipler and Gene Mosca
	Publisher	W.H. Freeman and Company
	Title	**Physics for Scientists and Engineers (3rd Edition)**
	Author(s)	Fishbane, Gasiorowicz, Thornton
	Publisher	Pearson Prentice Hall
	Title	**Physics for Engineers & Scientists (3rd Edition Extended)**
	Author(s)	Hans C. Ohanian and John T. Markert
	Publisher	W. W. Norton & Company New York. London
	Title	**MATLAB –A practical introduction to programming and problem solving (3rd Edition)**
	Author(s)	Stormy Attaway
	Publisher	Elsevier 2013
	Title	**Programming with MATLABfor Scientists**
	Author(s)	Eugeniy E. Mikhailov
	Publisher	CRC Press Taylor & Francis 2017
	Title	**Introduction to MATLAB for Engineers (3rd Edition)**
	Author(s)	William J. Palm III
	Publisher	The McGraw-Hill Companies

Week	Course Contents/Topics	Chapter
01	Adding Vectors, Components of Vectors, Unit Vectors, Vector & Scalar Products, Position & Displacement (2/3 dimensions), Numerical Problems & MATLAB Implications	03, 04
02	Average/Instantaneous Velocity/Acceleration, Uniform Circular Motion, Numerical Problems & MATLAB Implications	04
03	Projectile Motion, horizontal/vertical motions, equation of the path, max. height, time of flight and horizontal range, Numerical Problems & MATLAB Implications	04
04	Newton Laws of Motion, Forces (1D/2D): Gravitational, Friction, Tension, Weight, Numerical Problems & MATLAB Implications	05
	MIDTERM – I	
05	Simple Harmonic Motion, the Force Law for SHM, Angular SHM	15
06	Simple Pendulum, Circular Motion & SHM, Numerical Problems & MATLAB Implications	15
07	Types of Waves, Sinusoidal Waves, Wavelength and Frequency	16
08	Coulomb's Law, Charge Quantization & Conservation, Electric Field, Electric Field Due To Point Charge and Dipole, Numerical Problems & MATLAB Implications	21, 22
09	Gauss' Law, Flux, Flux Of Electric Field, Gauss's Law, Equivalency of Gauss's Law And Coulombs' Law	23
10	Cylindrical Symmetry, Planar Symmetry, Spherical Symmetry, Numerical Problems & MATLAB Implications	23
	MIDTERM - II	
11	Capacitance, Parallel Plate, Cylindrical & Spherical Capacitors, Capacitors In Parallel And In Series, Numerical Problems & MATLAB Implications	25
12	Electric Current, Current Density and Drift Speed, Resistance & Resistivity, Ohm's Law, Numerical Problems & MATLAB Implications	26
13	Magnetic Fields And Field Lines, Crossed Fields: Hall Effect, Circulating Charge Particles, Magnetic Force On Current Carrying Wire, Numerical Problems & MATLAB Implications	28
14	Magnetic Field Due To Current, Ampere's Law, Magnetic Field Inside/Outside Wire, Solenoids & Toroids & Between two Parallel Wires, Numerical Problems & MATLAB Implications	29

Teaching Methodology:

Lecturing, MATLAB laboratory practice, Assignments, Quizzes, Discussion, Midterm exams, presentations, simulations etc.

Course Assessment:

Assessment Tools	Weightage
Quizzes (3), Assignments (3)	10+10=20%
Midterms (I+II)	15+15=30%
Final Exam	50%

Important Instructions:

- You may have to secure at least 50% marks to pass the course.
- Plagiarism is not tolerable in any of its form; minimum penalty would be an 'F' grade in the course without prior warning.

Grading Criteria:

An Absolute Grading Scheme may be used for the course evaluation.

Total Marks (%)	Grade
≥ 90	A+
86-89	A
82-85	A-
78-81	B+
74-77	B
70-73	B-
66-69	C+
62-65	C
58-61	C-
54-57	D+
50-53	D
≤ 49	F

NATIONAL UNIVERSITY OF COMPUTER AND EMERGING SCIENCES
LAHORE CAMPUS

Calculus and Analytical Geometry Course Outline according to OBE

FALL-2019

Course Moderator: Dr. Akhlaq Ahmad Bhatti

CS Department Coordinator: Dr. Mubasher Baig

Department	Department of Computer Science	**Dept. Code**	CS
Course Title	Calculus and Analytical Geometry	**Course Code**	MT 119
Pre-requisite(s)	-	**Credit Hrs.**	3
Moderator	Dr. Akhlaq Ahmed Bhatti.		

National University

Of Computer & Emerging Sciences

Course Instructors	Dr. Akhlaq Ahmed Bhatti, Dr. Qaisar Mahmood, Dr. Muhammad Nasir Ali, Mr. Muzamil Hanif, Dr. Noreen Akram, Ms. Kinza Mumtaz, Ms. Quresha Hanif. Ms. Iffat Fayyaz.
Note:	It is a tentative schedule of the course. It may vary (if required).

Course Objective	The course is aimed at acquiring the basic techniques of differentiation and integration of functions of single variable. Stress will be given on the concepts of limit continuity and graphing of functions using derivatives. Students will be encouraged to go through the proofs of important theorems and solve some life problems as well.

No.	Assigned Program Learning Outcome (PLO)	Level	Tool
01			

I = Introduction, R = Reinforcement, E = Evaluation.
A = Assignment, Q = Quiz, M = Midterm, F = Final, L = Lab, P = Project, W = Written Report.

No.	Course Learning Outcome (CLO) Statements	Tools
01	• Solve algebraic equations and inequalities by using properties of absolute values.	Q1, M1
02	• Analyze the function and sketching the curve by using properties horizontal/ vertical and compressing / stretching	Q1, A1, M1
03	• Investigation of continuity through limits analytically / graphically.	A1, M1, F
04	• Apply the concept of differentiation in real life problem	A2, M1, M2, F
05	• Curve sketching using extrema theory	Q2, M2, F
06	• Riemann sum, evaluation of definite & indefinite integral and their applications to compute lengths of curves / area of regions / volume of solids.	M2, Q3,A3,F
07	• Correctly graphs/formulate the equation of line and plane in R3.	F

Department	Department of Computer Science	**Dept. Code**	CS
Course Title	Calculus & Analytical Geometry	**Course Code**	MT 119
Pre-requisite(s)	-	**Credit Hrs.**	3
Moderator	Dr. Akhlaq Ahmed Bhatti		

National University

Of Computer & Emerging Sciences

Course Instructors	Ms. Atroobs Saeed(A), Dr. Uzma Bashir(B, G), Mr. Adnan Malik(C), Ms. Noreen Akram(D), Dr. Akhlaq Ahmad Bhatti(E, F), Mr. Qasim Noor (H)
Note:	It is a tentative schedule of the course. It may vary (if required).

Text Book(s)	**Title**	Thomas Calculus
	Author	G. B. Thomas
	Edition	Latest Edition
Ref. Book(s)	**Title**	Calculus and Analytic Geometry Kenneth W. Thomas.
	Author	Kenneth W. Thomas.
	Edition	Latest Edition
	Title	Calculus
	Author	William E. Boyce & Richard C. DiPrima
	Edition	Latest Edition
Course Objective	The course is aimed at acquiring the basic techniques of differentiation and integration of functions of single variable. Stress will be given on the concepts of limit continuity and graphing of functions using derivatives. Students will be encouraged to go through the proofs of important theorems and solve some life problems as well.	

Week	Section	Course Contents	Chapter	CLO
01		**Inequalities** Rules for inequalities, solving inequalities	From previous edition	1
02	1.1 1.2	**Functions** Functions and their graphs: Combining functions; Shifting and Scaling graphs	1	2
03	2.1 2.2 2.3 2.4	**Limits and Continuity** Rates of Change and tangents to curves Limit of a function and limit laws The precise definition of a Limit One sided Limit	2	3
04	2.5 2.6	Continuity Limits involving Infinity; Asymptotes of Graphs	2	3
05	**3.1** 3.2 3.3 3.4 3.5	**Derivatives** Tangents and derivatives at a point The derivatives as a function Differentiation Rules The derivative as a rate of change Derivatives of trigonometric functions	3	4

	3.6 3.7 3.8 3.9	The chain rule Implicit differentiation Derivatives of inverse functions and logarithms Inverse trigonometric functions Related rates		
06		**MID-TERM-I**		
07	4.1 4.2 4.3	**Application of Derivatives** Extreme values of functions The Mean value theorem Monotonic functions and the first derivative test	4	5
08	4.4 4.5 4.6	Concavity and Curve sketching Indeterminate forms and L'Hopital's Rule Applied optimization	4	5
09	5.1 5.3	**Integrals** Area and estimating with finite sums The definite integral	5	6
10	5.4 5.5 5.6	The Fundamental theorem of calculus Indefinite integrals and the substitution method Definite integral Substitutions and area between the curves	5	6
11	6.1 6.2 6.3	**Application of Definite Integrals** Volumes using cross sections Volumes using Cylindrical Shell Arc length	6	6
12		**MID-TERM-II**		
13	7.1 7.2 7.3	**Integrals and Transcendental Functions** The Logarithm defined as an integral Exponential change and separable differential equations Hyperbolic Functions	7	6
14	8.1 8.2 8.3 8.4	**Techniques of Integration** Using basic Integration formulas Integration by parts Trigonometric integrals Trigonometric substitution	8	6
15	8.5 8.6 8.8	Integration of rational functions by Partial fractions Reduction formulas Improper integrals	8	6
16		**Analytical Geometry** Straight lines in R3, Equations for planes.	Reference Book	7
		FINAL EXAM		

Evaluation Procedure & Marks Distribution:

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Assessment Tools	Total No. of	Weightage
Quizzes	3	10%
Assignments	3	8 %
Home work	Every week	7%
Mid Term Exam	2 (I+II)	25%
Final Exam	1	50%

Note: No homework/ assignment submission after due date.

Department	Department of Sciences & Humanities	**Deptt. Code**	S & H
Course Title	Islamic Studies/Ethics	**Course Code**	SS111
Author	Hafiz Umair Gulzar	**Credit Hrs.**	3
Coordinator	Hafiz Umair Gulzar		

Course Objective	The course is designed to provide students with a comprehensive understanding of Islam. They will be able to comprehend fundamental beliefs, principles, norms and traditions in the light of Islam.

No.	Assigned Program Learning Outcome (PLO)	Level	Tool
01	An ability to identify, formulate, research literature, and analyze social, national and international fate of the Muslims and to suggest a salvation for these.	I	F

A = Assignment, Q = Quiz, M = Midterm, F=Final, GA=Group Assignment

No.	Course Learning Outcome (CLO) Statements	Tools
01	To further enhance the knowledge of Islam.	Q1,A1,M1,F
02	To understand the basic concept of Islam and the Quran.	Q2,M1,M2,F
03	To understand the concept of Human rights in the light of Quran.	A2,M2,F
04	To know the importance of Islamic concept about other Religions.	Q3,A3, F

Week	Course Contents/Topics	Detailed Discussion Points	Chapter	CLO
1	**Introduction to the Religion**	• Basic definition and concept • History of Religion • Quest of a man for his Creator • Need of a Religion • Every physical phenomenon of nature leads towards a Creator • Some Theological Ideas	1	1
2	**Introduction to the Islam**	• Literal meaning and basic concept • Subject & Objective of Islam • Beliefs, Worships, Dealings Rules & Law, Ethics and Purification • Oneness of Allah • Concept of Prophet hood • Why Islam?	2	1
3	**Pillars of Islam** Concept of Worship	• Tawhid • Salah Prayer • Fasting • Charity (Fiscal system of Islam) • Pilgrimage & its significance	3	1
4	**Islamic Jurisprudence & Sources of the Shariah** **The Qur'an**	• Definition and Importance of Islamic Jurisprudence • The Qur'an as a primary source • Inimitability of the Qur'an (Compilation, comparison with Sacred books and Scientific aspects)	4	1
5	**The Hadith** **Ijma & Qiyas**	• Introduction to Hadith • Esteem status, Interpretative and Legislative authority of Prophet Muhammad □ • Hadith as an essential source of Islamic Law (**حجیّتحدیث**) • Compilation of Hadith • 10 Major compilations of Hadith	5	1

		• Ijma and Qiyas brief introduction		
6	**The Social system of Islam**	• The characteristic of Islamic Society and Haqooq ul ibad in the light of Quran & Sunnah • Rights of Parents • Rights of Children	6	2
7	**The Social system of Islam**	• Rights of Husband and Wife • Rights of Orphans • Esteem Status of a soul (every extra judicial killing is strictly prohibited) • Rights of Non-Muslims	7	2
8	**The Holy Prophet as a Role Model**	• The Qur'an and Prophet Muhammad as an exemplary role Model • Greatest Influencer on the face of Earth • Prophet Muhammad in the sight of non-Muslims	8	2
9	**The Ethical System of Islam**	• Concept of Good & Bad ethics • Self-Purification • Sidq (Truthfulness) • Sakhawat (Generosity) • Tawakkaul (Trust in Allah), • Sabr (Patience) • Taqwa (Piety)	9	3
10	**The Ethical System of Islam**	• Equality of Humanity (Brotherhood) • Ethics of sharing an information • Don't use offensive nick names • Always avoid suspicion	10	3
11	**Islam & Science**	• Basic difference between the Domain of these 2 subjects • Scientific verses mentioned in the Qur'an	11	4
12	**The Islamic Political System**	• The Concept of Absolute Ownership	12	4

		• Caliphate & Democracy • Secularism		
13	**The Islamic Political System**	• Rightly Guided Caliphs as Role Model • Introduction of Caliphs and their Political role	13	4
14	**Islam & Modern world challenges**	• Westernization • Terrorism • Humanism • Liberalism • Materialism • Globalization	14	4
15	**Presentation**	As per Teacher's choice		
16	**Make Up Classes week**			
17	**Final Exams**			

Recommended Books

Title	Introduction to Islam
Author	Dr. Hamidullah
Title	Towards Understanding Islam
Author	Sayed Abu A'la Maududi
Title	Islam & Science
Author	Dr. Tahir ul Qadri, Molana Waheed ud Deen Khan

Evaluation Procedure & Marks Distribution:

Assessment Tools	Weightage
Quizzes (3), Assignment (2), Presentation	20%
Midterm I	15%
Midterm II	15%
Final Exam	50%

Grading Policy:

Relative grading Scheme will be followed for grading

NATIONAL UNIVERSITY OF COMPUTER
& EMERGING SCIENCES

English Comprehension and Composition

FALL 2019

COURSE CODE	**SS 150**
COURSE TITLE	**English Composition and Comprehension**
CREDIT HOURS	**2**
COURSE DESCRIPTION	This course aims to develop proficiency in the major communicative skills Writing. Students get an opportunity to study English language through a academic contexts: essays, short stories, and articles from several media also learn in-depth comprehension skills and write informational and exp consequently, students cultivate their power of argument and analytical s student will be required to complete individual and group assignments.
MODE OF INSTRUCTIONS	- Lectures and Discussion - Collaborative learning - Education technologies, including word processing, the internet and presentation.
COURSE OBJECTIVES	Students will be able to 1. Recognize author's main idea and supporting details. 2. Identify logical relationships, style and tone of the text. 3. Organize and develop ideas effectively, with logical and well supporte 4. Develop ability to organize and structure ideas 5. Develop ability to write for academic purposes through well supporte
TEXT BOOKS	- Models for Writers _Thirteenth Edition (Alfred Rosa and Paul Eschhol - The Writer's Reference - Diana Hacker
GRADING CRITERIA	- Mid-Terms (2) 30 - Quizzes 10 - Assignments 10 - Final Exam 50
CLASSROOM COURTESIES	- Dress code: Formal - Attendance is compulsory - Deadlines must be observed
PLAGIARISM / ACADEMIC DISHONESTY	- All work submitted must be the student's own work. Cases of plagiar sent to the Disciplinary Committee. Research format is expected to fo documentation APA guidelines.

Course Contents:

Week	Topics	Assigned Reading	Evaluation
Week 1	Introduction to the Course **Reading Strategies:** - **Author's Purpose** - **Style** - **Tone**	Readings: **Models for Writers** Analysis of assigned essay/story/article	

Week 2	**Reading Strategies:** Stated Main Idea + Supporting Details - **Author's Purpose** - **Style** Informal/Formal - **Tone** - **Pattern of Organization** - **Discussion**: Analysis of assigned essays/stories/articles	Readings: **Models for Writers** Analysis of assigned essay/story/article	Assignment 1 – Implied, stated, tone, purpose
Week 3	**Reading Strategies:** Implied Main Idea +Supporting Details - **Author's Purpose** - **Style** Informal/Formal - **Tone** - **Pattern of Organization** - **Discussion Work**: Analysis of assigned essays/stories/articles	Readings: **Models for Writers** Analysis of assigned essay/story/article	
Week 4	**Paraphrase** • Lecture • Practice (selected articles)	Pair Work	Quiz 1 – Implied and stated main idea
Week 5	**Writing Process** • Narrow Down a broad topic • Pre-writing strategies (brainstorming; clustering; listing) • Writing a Thesis Statement		
Week 6	**Five Paragraph Essay** – structure- Introduction (Readers' hook - lead in- Thesis statement) Writing Expository paragraph	Assign Short story	
Week 7	**Expository Essay** Extended explanation and writing practice with feedback/ evaluation	Assign Reading for Comparison and Contrast Essays	Assignment 2 – write essay, submit in next class
Week 8	**Comparison and Contrast Essay** Structure- Introduction	Assign Reading for Cause-and-Effect Essays	Quiz II – Thesis Statement Assignment 3 – Write essay, complete and submit in next class
Week 9	**Cause and Effect Essay** Extended explanation and writing practice with feedback- Submission:		Assignment 4 – Write essay, complete and submit in next class

Week 10	Components of Critical Analysis	Assign texts for Critical Analysis	
	MID TERM II		
Week 11	**Persuasive Essay** Written work based on assigned reading Peer checking	Assign Reading for Persuasive Essays	
Week 12	**Persuasive Essay**- Extended explanation and writing practice with feedback/ evaluation		
Week 13	**Critical Analysis** Explanation and writing practice and feedback In-class writing		Quiz III – Interlocutory Paragraph of Argumentative essay
Week 14	**Critical Analysis** Presentations		
Week 15	Revision		
	FINAL EXAMS		

NATIONAL UNIVERSITY
of Computer & Emerging Sciences, Lahore

Department of Computer Science

CS 211– Discrete Structures

Spring 2020

Instructor Name:

Program: BSCS **Credit Hours:** 3 **Type:** Core

Course Description/Objectives/Goals:

The goal of this course is to introduce the students to "Discrete Mathematics", which is an important area of mathematics and theoretical computer science. It deals with structures that are not continuous and do not vary smoothly, but are distinct with separate values. The course covers the basics of logic, set theory, proof techniques, counting, number theory and graph theory.

Course Learning Outcomes (CLOs):		
At the end of the course students will be able to:	**Domain**	**BT* Level**
1. Understand the key concepts of Discrete Structures such as Sets, Permutations, Combinations , Relations, Graphs, etc.	C	2
2. Apply formal logic proofs and/or informal, but rigorous, logical reasoning.	C	3
3. Apply discrete structures into computing problems.	C	3
4. Differentiate various discrete structures.	C	4
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain. **Bloom's taxonomy Levels:**1. Knowledge, 2. Comprehension, 3. Application, 4. Analysis, 5. Synthesis, 6. Evaluation		

Course Textbook

1. Kenneth H. Rosen, Discrete Mathematics and Its Applications, Sixth Edition or later, McGraw-Hill.

Additional references and books related to the course:

1. Ralph P. Grimaldi, *Discrete and Combinatorial Mathematics: An Applied Introduction*, Fourth edition or later, Addison-Wesley.
2. Winifred K. Grassman, Jean P. Tremblay, *Logic and Discrete Mathematics: A Computer Science Perspective,* International Edition (or edition 1 or later), Prentice Hall.
3. Stuart Russell and Peter Norvig, *Artificial Intelligence, A Modern Approach*, Second edition or later, Pearson.

Tentative Weekly Schedule

Week	Topics to be covered	Readings	Assignments/Projects?
1	Introduction to discrete structures		
2	Propositional calculus, logical connectives and examples		
3	Propositional calculus continued, inference techniques		
4	First order logic: predicates and quantifiers, inference techniques		
5	Set theory: set operations, set relationships, Functions, classification and composition.		
6	Midterm Exam 1		
6	Cardinality of sets. countable and uncountable sets		
7	Binary and n-ary Relations, representing Relations, closure, equivalence		
8	Proof techniques		
9	Proof techniques continued + Mathematical induction with examples		
10	Number theory: Euclidean algorithm, LCM, Fermat's little theorem, Chinese remainder theorem, modular exponentiation.		
11	Recurrence relation, homogenous and non-homogenous equations		
12	Midterm 2		
12	Introduction to counting, permutations, combinations, pigeon hole principle		
13	Combinatorics: Pascal's Triangle, pascal's identity, Vandermonde identity		

14	Introduction to graphs		
15	Problems related to graphs		

Evaluations

1. Assignments: 10%
2. Quizzes: 10%
3. Midterm Exams:30%
4. Final Exam: 50%

Grading Scheme: Relative Grading

Course Policies

1. Quizzes may be un-announced.
2. No makeup for missed quizzes or assignments.
3. 80% attendance is essential

NATIONAL UNIVERSITY
of Computer & Emerging Sciences, Lahore

Department of Computer Science

CS-217 – Object Oriented Programming
Fall 2020

Instructor Name: Usama Hassan Alvi

Email address: Usama.hassan@lhr.nu.edu.pk

TA Name: Sulaiman Javed

Email address: l191129@lhr.nu.edu.pk

Office Location: **Liberty Lab**

Office Hours: **Mon, Tue: 11:00 AM - 3:00 PM.**

Course Information

Program: BS (CS)

Credit Hours: 3 + 1 for Lab

Type: Core

Class Venue: CS-5

Pre-requisites: Programming Fundamentals (CS-1002)

Class Meeting Time: Wed to Friday (8:00AM to 10:20 AM)

Course Description/Objectives/Goals:

The core objectives of this course are to introduce,

- Object oriented programming with data abstraction and encapsulation.
- The classes, objects and relationship among different objects and classes in C++?
- Generic programming using templates, and template specializations.

Course Learning Outcomes (CLOs):

At the end of the course students will be able to:	Domain	BT* Level
Understand dynamic memory management with pointers.	C	2
Understand principles of object oriented program	C	2
Identify the objects & their relationships to build object oriented solution	C	3
Model a solution for a given problem using object oriented principles	C	3
Examine an object oriented solution	C	4
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Textbooks:

1. C++ Programming: Program Design Including Data Structures, by D. S. Malik (8th Edition)
2. C++: How to Program? by Deitle & Deitle (9th Edition)

Additional references and books related to the course:

3. Problem Solving with C++, by Walter Savitch
4. https://www.learncpp.com

Course Contents Weekly and Lecture-wise Breakdown

Lecture	Topic	Lecture-1
1&2 1 and 6 July	**Pointers**	Pointers Introduction, Pointer variables and Initialization, Address of Operator, Dereferencing Operator. Pointer Operations (Relational, Arithmetic) Use of Constant with Pointers. Difference between a Pointer and a Reference. Passing pointers to functions by value and by reference.
3 7 July		Dynamic memory allocation using pointers and accessing dynamic memory. Dynamic Variables new and delete operators. Dynamic 1- dimensional arrays, Create, Delete, Grow and Shrink. Example of programs using 1D dynamic allocation: e.g., mathematical sets union and intersection.
4 8 July		Memory Leak and Dangling Pointers, Dynamic 1- dimensional char arrays for strings, string operations like search, concatenation etc. Pointers Indirection. Dynamic 2D, allocation, matrices, CStrings etc.
5 13 July	**Object-oriented basics**	Structured Programming vs Object-oriented Programming, Principles of modularization, abstraction and encapsulation. Objects vs Class, state vs behavior, access specifiers (Public, Private), Member functions (accessors, utilities, mutators etc)
6 14 July		Constructors (default, overloaded), Function overloading. Dynamic memory allocation and Object assignment, Parameter passing, Shallow vs Deep copy
7 15 July	**Object-oriented basics**	Copy constructor, Destructors, this pointer, Cascaded function calls, static members, inline functions and other miscellaneous issues
8 20 July	**Operator overloading**	Unary operators using member functions Binary operators using member functions

9 21 July	**Operator overloading**	Binary operators using non-member functions, concept of friendship, Unary operators, Pre and post increment, subscript operator.
10 22 July	**Mid Term Exam**	
11 27 July	**Object and Class relationships**	Part-whole relationships, Association/Aggregation
12 28 July		Inheritance basics, Type of Inheritance, public, protected, private. Function Overriding and sub-typing details
13 29 July	**Object and Class relationships**	Polymorphism introduction Static vs dynamic binding details, virtual tables and virtual pointers, Polymorphism vs down casting, run-time type identification, dynamic cast
14 3 Aug		Pure-virtual functions, Abstract classes, Interfaces (optional) Multiple Inheritance and Diamond Problem Multiplicity, Memory Management Bi-directional relationships, Forward-class declarations issues
15 4 Aug	**Generic Programming & Exception Handling.**	Template functions Template classes Template Specializations
16 5 Aug		Exception Handling. Introduction to STL, Iterators and Collections

(Tentative) Grading Criteria:

1. Assignments + Home works **(20 %)**
2. Quizzes **(10 %)**
3. Midterms **(30 %)**
4. Final Exam **(40 %)**

- Grading scheme for this course is **Absolute** under application of CS department's grading policies.
- Minimum requirement to pass this course is to obtain at least **50%** absolute marks

Course Policies:

- All assignments and homework must be done individually.
- Late Submissions of assignments will not be accepted.
- **Plagiarism** in any work (Quiz, Assignment, Midterms, Project and Final Exam) from any source, Internet or a Student will result in **deduction of absolute marks or F** grade.
- Minimum **80%** attendance is required for appearing in the Final exams.

	Department of Computer Science **FAST National University of Computer & Emerging Science** **Lahore Campus** **Weekly Lecture Breakdown**	

Course Code: **EE 227**
Course Title: **Digital Logic Design**
Credit Hours: **03**
Contact Hours: **03**
Prerequisite: **None**
Mode of Teaching: **Three hours of lecture per week**
Course Instructors: **Mr. Muhammad Adeel**

Course Description:

This course introduces fundamental concepts of the digital design and implementation. It starts with an introduction to information representation, number system, Boolean algebra, minimization of Boolean functions, switching theory, logic gates and their operational characteristics. Analysis and design of combinational circuits (multiplexers, decoders, comparators and adders) and sequential circuits (using the SR, JK, D flip flops) is covered in detail. Different types of memories and PLD design techniques are also introduced. Lab experiments are used to reinforce the theoretical concepts covered in the lectures.

Weekly Schedule

Week	Topic
1	Introduction to course, Number system, Base conversions Complements of numbers. Binary Codes, Binary Storage and Registers,Binary Log timing diagrams
2	Boolean algebra,Boolean Functions, Canonical and Standard forms. Canonical and Standard forms Digital Logic Gates, Integrated Circuits
3	KARANUGH Map Method with 2, 3 and 4 variables
4	POS simplifications. SOP simplifications, Don't Care Conditions
5	NAND and NOR Implementation XOR and XNOR Function Parity Generation and Checking
6	Combinational Circuits Analysis and Design Procedures. Binary Adder/Subtractor
7	Carry Lookahead Generator BCD Adder Decoders, Decoder Expansion
8	Boolean Function implementation with decoder Encoders Multiplexers
9	Boolean Function implementation with MUX DE-MUX Boolean Function implementation with MUX DE-MUX

10	Analysis of Sequential Circuits Storage Elements Latches (SR, D latches) Latches (SR, D latches)
11	Flip-flops (Edge and Level triggered) D, JK ,T and master slave flip flops
12	Sequential Circuits (State Equations, Tables and Diagrams) Sequential Circuit Design (with D Flip-Flops, JK Flip-Flops, T flip flops)
13	Sequential Circuit Design (with D Flip-Flops, JK Flip-Flops, T flip flops) Mealy Moore Models of FSM State Reduction
14	Registers Shift Registers Universal Shift Register
15	Ripple Counters (BCD and Binary) Synchronous Counters (BCD, Binary (Up/Down) and with arbitrary sequence)
16	Registers and Counter Practice Other Counters Johnson Counter etc

Books

Text Book(s)

Title Digital Design
Author M. Morris Mano, Michael Cilleti
Publisher Prentice Hall

Ref. Book(s)

Title Logic and Computer Design Fundamentals
Author M. Morris Mano, Charles R Kime
Publisher Pearson

Grade Marks Distribution

Assignments	10
Quizzes	20
Mids (Mid-1 + Mid-2)	12.5+12.5
Class Participation	05
Final Exam	40

Grading Scheme

Absolute grading scheme (Need 50 absolutes to pass)

	Department of Computer Science	
	FAST National University of Computer & Emerging Science Lahore Campus	
	Weekly Lecture Breakdown	

Assessment of Course Learning Objectives

	Assignments	Labs	Quizzes	MID-1	MID-2	Viva	Presentation	Individual Project	Group Project	Class Participation	Final Exam
	✔		✔	✔	✔					✔	✔

Course Instructor	Name with Sign	Mr. Muhammad Adeel
	Submission Date	08-January-2020

NATIONAL UNIVERSITY OF COMPUTER AND EMERGING SCIENCES
LAHORE CAMPUS

Linear Algebra Outline according to OBE, FALL-2020

FILE CONTENTS

Outline of Linear Algebra (CS, SE, DS)

DEPARTMENT OF SCIENCES & HUMANITIES

Department	Department of Sciences & Humanities	**Dept. Code**	S & H
Course Title	Linear Algebra	**Course Code**	MT104
Pre-requisite(s)	-	**Credit Hrs.**	3
Moderator	Dr. Tayyaba Naz		
Course Instructors	Dr. Akhlaq Ahmad (BCS-3C, 3D, 3K), Dr. Tayyaba Naz (BSE-3A, 3B) Dr. Nasir (BCS, 3F, 3J), Mr. Muhammad Rizwan (BCS-3G, 3B), Dr. Nazish (BCS-3A, BDS-3A), Dr. Sonia Hanif (BDS-3B), Dr. Komal Hassan (BDS-3C), Ms. Maria Shabir (BCS-3H, BCS-3E)		
Note:	It is a tentative schedule of the course. Any change(s) will be communicated by the respective instructor (if required).		

Course Objective	The objective is to impart training to the students in this very important branch of Mathematics. Students are expected to learn about system of linear equations, vector spaces, inner products, Eigen values and linear transformations. Attempt will be made to introduce the students to postulation and axiomatic approach in Mathematics. This course also emphasizes the application of linear algebra in science and real life.

No.	Assigned Program Learning Outcome (PLO)	Level	Tool
01			

I = Introduction, R = Reinforcement, E = Evaluation.
A = Assignment, Q = Quiz, M = Midterm, F = Final, L = Lab, P = Project, W = Written Report.

No.	Course Learning Outcome (CLO) Statements	Tools
01	• Use concept of elementary row operations to find the inverse of square matrices, determinant of a matrix and solving the system of linear equations.	Q1, A1, M1, F
02	• Properties of vectors in 2-space, 3-space and n-space and recognize vector spaces and/or subspaces to compute their bases and its dimension.	Q2, A2, M2, F
03	• Perform Eigen Value analysis and use it to Diagonalize a matrix and/or find its powers.	Q3, A2, M2, F
04	• Identify inner product spaces and/or perform Gram Schmidt process/QR decomposition using inner products.	Q4, M2, A3, F
05	• Express a linear transformation graphically using matrices and to solve problems.	Q3, A3, F

Text Book(s)	**Title**	Elementary Linear Algebra
	Author	Howard A. Anton (Latest Edition)
	Publisher	
Ref. Book(s)	**Title**	Linear Algebra with Applications
	Author	Bernard Kolman (Latest Edition)

Week	Course Contents	Chapter	CLO
01	**System of Linear Equations and Matrices** 1.1 Introduction to linear system 1.2 Gaussian Elimination 1.3 Matrices and Matrix operations	1	01
02	1.4 Inverses; Algebraic properties of Matrices 1.5 Elementary Matrices and Method of finding matrix inverse	1	01
03	1.6 More on linear systems and Invertible Matrices 1.7 Diagonal, Triangular and Symmetric matrices 1.8 Matrix Transformations	1	01, 05
04	**Determinants** 2.1 Determinants by Cofactor Expansion 2.2 Evaluating Determinants by row reduction 2.3 Properties of Determinants; Cramer's rule	2	02
05	**MID TERM-I**		
06	**Euclidean Vector Spaces** 3.1 Vectors in 2-space, 3-space and n-space 3.2 Norm, Dot Product, and Distance in R^n 3.3 Orthogonality of vectors 3.4 The Geometry of Linear Systems 3.5 Cross Product	3	03
07	**General Vector Spaces** 4.1 Real Vector Spaces 4.2 Subspaces	4	05
08	4.3 Linear Independence / Dependence 4.4 Coordinates and Basis for a vector space 4.5 Dimension 4.6 Change of Basis	4	02
09	4.7 Row space, Column Space and Null Space 4.8 Rank and Nullity 4.9 Basic Matrix Transformations in R^2 and R^3 4.10 Properties of Matrix Transformations (if time permits at the end)	4	02
10	**Eigenvalues and Eigen vectors** 5.1 Eigenvalues and Eigenvectors 5.2 Diagonalization of matrices	5	03
11	**Inner Product Spaces** 6.1 Inner product spaces 6.2 Angle and Orthogonality in Inner product Spaces	6	04

12	6.3 Gram-Schmidt Process, QR- Decomposition		
13	**MID TERM II**		
14	**General Linear Transformations** 8.1 General Linear Transformations 8.2 Compositions and Inverse Transformations	8	05
15	8.3 Isomorphism 8.4 Matrices for General Linear Transformations 8.5 Similarity	8	05
If time permits	7.1 Orthogonal Matrices 7.5 Hermitian, Unitary and Normal Matrices		
	FINAL EXAM		

Evaluation Procedure & Marks Distribution:

Assessment Tools	Total No. of	Weightage
Quizzes	As announced by instructor (3 at least)	12%
Assignments	As announced by **Moderator** (3 at least)	8%
Mid Term Exam	2	30%
Final Exam	1	50%

Important Note(s):

1. Student(s) of any section can visit the moderator office in case of any academic issue.
2. Relative grading scheme will be used at the end of the semester.
3. If an instructor is teaching more than one section in a same degree then combined grading scheme will be used for all the sections the instructor is teaching.
4. Moderator will forward all the Assignment(s) questions to all the sections.
5. Any kind of plagiarism will result strict disciplinary action as per university rules.
6. University require 100% attendance in the course. Absence of a maximum of 20% of the total lecture hours may be condoned for genuine reasons, such as medical illness. Failure to meet the attendance requirement the student will not be allowed to sit in final exam.

Best of Luck

NATIONAL UNIVERSITY
of Computer & Emerging Sciences, Lahore

F A S T S c h o o l o f C o m p u t i n g

CS218 – Data Structures
Spring 2021

Instructor Name: Abeeda Akram
Email address: abeeda.akram@nu.edu.pk, abeeda.akram@lhr.nu.edu.pk
Office Location: Old-Admin Block Exam Hall
Office Hours: Monday- Wednesday 12:00 to 02:00 PM

TA Name: Muhammad Zubair Khan
Email address: l192235@lhr.nu.edu.pk

Course Information

Program: BS (CS) **Credit Hours:** 3+ 1 for Lab **Type:** Core

Pre-requisites: Object Oriented Programming

Class Meeting Time: BCS-3A Tue- Thu 10:00 – 11:30 AM **BCS-3B** Tue- Thu 11:30 – 1:00 PM

Class Venue: CS-10

Course Description/Objectives/Goals:

- Introduce students with data structures and their associated algorithms.
- Introduce the concept of efficient data structures and how this efficiency can be measured.
- Prepare students to select appropriate data structure for a given computational problem.

Course Learning Outcomes (CLOs):

At the end of the course students will be able to:	**Domain**	**BT* Level**
Understand data structures and their use.	C	2
Select efficient and appropriate data structures for different applications.	C	3

* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain

Bloom's taxonomy Levels: 1. Knowledge, 2. Comprehension, 3. Application, 4. Analysis, 5. Synthesis, 6. Evaluation

Course Textbooks:

- Mark Allen Weiss, *Data structures and algorithm analysis*, Pearson Education, 2007.
- Adam Drozdek, *Data structures and algorithms in C++*, Course technology, 2004.
- Nell Dale, *C++ Plus Data Structures*, 3rd Edition, Jones and Bartlett, 2003.
- Michael T. Goodrich, Roberto Tamassia and David M. Mount, Data structures and algorithms, 2nd Edition, John Wiley & Sons, 2011.

Tentative Weekly Schedule

Lecture Count	Topics
1	Introduction
3	Time Complexity Analysis and Asymptotic Bounds
4	Review of Pointers and class Templates **Linked Lists:** Singly linked lists, doubly linked lists, circular lists and corresponding iterators. Skip List (optional)
2	Stacks (Expression Evaluation), Queues
Mid 1	
2	**Recursion** with Time complexity Analysis
3	**Trees:** Binary trees and their traversals Binary search trees (Insertion, Deletion and Search)
3	Height Balanced Binary Search Trees (AVL Trees)
2	Priority Queues Or Heaps and heap sort
Mid 2	
1	Data compression and Huffman coding
4	**Hashing:** Hash tables and hash functions Collision resolution methods Universal hashing Bit vectors and bloom filters
3	**Graph:** Breadth first search and Depth first search Finding Paths, Cycles

(Tentative) Grading Criteria:

1. Assignments **(15 %)**
2. Quizzes **(10 %)**
3. Midterms **(30 %)**
4. Final Exam **(45 %)**

Grading scheme for this course is **Absolute** under application of CS department's grading policies.

Minimum requirement to pass this course is to obtain at least **50%** absolute marks

Course Policies:

- Quizzes may be announced or surprise.
- All assignments and course work must be done individually.
- **Plagiarism** in any work (Labs, Quiz, Assignment, Midterms, and Final Exam) from any source, Internet or a Student will result in **F** grade or deduction of absolute marks.
- No Late Submissions or Makeup Quizzes.
- 80% attendance is required for appearing in the Final exams.

NATIONAL UNIVERSITY
of Computer & Emerging Sciences, Lahore

Department of Computer Science

EE-229 – Computer Organization and Assembly Language

Spring 2021

Instructor Name: Aleena Ahmad **TA Name (if any):** TBA
Email address: aleena.ahmad@lhr.nu.edu.pk
Office Location/Number: Exam Hall (office # 119)
Office Hours: Thurs 10:00 am-04:00 pm

Course Information

Program: BS/MS **Credit Hours:** 3 **Type:** Core
Pre-requisites (if any): PF,DLD
Class Meeting Time: Section 3H 10:00am, Section 3J 11:30am (Mon, Wed), Section 3K 2:30pm, 01:30pm (Mon,Tues)
Class Venue: CS-9 (3H), CS-4 (3J), CS-11 (3K)

Course Description/Objectives/Goals:

Course Learning Outcomes (CLOs):

1. Understanding of basic concepts of computer organization with emphasis on the lower level abstraction of a computer system including machine-level representation of data, instruction set architecture, addressing modes, memory models, and assembly language programming.
2. Interfacing and Communication with hardware. Includes understanding of I/O fundamentals, Interrupts and their structures, Buses, external storage and physical organization
3. Illustrate the computer organization concepts by Assembly Language programming
4. Introduction to Intel IA-32 Architecture.
5. Familiarization with Assembly Language directives, macros , operators, and program structures.
6. Understanding of interrelationship between hardware and software
7. Comparison between different processors families
8. Introduction to computer architecture, and pipelining

Course Textbook

- Assembly Language Programming Lecture Notes by Bilal Hashmi (BH).
- Assembly Language for x86 Processors Seventh Edition Kip R. Irvine (KI)
- Computer Organization and Architecture Designing for Performance Tenth Edition by William Stallings (WS)

Tentative Lecture Plan

Topics to be covered	#Lectures
Introduction to Computer Organization and Assembly language	0.5
Computer functions and Interconnection	0.5
Intro to intel architecture (registers, bus and memory) Getting started in assembly language	2
Data Transfer and Addressing Modes	2
Instruction set with examples and integer arithmetic	5
Procedures and stack	4
Display memory and string processing	5
Interrupts	4
Computer Architecture and Pipelining	5

(Tentative) Grading Criteria

1. Quizzes 10
2. Midterms 30
3. Final 45
4. Assign/Project 15

Course Policies

1. Quizzes un-announced.
2. No makeup for missed assignments.

Academic Integrity

- Plagiarism and Cheating against academic integrity. Both parties involved in such cases will face strict penalty (negative marking, F grade, DC)
- CODE/ ASSIGNMENT SHARING is strictly prohibited.
- Keep in mind that by sharing your code/assignment you are not helping anyone rather hindering the learning process or the other person.
- No excuse will be entertained if your work is stolen or lost. To avoid such incidents
    - Keep back up of your code on safe online storage, such as Google Drive, Drop box or One drive.
    - Do not leave your work on university lab computer, transfer your work to online storage and delete from the university lab computer (empty recycle bin as well)

Department	Department o Sciences & Humanities	**Dept. Code**	SH
Course Title	Probability &Statistics (CS)	**Course Code**	MT205
Pre-requisite(s)	-	**Credit Hrs.**	3
Moderator	Dr. M. Farasat Shamir / Ms. Kanwal Saleem		
Course Instructors (Spring 2021)			
Note:	It is a tentative schedule of course. It may vary (if required).		

CourseObjective	To understan the basic concepts and tools of statistics &probability and to apply them for the analysis of problems in computer sciences.

No.	Assigned rogram Learning Outcome (PLO)	Level	Tool
01			

I = Introduction, R = Reinforcement, E = Evaluation.
A = Assignment, Q = Quiz, M = Midterm, F=Final,

No.	Course Learning Outcome (CLO) Statements	Tools
01	• Compute and Interpr t the various measures of location and measures of variation and construct a suitable graph for the given real life situation.	A,Q1,M1,F
02	• Use of basic counting principles and laws of probability to analyze a probabilistic experiment.	A,Q2,M1,F
03	• Identify and analyze the types of random variables and its probability distributions.	A,Q2,M2,F
04	• Determine the type of discrete distribution and evaluate its probability distribution	A,Q2,M2,F
05	• Determine the type of continuous distribution and evaluate its probability distribution	A,Q2,M2,F
06	• Apply classical hypothesis testing/confidence intervals for single population and to co pare two populations and draw inferences.	A,Q3,M2,F
07	• Testing equality of means by using F-test in One-way Analysis of Variance (ANOVA)	A,Q3,F
08	• Methodologies of regression analysis for future predictions. Able to check the goodness f fit and strength of the relationship between two variables.	A,Q3,F

Text Book(s)	**Title**	Probability and Statistics for Engineers and Scientists 9th ed.
	Author	R. E. Walpole, R. H. Myers, S.L. Myers and Keying Ye
	Publisher	Prentice Hall, 2011
Ref. Book(s)	**Title**	Probability and Statistics for Engineering and the Sciences
	Author	Jay Devore

Week	Course Contents	Chapter	CLO
01	Basic introduction, Types of variables, Mean, Median, Mode, Variance, Standard Deviation, Quartiles, Deciles, Percentiles, IQ Range, Five point summary	1	1
02	Graphical representation o data	1	1
03	Introduction to probability, tree diagram, set theory, Venn diagram	2	2
04	Counting techniques, Probability of an event, Additive rules	2	2
05	Conditional Probability, Independence and Multiplicative rules. Bayes Rule	2	2
06	**MID-TERM-I**		
07	Concept of random variable, Discrete Probability Distributions and CDF, Joint Probability Distributions, Marginal distribution, Mathematical Expectation and variance of discrete random variable	3,4	3
08	Binomial & Multinomial distribution, Poisson Distribution, Hypergeometric distribution,	5	4
09	Normal distribution, Area under the normal curve, Application of Normal distribution, Normal approximation to the binomial, Standard Normal Distribution	6	5
10	Concept of estimation, Point estimation, interval estimation, confidence interval for mean	9,10	6
11	Introduction to Hypothesis testing: z-test**,** t-test, F- distribution	10	6
12	**MID-TERM-II**		
13	One way ANOVA	13	6
14	Introduction to Simple linear regression, Scatter diagram, Correlation, coefficient of determination	11	7
15	Introduction to Multiple regression	12	8
16	Revision of concepts and problem discussion		
	FINAL EXAM		

Evaluation Procedure & Marks Distribution:

Assessment Tools	Total No.	Weightage
Quizzes	3 (At least)	10%
Assignments/Tests/Class Participation	3(At least)	10%
Mid Term Exam	2 (I+II)	30% (15% each)
Final Exam	1	50%

NATIONAL UNIVERSITY OF COMPUTER AND EMERGING SCIENCES
LAHORE CAMPUS

Differential Equations (Calculus-II)-MT 224 Outline according to OBE
Spring-2021

Prepared By: Dr. Akhlaq Ahmad Bhatti

FILE CONTENTS

Outline of Differential Equations (Calculus-II)

Dr. Mubashar Baig - Coordinator Math Courses in CS Department

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Signature for Final Approval

National University

of Computer & Emerging Sciences

DEPARTMENT OF SCIENCES & HUMANITIES

National University

of Computer & Emerging Sciences

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Text Book(s)	**Title**	Thomas Calculus / A first course in Differential Equations (DE) with modeling applications / Differential Equations with boundary-value problems.
	Authors	G. B. Thomas / Dennis G. Zill (DE) (Latest Editions).
Ref. Book(s)	**Title**	Elementary Differential Equations (DE) with applications.
	Author	C. H. Edwards. David, E.

Week	Course Contents	Chapter	CLO
01	**Infinite Sequences and Series** 10.1 Introduction to Sequences 10.2 Infinite series	10 (13th Edition)	01
02	10.3 The integral test 10.4 Comparison tests	10 (13th Edition)	01
03	10.5 Absolute convergence; The ratio and root test 10.6 Alternating series and conditional convergence **Quiz#1**	10 (13th Edition)	01
04	10.7 Power series 10.8 Taylor and Maclaurin series	10 (13th Edition)	01
05	**1st Order Differential Equations:** 2.1 Basic concepts, formation and solution of differential equations by direct integration and by separating the variables. Direction Fields. 2.2 Separable variables.	2 (9th Edition)	02
06 (Mon-Wed)	**MID TERM-I**		
07-09	2.3 Linear Equations. 2.4 Exact Equations. **Solution by Substitution** 2.5 Equations (Homogeneous & Bernoulli's DE) reducible to linear equations & Riccati. 3.1 01st order ODE's arising from Real life problems. 3.3 01st order ODE's arising from Real life problems.	02 (9th Edition) 03 (9th Edition)	03-05
10-12	**2nd & Higher Order Differential Equations** 4.1 Initial and Boundary value problem, Existence of a unique solution. Homogeneous DEs', Linear Dependence and Independence. Wronskian and non-homogeneous Linear Differential Equations. 4.2 Reduction of order. **Quiz#2** 4.3 Homogeneous Linear Equations with Constant Coefficients. 4.4 Undetermined coefficients-Superposition approach. 4.5 The operator D, Inverse operator 1/ D, Solution of	04 (9th Edition)	06, 07

	differential equations by operator D methods, Special cases. 4.5 Undetermined coefficients-Annihilator approach. 4.6 Variation of parameters. 4.7 Cauchy Euler equation.		
13	**Partial Differential Equations** 12.1 Basic concepts and formation of partial differential equations. Linear homogeneous partial differential equations and relations to ordinary differential equations. 12.2 Classical Equations & Boundary Value Problems. 12.3 Heat Equation 12.4 Wave Equation 12.5 Laplace Equation	12(3rd Edition)	08
14 (Thu-Sat)	**MID TERM II**		
15-16	**Orthogonal Functions and Fourier Series** 11.1 Orthogonal Functions 11.2 Fourier Series **Quiz#3** 11.3 Fourier Cosine & Sine Series (Periodic functions and expansion of periodic functions in Fourier series and Fourier coefficients.) 11.4 Sturm-Liouville Problem.	11 (3rd Edition)	09
	Series Solutions of Linear Equations: (If time permits**)** 6.2 Solution about ordinary point & Singular points.	09th edition	
	FINAL EXAM		

Evaluation Scheme & Marks Distribution: Relative grading scheme will be used for final assignment of grades. Marks distribution is given below.

Assessment Tools	Total No.	Weightage
Quizzes	3 (at least)	10%
Assignments	3(at least)	8%
Homework	As per instructors advice.	7%
Mid Term Exam	2	25%
Final Exam	1	50%

Note:

1. **Reaching 10 minutes late after the class starts will not be considered present.**
2. **Late submission of home works will not be rewarded.**
3. **Relative grading scheme will be followed in the course.**

Important links: https://www.youtube.com/watch?v=8yEE2YURbAo&list=PLlXfTHzgMRUK56vbQgzCVM9vxjKxc8DCr&index=31

Department	FAST School of Computing	**Dept. Code**	FSC
Course Title	Pakistan Studies	**Course Code**	SS113
Pre-requisite(s)		**Credit Hrs.**	3
Coordinators	Dr. Muhammad Tahir Rashid & Mr.Abdul Sattar		
Course Instructors	Dr. Muhammad Tahir Rashid, Abdul Sattar, Quratul Ain Ilyas, Muhamad Ashraf, Muzna Saleha, Muhammad Ishtiaque		

Course Objective	The course aims at building an understanding of Muslim Nationalism from historical point of view and socio-political development after the creation of Pakistan. It also aims at evaluating and analyzing the history to build a better understanding of today's challenges to Pakistan as state and a society.

No.	Assigned Program Learning Outcome (PLO)	Level	Tool
01			

A = Assignment, Q = Quiz, M = Midterm, F=Final, GA=Group Assignment

No.	Course Learning Outcome (CLO) Statements	Tools
01	Explains the historical background of freedom movement.	Q1,A1,M1,F
02	Analyze the impacts of Democratic Eras of Pakistan	Q2,M1,M2,F
03	Analyze the effects of the Military Regimes on socio-economic and political conditions of Pakistan	A2,M2,F
04	Evaluate the socio-political issues of Pakistan	Q3,A3, F

Week	Course Contents/Topics	Detailed Discussion Points	Chapter	CLO
01	**Colony, British Colonialism in Subcontinent** • Colonialism and Imperialism • British Imperialism with special reference to Sub Continent	• Basic concepts on Colonialism • Impacts of colonialism on politics, economy, infrastructure, culture, rule of law, democracy and education with reference to colonialism	1*	1
02	**Historical Background of Muslim Nationalism –Sir Syed** • War of Independence & its impacts on the politics of Sub-Continent. Sir Syed and Muslim Nationalism	• Sir Syed and Muslim Nationalism • Post war of independence Scenario • Responses of Muslims towards a new situation after 1857 • Sir Syed's efforts to form Muslim identity through education	1*	1
03	**Historical Background of Muslim Nationalism –Allam Iqbal** Muslim Nationalism and Iqbal	• Iqbal and Muslim Nationalism • His Political Struggle and vision for a new Muslim State • His concept of Khudi and Muslim Nationalism	2*	1
04	**Historical Background of Muslim Nationalism- Quaid-i-Azam** • Muslim Nationalism and Jinnah • Ideology, Two Nation Theory and the making of Pakistan	• Jinnah and Muslim Nationalism • His Politics & Joining AIML,Lucknow Pact • Why did he leave Congress? • Quaid-i-Azam as a President of All India Muslim League from 1935 to 1947 (All important events during this time)	2*	1
05	**State ,Society and Constitution** • Evolution & Rationale of State as an institution	• State • Elements of State • Organs of Government • A brief discussion on Pakistani Political system	Course Pack	2
06	**Political & Constitutional History of Pakistan 1947-58** • Reasons of delay and Making of first constitution • Decade of Instability	• New State formation • Reasons of the delays • Power distribution between East and West Pakistan • Issue of One-Unit	2**	2

		• Bogra Formula • Language Issue • Nature of State • 1956 Constitution		
07	**Ayub Era** • Form of Government • De-politicization • Economic Development	• Background • Political Development • A brief discussion on EBDO & PODO • BD system • Impacts of Industrial, agricultural & economic development	4**	3
08	**Z.A Bhutto** • Politics of Populism • Constitution of 1973	• Background • Consolidation • Land Reforms • Nationalization • Labor Reforms • Salient Features of 1973 Constitution	5**	3
09	**Zia-Ul-haq Era** • Authoritarianism • Islamization	• Background • Political Process • Non-Partisan Elections • Process of Islamization	6**	3
10	**Decade of Democracy (1988-99)** • Political Infightings • Instability during 90s	• Background • Political Infightings • Transitions of four democratic Governments • Discussion on how political instability is harmful for democracy	7**	2
11	**Musharaf Era** · Political developments during Musharaf era · Lawyers Movement	• Background • Elections 2002 • Elections 2008 • 17th Amendment • Lawyers Movement	8** Course Pack	3
12	**Geo Political importance of Pakistan** • Pakistan in Region • Geo Strategic Importance of Pakistan	• Regional Geo-Politics • Pakistan in Region • CPEC	1** Course Pack	4
13	**Society and the Futuristic Outlook of Pakistan** • Concept of Welfare State • How Pakistan can be a welfare state	• Basic Concept of Welfare State • Social Democracy and Welfare State	Course Pack	4
14	**Presentation**	• Students are supposed to write a Book Review and to	Groups Project.	

		give presentations on the Books they reviewed	Books relevant to the course	
15	**Presentations**	• Students are supposed to write a Book Review and to give presentations on the Books they reviewed	Groups Project. Books relevant to the course	
16	**Final Exams**			

Title	Pakistan: The Formative Phase ,1857-1948*
Author	Khalid Bin Sayyed
Title	Pakistan :A Modern History**
Author	Ian Talbot
Title	Constitutional and Political History of Pakistan **(Reference Book)**
Author	Hamid Khan
	Supplement readings including book chapters, research articles and newspaper article will also be shared with the students

Evaluation Procedure & Marks Distribution:

Assessment Tools	Weightage
Quizzes (3)	10%
Individual Assignment (2)	4%
Group Assignment and Presentations (1)	6%
Midterm I	15%
Midterm II	15%
Final Exam	50%

Grading Policy:

Relative grading Scheme will be followed for grading

NATIONAL UNIVERSITY
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F A S T S c h o o l o f C o m p u t i n g

Database Systems

Fall 2021

Instructor Name: Aleena Ahmad
Email address: aleena.ahmad@nu.edu.pk
Office Location/Number: Exam Hall (Office # 119)
Office Hours: M 2:00-4:30 pm, **F** 10:00-02:00 PM

TA Name: Areeba Shafiq
Email address: l201340@lhr.nu.edu.pk

Course Information

Program: BS **Credit Hours:** 3 **Type:** Core
Pre-requisites (if any): CS218 - Data Structures
Course Website (if any):

Course Description/Objectives/Goals

This course is an introduction to relational databases management Systems. The course will cover fundamental concepts of databases with an emphasis on modeling, designing and implementation of database systems. The theory will be augmented with hands-on exercises on database system. A project will be conducted in the database system lab that runs in parallel with the course. In project, the students will develop a data-centric application with complete set of business transactions and appropriate user interface using a popular programming language and a popular database management system.

Course Learning Outcomes (CLOs)		
At the end of the course students will be able to:	**Domain**	**BT* Level**
Describe how databases store and retrieve information using the basic concepts and terminology of relational databases.	C	2
Create a logical data model from an ER diagram to design a set of DB relations.	C	3
Normalize a set of attributes to eliminate update anomalies or redundancies from a set of relations.	C	4
Implement a logical data model using a DBMS.	C	3
Write queries using formal query languages such as relational algebra.	C	3
Write SQL statements to query a set of tables in a DBMS involving multiple conditions, ordering, aggregate functions, grouping, and group selection, set operations, joins, and nested queries.	C	3
Write SQL statements to insert, delete and update a set of tables in a DBMS.	C	3
Write SQL statements to create, alter, drop, and rename a set of tables in a DBMS.	C	3
Write SQL statements to add and drop constraints on a set of tables in a DBMS.	C	3
Create an ER diagram (semantic model) about an enterprise (e.g., retail industry, airport, school, and library) that correctly describes the	C	5

entities, attributes, and relationships among the entities, for some of its major business functions.		
Comprehend the ACID properties of Transactions and recoverability schedules.	C	2

* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain.

Bloom's taxonomy Levels: 1. Knowledge, 2. Comprehension, 3. Application, 4. Analysis, 5. Synthesis, 6. Evaluation

Course Textbook

1. Ramez Elmasri, *Fundamentals of Database Systems* (7th Edition)

Additional references and books related to the course

1. Raghu Ramakrishnan, *Database Management Systems* (3rd Edition)
2. C. J. Date, *An Introduction to Database Systems* (8th Edition)

Tentative Weekly Schedule

Week	Topics to be covered	Topics Detail		Readings (Textbook)	No of Lec.	Asst.
1	Introduction to Databases	• Databases and Database Users • Characteristics of the Database Approach • Advantages of Using the DBMS Approach • Data Models, Schemas, Instances • Architecture and Components of a DBMS		Ch 1,2	2	
2-3	Relational Data Model	RA	SQL	Ch 5, 6	4	A1
		• Relational Model Concepts o Domain, Attributes, Tuples, Relations o Characteristics of Relations • Relational Model Constraints o Domain, Keys, Integrity • Update Operations and Dealing with Constraint Violation	• Data Definition Statements (DDL) o Create, Alter, Drop, Rename • Specifying Constraints o Attribute, Key, Referential Integrity, Tuple-Based Using CHECK • Data Modification Statements (DML) o Insert, Update, Delete			
4-6	Formal Query Language: Relational Algebra and The Database Language: SQL	RA	SQL	Ch 6, 7, 8	6	A2
		o Unary Relational Operations o SELECT, PROJECT, RENAME	o Retrieval Queries o Basic Queries: SELECT-FROM-WHERE o Ordering, Arithmetic Operations, Substring Comparison			
		o Binary Operations o Union, Intersection, Difference, Division	o Set Operations			
		o Cartesian Product, JOIN o Outer Join, Outer Union, Full	o Joining, Full, outer, inner, Cross			
		o Aggregate Functions and Grouping	o Aggregate Functions and Grouping			
		Query Tree	o Nested Queries o Correlated Nested Queries			
		--	o Views (Virtual Tables), Stores Procedures, Assertions and Triggers			

7-9	Database Design Theory and Normalization	• Design Anomalies • Informal Design Guidelines for Relational Databases • Functional Dependencies (FDs) o Convert Business statements into Dependencies o Armstrong's Inference Rules for FDs o Algorithm for computing Attribute Closure o Minimal Cover of FDs o Equivalence of Sets of FDs • Normalization for Relational databases o Normalization and De-Normalization o Normal Forms: 1NF, 2Nf, 3NF, BCNF, 4NF, 5NF • Overview of Relational Database Design Algorithms	Ch 14, 15	6	A3
10-12	Data Modeling Using Entity-Relationship (ER) Model	• Entity Types, Entity Sets, Attributes, Keys • Relationship Types, Relationship Sets, Roles • Constraints on Relationship Types • Relationship Types of Degree Higher than Two • Enhanced Entity-Relationship (EER) Model Concepts • Subclasses, Superclasses, Inheritance • Specialization and Generalization • Constraints and Characteristics of Specialization and Generalization • Shared and UNION Type subclasses	Ch 3, 4	5	A4
12-13	Relational Database Design by ER- and EER-to-Relational Mapping	• Mapping ER Model Constructs to Relations • Mapping EER Model Constructs to Relations	Ch 9	2	
13-14	Transaction Processing Concepts	• Issues in Transaction Processing • Why Concurrency Control is Needed • Why Recovery is Needed • Transaction States and Operations, System Log, Commit Point of a Transaction • ACID Properties of Transactions • Characterizing Schedules based on Recoverability • Characterizing Schedules based on Serializability • Transactions Isolation Levels and Possible Violations • Basic Two-Phase Locking Technique for Concurrency Control	Ch 20	3	

(Tentative) Grading Criteria

1. Assignments (10%)
2. Quizzes (10%)
3. Class Participation (5%)
4. 2 Midterm Exams (30%)
5. Final Exam (45%)

Grading Scheme: Absolute

Course Policies

1. Minimum eligibility to pass this course is to get 50% marks.

Project

Students will design, implement, demonstrate and document a database system. The project is to be done in groups of 3/4 students. Pick your partner as soon as possible. The groups are self-policing (e.g. each group is responsible for its own division of labor, scheduling, etc.). A separate handout will be provided describing the project requirements in the 2nd Lab of the course.

NATIONAL UNIVERSITY
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Department of Computer Science

CS2006 – Operating Systems

Fall 2021

Instructor Name: Zeeshan Ali Khan
Email: zeeshanali.khan@nu.edu.pk
Office Location/Number: First floor, Library Building
Office Hours: Mon, Tue 2 pm - 4 pm

TA Name (if any): Muhammad Jareer
Email: l201224@lhr.nu.edu.pk
Office Location/Number: N/A
Office Hours: TBA

Course Information

Program: BS~~/MS~~ **Credit Hours:** 3 **Type:** Core~~/Elective~~
Pre-requisites (if any): Data Structures
Class Meeting Time: Mon, Wed 10:00 – 11:20
Class Venue: CS-6

Course Description/Objectives/Goals:

This course helps in understanding the behavior, role and scope of operating system, the underlying hardware, and the application programs. Secondly, in this course students learn how to program in a multi-programmed and multithreaded environment. The course also introduces important system development methodologies and algorithms in the areas of CPU scheduling, process communication, memory management, concurrency, synchronization, and file systems.

Course Learning Outcomes (CLOs):

1. Describe services provided by the modern Operating Systems.
2. Implement solutions employing concepts of Processes and Threads.
3. Evaluate the commonly used mechanisms for scheduling of tasks and implement synchronization mechanisms like Semaphores, TSL, etc.
4. Deploy OS tools related to Virtualization and Containers.
5. Understand the dead locks and memory management.

Course Textbook

- Operating System Concepts (Tenth Edition) By Silberschatz, Galvin, and Gagne.

Additional Readings

- Operating Systems (Third Edition) By Gary Nutt.
- The Little Book of Semaphores (Second Edition) By Allen B. Downey.

Tentative Lecture Plan

	Topics
Processes, Process Communication, and Threads	Introduction and Background, Introduction to Process Management, Fork, wait, execlp, Inter-process Communication, Linux pipeline, Multithreading Models Thread Libraries, Exploiting processing and I/O in parallel.
Scheduling and Synchronization	Process Scheduling Basic Concepts, Scheduling Algorithms, Synchronization, Critical Section Problem and its Solutions, Semaphores Classical Problems.
Memory Management, and File Systems	Memory Management Challenges, Paging, Virtual Memory Demand Paging, Page Replacement Algorithms, File System – Introduction Allocation Methods, Free-Space Management Implementation.

(Tentative) Grading Criteria

1. Quizzes 15
2. Midterms 30
3. Final 40
4. Assignments 10
5. Project 5

Grading Scheme: Absolute

Absolute Grading Scheme:

Total Marks (%)	Grade
≥ 90	A+
86-89	A
82-85	A-
78-81	B+
74-77	B
70-73	B-
66-69	C+
62-65	C
58-61	C-
54-57	D+
50-53	D
≤ 49	F

Course Policies

1. Quizzes may be un-announced.
2. No makeup for missed quiz or assignment.
3. 80% attendance
4. 50% passing marks
5. Announcements related to different aspects of this course (e.g. lectures, quizzes, exams, etc.) may be posted on google classroom. Students are expected to view the announcements section of google classroom regularly.

National University of Computer & Emerging Sciences - FAST Lahore

Course Name: CS2008: Numerical Computing
Semester: Fall-2021
Credit hours: 3+0
Instructor: Prof. Dr. Mubashir Qayyum
Email: mubashir.qayyum@nu.edu.pk
Telephone: (042) 111 128 128 Ext (283)

Objective: Main objectives of this course are:
1. To provide suitable and effective Numerical Methods for obtaining approximate results.
2. To solve mathematical models encounter in various fields of science and engineering which requires numerical computing using certain raw data.
3. To solve complex mathematical problems using only simple arithmetic operations. The approach involves formulation of mathematical models of physical situations that can be solved with arithmetic operations.
4. To deal with various topics like root finding in equations, solving systems of linear algebraic equations, interpolation and regression analysis, numerical integration & differentiation, solution of differential equation (IVPs), boundary value problems, solution of matrix problems.
5. To facilitate numerical computing and writing codes of the mentioned techniques.

At the end of the course, it is expected from students to obtain a working knowledge of how to apply numerical methods to real-world problems and a basic understanding of the mathematics and properties of these methods.

Text Books / Reference Books:
Numerical Analysis by Burden Faires
Applied Numerical Analysis by Gerald / Wheatley
An Introduction to Numerical Analysis (2nd Edition) by Kendall E. Atkinson
Computer-Oriented Numerical Methods by P. Thangaraj
Numerical Methods Using MATLAB by John H. Mathews and Kurtis D. Fink
Numerical Methods by S Kalavathy.

Grading Policy:
Grads will be awarded on the basis of continuous assessment through quizzes, assignment, two midterm exams and a final exam. The distribution of marks is as under:
Assignment (10), Quizzes (10), Midterm exams 1 & 2 (15+15) and Final exam (50)
Grading Scheme: Absolute

Note: Tentative topics in Sessional I and II are highlighted in yellow and pink respectively. Final exam will contain full course outline.

Topics

Introduction to Numerical Computing
What is numerical computing and numerical analysis. Error, Different types of errors, convergence of computer arithmetic, Algorithms, Numerical soft wares (working platforms – Mathematica, Matlab, Python), Mathematica implementation of different numerical techniques.

Interpolation with equally spaced data
The difference table, Newton's forward and backward difference formulae, Gauss formula, stirling's interpolation formula, Bessel's interpolation formula, Inverse Interpolation.

Interpolation with unequally spaced data
Lagrange's formula, divided differences, divided–difference table, Newton Divided difference formula.
(Additioanl: Curve fitting by method of least square)

Numerical differentiation
Numerical differentiation based on forward and backward differences, Numerical differentiation based on Gauss forward, Gauss backward, Sterling's, Bessel's and Laplace Everet formula, Newton divided difference and Lagrange's formulae.

Numerical integration
The composite trapezoidal rule, composite Simpson's rule, Romberg Integration based on Trapezoidal and Simpson's rules
P1a: Multivariate interpolation, numerical differentiation and integration.

The solution of nonlinear equations
Bisection method, Regula-Falsi method, Newton-Raphson method, Fixed point iteration, Secant method, Error and convergence analysis for iterative methods.

Solution of system of linear equations
(direct method):
Gauss's elimination method based on partial and total pivoting, LU decomposition, Doolittle's method, Crout's method, Cholesky's method.

(Indirect method)
Iterative methods: Gauss Jacobi iterative method, Gauss Seidel iterative method.

Numerical solution of ordinary differential equations
Taylor's series method for single ODE and system of ODEs, Picard method, Euler's method, Improved Euler's method, Modified Euler method, Runge-Kutta methods of order 1,2,3 and 4 for single ODE and system of ODEs,

Multistep methods: Predictor-Corrector schemes including Adams-Bash-Forth technique, Adams-Molten technique, Milan's technique.
Higher order equations and systems of differential equations.

Numerical Solution of BVPs:
Finite difference method, Stability, convergence and consistency of the methods.

Additional Topics

Review of some advanced numerical schemes for the solution of ODEs including Homotopy based schemes (Homotopy Perturbation Method, Optimal Homotopy Asymptotic Method, Homotopy Analysis Method, He Laplace Method and Least Square with HP Algorithm), and Modifications of RK family of methods (Implicit and Explicit RK Methods, RK45 Methods) etc.

NATIONAL UNIVERSITY
of Computer & Emerging Sciences, Lahore

Department of Computer Science

CS2009 – Design and Analysis of Algorithms

Fall 2021

Instructor Name: Maryam Bashir
Email address: maryam.bashir@nu.edu.pk
Office Location/Number: C142
Office Hours: Monday 10:00 am till 12:00 pm, Tuesday, Thursday 9:30 AM to 10:30 AM

Course Information

Program: BS **Credit Hours:** 3 **Type:** Core
Pre-requisites (if any): Data Structures
Class Meeting Time: Tuesday, Thursday: Section **BCS-7F** 8:00 AM to 9:20 AM, Section **BCS-7E** 11:00 AM to 12:20PM
Class Venue:

Course Description:

The objective of this course is not to fill your brains with every algorithm that you would ever need. One of the aims of this course is to teach you to reason about algorithms and describe them. In addition, many known algorithms to solve known problems will be taught. At the end of the course, you should be able to choose an appropriate algorithm from a set of algorithms for a given problem.

Course Learning Outcomes (CLOs):
1. Explain what is meant by “best”, “expected”, and “worst” case behavior of an algorithm
2. Identify the characteristics of data and/or other conditions or assumptions that lead to different behaviors.
3. Determine informally the time and space complexity of simple algorithms
4. List and contrast standard complexity classes
5. Use big O, Omega, Theta notation formally to give asymptotic upper bounds on time and space complexity of algorithms
6. Use of the strategies(brute−force, greedy, divide−and−conquer, and dynamic programming) to solve an appropriate problem
7. Solve problems using graph algorithms, including single−source and all−pairs shortest paths, and at least one minimum spanning tree algorithm

Course Textbook

- *Introduction to Algorithms* by Cormen, Leiserson, Rivest, and Stein, 3rd Ed., MIT Press, 2001.

Additional references and books related to the course:

- Jon Kleinberg, Éva Tardos, Algorithm Design, Pearson/Addison−Wesley
- Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani, Algorithms, McGraw−Hill Education
- *Algorithms in C++* by Robert Sedgewick, Addison−Wesley, 1992.
- *Data Structures and Algorithms* by Aho, Hopcroft, and Ullman.

Weekly Schedule

Lectures	Description	Chapters of Text
Week −1	The role of algorithms in computers, Asymptotic functions and notations (Bid−oh, big−omega, theeta) best and worst case time complexity	1, 2, 3
Week – 2, 3, 4	Divide and Conquer (maximum subarray, counting inversions, quicksort, merge sort) + Solving recurrences	2, 3, 6
Week – 5	Lower bound for comparison based sorting, Sorting in linear time: Count Sort, radix sort	8
	Midterm – I	
Week – 6,7	Dynamic Programming (maximum subarray, rod cutting, longest common subsequence, 0/1 knapsack)	15
Week – 8, 9	Greedy Algorithms (Activity selection, fractional knapsack and huffman codes)	16
Week – 10, 11	Introduction to graphs (revision of BFS, DFS) and their application (Bridges and articulation point, topological sort, strongly connected components)	22
	Midterm – II	
Week – 12	Minimum Spanning Trees (MST)(Prim's Algorithm and Kruskal's Algorithm)	23
Week – 13, 14	Shortest Path Algorithms (dijkstra's Algorithm, BellmanFord and Floyd Warshall Algorithm	24
	Final Exam	Comprehensive

Grading Criteria

1. 4 Assignments (15%)
2. 4 Quizzes (15%) (3 best out of 4)
3. 2 Midterm Exam (12.5% each)
4. Final Exam (45%)

Grading Policy

Absolute Grading

Course Policies

1. Quizzes will be announced.
2. No makeup for missed quiz or assignment.

Plagiarism in Assignments

In writing up your assignments and in answering questions in exams, be as clear, precise, and concise as you can. **Understandability will be an important factor in grading**.

Academic Integrity: All work MUST be done individually. Any copying of work from other person(s) or source(s) (e.g. the Internet) will automatically result in at least an F grade in the course. It does not matter whether the copying is done in an assignment, quiz, midterm exam, or final exam, it will be considered equally significant.

NATIONAL UNIVERSITY
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Department of Computer Science

CS3004 – Software Design & Analysis

Fall 2021

Instructor Name: Aamir Raheem
Email address: aamir.raheem@nu.edu.pk
Phone: 111-128-128 X 257
Office Location/Number: Liberty lab
Office Hours: (after your class)

Course Information

Program: BS **Credit Hours:** 3 **Type:** Core
Pre-requisites (if any): Data Structures (course and lab)

Course Description/Objectives/Goals:

Purpose of this course is to enable students to analyze, design and implement software systems and applications. The students learn these skills using the modern object-oriented paradigm, which promises reusable, readable and maintainable software components and applications.

Course Learning Outcomes (CLOs):

At the end of the course students will be able to:

1) Understand and appreciate the pillars and advantages of the OO paradigm.
2) Conduct a grammatical parse of a problem statement to identify the relevant abstractions (classes) and their attributes, operations, and relationships.
3) Analyze a given problem and model it using UML diagrams
4) Model the static aspects of a solution using a detailed UML design class diagram.
5) Model the dynamic aspects of a solution using different UML state and interaction- diagrams.
6) Produce elegant and flexible designs using the concept of design patterns.
7) Implement a given object-oriented design.
8) Understand and apply the fundamental design principles.

Course Textbook

Timothy C. Lethbridge, Robert Laganaiere , Object-Oriented Software Engineering (2nd Edition), McGraw-Hill, 2005

Additional references and books related to the course:

- Blaha and Rumbaugh, Object-oriented Modeling and Design with UML (Second Edition), Pearson Prentice Hall 2005
- Erich Gamma, et al., Design Patterns: Elements of Re-usable Object-oriented Design, Addison-Wesley, 1999
- Martin Fowler, Refactoring: Improving the Design of Existing Code (First Edition), Addison-Wesley
- Robert C. Martin, Clean Architecture: A Craftsman's Guide to Software Structure and Design, Pearson 2017
- Grady Booch et al., Object-Oriented Analysis and Design with Applications (3rd Edition), Pearson 2007.
- Larman, Craig. Applying UML and patterns: an introduction to object oriented analysis and design and interative development. Pearson Education India, 2012.

Tentative Weekly Schedule

Week	Topics to be covered
1	Intro + SDLC; Characteristics of good programs
2	OOP review, classes and objects; Inheritance, polymorphism, UML, is-a rule
3	Object associations (simple association, aggregation, composition; implementation; one to one, many to one, many to many; reflexive)
4	Multiple inheritance, diamond problem, Java interfaces, C++ virtual inheritance
5	Class diagrams
6	Use case diagrams, use case descriptions
7	Sequence diagrams, principles of choesion & coupling
8	State diagrams, Activity diagrams
9	Design principles (SOLID) 1
10	Design principles (SOLID) 2
11	Object-Oriented Metrics
12	Design patterns 1, 2
13	Design patterns 3, 4
14	Design patterns 5, 6
15	Design patterns 7, 8

(Tentative) Marks Distribution

1. Class participation (3%)
2. Quizzes (7%)
3. Assignments (10%)
4. Project (10%)
5. Midterm Exams (30%)
6. Final Exam (40%)

Grading Scheme

Absolute grading will be used

Course Policies

1. 80% attendance is required to appear in the exams
2. Plagiarism is not tolerable in any of its form. The penalty may be an ‘F’ grade in the course. Students bear all the responsibility for protecting their assignments. In case of cheating, both parties will be considered equally responsible!
3. Assignments must be submitted in time. Late submissions (maximum one week) would result in deduction in marks. Only the submitted articles will be marked.

AI 2002 – Artificial Intelligence

COURSEWARE OUTLINE/ DOCUMENT						
COURSE INSTRUCTOR INFORMATION	**Name**	Dr. Hashim Yasin				
	email ID	hashim.yasin@nu.edu.pk				
	Contact info.	*Department of Computer Science, Faculty Offices – First Floor* *+92 – 41 – 111 – 128 – 128 Ext: 165*				
DEGREE INFORMATION	**Program**	**Batch**	**Section(s)**		**Semester**	Spring
	BS(CS)	19	A, B	E	**Year**	2022

COURSE INFORMATION	**Course Category** **C-** Core/ **E-**Elective	**Code**	**Title**	**Credit hours**
	C-Core	AI-2002	*Artificial Intelligence*	3
	Prerequisite(s)	N/A	N/A	N/A

TEXT BOOK(s) INFORMATION	**Title of Book**	*Artificial Intelligence: A Modern Approach by S. Russell and P. Norvig*	**Edition**
			3rd
Reference book(s)	1	*Artificial Intelligence by George F. Luger.*	
	2	*Artificial Intelligence: Foundations of Computational Agents by David L. Poole and Alan K. Mackworth*	

Course Objectives:	
1.	To introduce the notion of intelligence and the so called artificiality associated with it, and how these can be modeled in computational systems.
2.	To introduce students with computational intelligence theory and techniques used to design and develop intelligent systems.
3.	To motivate students toward carrying real world AI projects, keeping the local context in view.
4.	To introduce advance AI topics.
5.	To create a solid AI foundation which motivates students towards taking advanced AI courses/research.

Course Learning Objectives:

Learning Outcomes	**At the end of the course students will be expected to have:**	
	a.	Enough knowledge to design intelligence components of real world systems
	b.	Ability to think in terms of computational intelligence for solving real world problems
	c.	A necessary AI foundation on which student can take next level AI course/research
Outcome Assessments	Outcome assessments are conducted throughout the semester by taking regular quizzes, assignments and mod and final exams.	
Overview	This course introduces artificial intelligence (AI), from brief history, to basic theories, applications of intelligent agents, design of rational agents. The focus is to motivate students towards carrying on real world AI projects	
Design skills/ Techniques	Students are given multiple assignments regarding implementation to Studied algorithms like A* and Neural network in different problem like face detection and path finding problems	
Effectiveness of course and level of skills	This course introduce students with computational intelligence theory and techniques used to design and develop intelligent systems.	
Emerging paradigms	AI foundation which motivates students towards taking advanced AI courses/research.	
Modeling and Design	Agent modeling and design	

Courseware Structure: (Mark X where applies)

Lecture (Lect)	*Multimedia (MM)*	*Exercise (Exer)*	*IT Labs (Lab)*	*Case Studies (CAS)*	*Individual Assignment (Assign)*	*Group Tasks*	*Any other Medium*
X	X	X			X	X	

Tentative Lectures Plan		
Weeks	**Contents/Topics**	**Course Activity**
Week-01	• Introduction (course & conduct), Introduction to artificial intelligence, history and its applications • Rational agents, PEAS, agent environment and its types: simple reflex, model, goal based, utility based, intelligent agents, learning Agents	
Week-02	• State space search – I (uninformed search) • State space search – II (uninformed search) Breath First Search Depth First Search Depth Limited Search Iterative Deepening Search Uniform Cost Search Bidirectional Search	
Week-03	• State space search – II (informed search) • State space search – III (informed search) Best First Search A* Search Heuristic Admissibility Heuristic Consistency Recursively Best First Search	Quiz # 1 Assignment # 1 (uninformed &informed Search)
Week-04	• Beyond Classical Search • Hill climbing ,Simulated annealing, Local beam search	
Week-05	• Adversarial search – I: minimax • Adversarial search – II: alpha-beta pruning, etc.	Quiz # 2
Week-06	**First Mid Term Exam**	
Week-07	• Constraint Satisfaction Problems (CSPs) – I • Constraint Satisfaction Problems (CSPs) – II Formulation of CSP Inference in CSP Constraint Propagation Heuristics in CSP	Assignment # 2
Week-08	• Knowledge based reasoning, Propositional logic – I • Propositional logic – II Syntax and semantic Entailment Inference Resolution Theorem CNF	Quiz # 3
Week-09	• First order logic – I • First order logic – II First Logic Sentences (Quantifiers) CNF in FOL	

Week-10	• Inference in FOL – I • Inference in FOL – II Resolution Theorem in FOL Unification Factoring	Assignment # 3 Quiz # 4
Week-11	**Second Mid Term Exam**	
Week 12	• Planning – I (partial order planning) • Planning – II (graph plan)	
Week-13	• Unsupervised Learning algorithm (Clustering like K-Mean, K-mediod) • Supervised Learning (General Concepts)	Quiz # 5
Week-14	• Supervised Learning Algorithm (ANN) • Supervised Learning Algorithm (ANN) Perceptron Training Rule Delta Rule Gradient Descent Rule MLP Backpropagation	Assignment #4
Week-15	• Naive Bayes classifier • Genetic algorithm	Quiz # 6
Week-16	• Advance Topics (SVM, Decision Tree)	
Week-17	**Final Exam**	

Marks Distribution:

Particulars	% Marks	*Weight Ranges
1. Quizzes	10	0 ~ 20
2. Assignments / Project	10	0 ~ 20
3. Mid Term 1	15	10 ~ 20
4. Mid Term 2	15	10 ~ 20
5. Final Exam	50	40 ~ 60
Total:-	**100**	**100**

Planned Courseware Events:

Particulars	Planned Items	Remarks
1. Quizzes	**>= 5**	Announced/Unannounced, both
2. Assignments	**>= 3**	Individual/group assignments

Grading Policy: Relative Grading

Qualifying Attendance	You must attend every class for your own personal benefit. Please refer to university policy of minimum attendance requirement. Failing to confirm qualifying attendance threshold, the student will stand debarred from sitting in the examination and assigned with "F" Grade.

Academic and Moral Integrity:	1. All assignments should be your own work (or your group's when approved). PLAGIARISM will be awarded with "F" grade and/or reported to the University for academic and moral misconduct. 2. Missed quizzes/assignments will not be rescheduled. 3. Copied assignments shall not be accepted and will result in deduction of marks already scored.

Instructions / Suggestions for STUDENTS for satisfactory progress in this course:

- ✓ On average, most students find at least three hours outside of class for each class hour necessary for satisfactory learning.
- ✓ The homework assigned is a minimum. You should always work extra hours on your own.
- ✓ Use the few minutes you usually have before the start of each class to review the prior meetings' notes and homework. This will save us valuable in-class time to work on new material.
- ✓ Develop a learning habit rather than memorizing; work in groups, whenever appropriate.
- ✓ Apply the learned principles and gained knowledge; be creative in thinking.
- ✓ **Assignments/ Activities:** They are not meant simply for grades, but to reinforce your learning. Assignments are due on time. Each day late will lower your assignment grade by 30%.

Computer Networks-CS3001
Spring 2022

Course Outline

Instructor: Dr. Arshad Ali
Email: arshad.ali@lhr.nu.edu.pk
Office location: Faculty Office (C-140) Civil Building
Office Timings: Monday & Wednesday after 2:30 pm

TA Name
Email:
LAB Instructor:
Email:
LAB Instructor:
Email:

Course Information

Program: BS
Credit hours: 3+1 (LAB)
Type: Core
Class meeting time: Sec 5C: Monday, Wednesday: 11:30 am – 01:00 pm
Sec 5D: Monday, Wednesday: 1:00 am – 02:30 pm

Course website: Google Classroom
Class Venue: CS-5 / Google Meet
Pre-requisites: CS218 Data Structures, CL 218

Objective of the Course

The objective of this course is to introduce the principles and practices of Computer Networking, specifically focusing on the Internet. By the end of the course, students should be able to:

- Understand the anatomy of the Internet
- Understand fundamental layered structure, understand common offered layered services, examine protocols and algorithms used to operate the network
- Create foundation for more advanced courses in computer networks
- Be able to write networking application with Socket programming in C/C++
- Design and test networks on network designing tools
- Simulate existing protocols along with designing new protocols in network simulators

Course Learning Outcomes

The objective of this course is to introduce the principles and practices of Computer Networking, specifically focusing on the Internet. By the end of the course, students should be able to achieve the following CLOs:

CLO#	CLO description	BT Domain/ BT Level	PLO #
CLO 1	**Describe the key terminologies and technologies of computer networks**	**C2**	**PLO 1**
CLO 2	**Explain the services and functions provided by each layer in the Internet protocol stack**	**C2**	**PLO 1**
CLO 3	**Identify and analyze various internetworking devices and protocols, and their functions in a network**	C4	**PLO 2**
CLO 4	**Analyze working and performance of key technologies, algorithms and protocols**	**C4**	**PLO 2**
CLO 5	**Build Computer Network on various Topologies**	**P3**	**PLO 5**

Text Book

Computer Networking: A Top Down approach featuring the Internet, 6th Edition — James F. Kurose and Keith W. Ross

Reference book

Computer Networks, 5th Edition — Andrew Tanenbaum
Data Communications and Networking, 4th Edition — Behrouz A. Forouzan

Course Outline

Module	No. Of Lectures	Reference Text
Introduction and Overview Basic Concepts of Networking Circuit switching Packet switching Multiplexing (TDM, FDM) Throughput, Loss and delay Internet Architecture Protocol Layering	**4**	**Chapter 1 Supplement text from Forouzan**
Application Layer Network application architectures HTTP, FTP, Email, DNS Basics of P2P applications	**4**	**Chapter 2**
Transport Layer Multiplexing in UDP and TCP Connectionless Transport: UDP Reliable data transfer and TCP Congestion avoidance and control	**7**	**Chapter 3**
Network Layer The Internet Protocol Routing algorithms Routing protocols Broadcasting and Multicasting	**8**	**Chapter 4**
Link Layer and MAC Layer Functionalities Error Detection & Control, ARP Link layer addressing Bridges and Hubs LAN Technologies Multiple Access	**5**	**Chapter 5 Supplement text from Tenanbaum**
Advanced Topics (subject to availability of time) Introduction to Internet of things Multimedia networking Applications Introduction to Network Security and Principles of Cryptography Introduction to 1 G, 2G and 3G		**Chapter 7 Supplement text from Tenanbaum/ Network security: private communication in a public world by Radia Perlman** [Subject to the availability of the time]

Evaluation (Subject to change)

Assignments	(4 to 6)	10%
Quizzes	(4 to 6)	15%
Mid Exams	(2)	30% (15% + 15%)
Final Exam	(1)	45%
Total:		**100 %**

Grading Policy

Absolute Grading Scheme

Course Policies

- Course outline may change 10-20% as we proceed in the semester
- Important: It is strived & intended to have uniform & similar weightages of different course components & grade assigning policy across all the sections for this course for the semester, but there may be variations owing to various factors, for example different number / types of assessments like assignments, home works, quizzes and/or projects.
- Assignment deadlines for both class and lab are hard.
- Quizzes might be announced or unannounced.
- There will be **no re-take** of quizzes or exams. Special consideration may be given only for mid or final exam for an emergency on per case basis subject to approval from the department administration & the instructor. In approved circumstances, percentage of mid will be awarded for final or vise versa.
- Integrity in the assignments/quizzes is expected; otherwise, result would be an F grade in the course or the case may be forwarded to the Disciplinary Committee.
- The lectures will be of 1.5 hours duration + there will be one 3 hours lab/week.
- (80%) Attendance for the student is a MUST which needs to be ensured according to the University policy to avoid disqualification.
- You may request an appointment according to my schedule by emailing me on the aforementioned email.

NATIONAL UNIVERSITY
of Computer & Emerging Sciences, Lahore

Department of Computer Science

CS3005 – Theory of Automata

Spring 2022

Instructor Name: Sobia Tariq Javed
Email address: sobia.tariq@nu.edu.pk
Office Location/Number: (N-203) Near Seminar Hall
Office Hours:

TA Name (if any):
Email address: ---@lhr.nu.edu.pk

Course Information

Program: BS (CS)
Credit Hours: 3
Type: Core
Pre-requisite: CS211 Discrete Structures
Course Website: N/A
Class Meeting Time:
Class Venue:

Course Description/Objectives/Goals

This core course belongs to an important branch of computer science known as Theoretical Computer Science (TCS). TCS deals with, among other concepts, the theory of computation which focuses on automata theory, computability theory, and complexity theory. Students are gradually familiarized with different types of increasingly more powerful mathematical models of computers known as automata (plural of automaton) and the languages they can recognize.

#	Course Learning Outcomes (CLOs)
CLO1	Identify formal language classes and prove language membership properties
CLO2	Differentiate and manipulate formal descriptions of languages, automata and grammars with focus on non-regular and regular using automata (DFA, NFA, NFA-NULL)
CLO3	Differentiate and manipulate formal descriptions of languages, automata and grammars with focus on context-free languages using automata (PDA and NPDA).
CLO4	Differentiate and manipulate formal descriptions of languages, automata and grammars with focus on non context-free languages using Turing Machines
CLO5	Prove and disprove theorems establishing key properties of formal languages and automata

Textbook and Reference Book

1. **John C. Martin. *Introduction to Languages and the Theory of Computation*. Fourth Edition. McGraw-Hill. ISBN: 0-07-115468-X (International Students Edition).**
2. Introduction to the Theory of Computation, Michael Sipser, 3rd Edition, Cengage Learning, 2012.
3. Introduction to Automata Theory, Languages, and Computation, John E. Hopcroft, Rajeev Motwani, and Jeffrey D. Ullman, 3rd Edition, Pearson, 2006.

Tentative Weekly Schedule

Week	Topics
1	Introduction and Revision of Basic Concepts
2	Finite Automata: DFA
3	Finite Automata: NFA
4	Finite Automata: NFA-DFA Conversion
5	Regular Languages: Regular Expressions, Equivalence with FA
6	MIDTERM EXAM 1
6	Regular Languages: Pumping Lemma
7	Context-Free Languages: CFGs
8	Context-Free Languages: PDA
9	Context-Free Languages: PDA-CFG Equivalence
10	Context-Free Languages: Pumping Lemma
11, 12	Context-Free Languages: DCFLs
12	MIDTERM EXAM 2
13	Turing Machines: Introduction
14	Turing Machines: Variants
15, 16	Decidability

(Tentative) Grading

1. Quizzes (15%)
2. Assignments (10%)
3. Midterm Exams (35%)
4. Final Exam (40%)

Grading Scheme: Absolute

Absolute Grading Scheme:

Total Marks (%)	Grade
≥ 90	A+
86-89	A
82-85	A-
78-81	B+
74-77	B
70-73	B-
66-69	C+
62-65	C
58-61	C-
54-57	D+
50-53	D
≤ 49	F

Course Policies

1. Announcements related to different aspects of this course (e.g. lectures, quizzes, exams, etc.) may be posted on google classroom. Students are expected to check the classroom regularly.
2. All students are expected to attend all lectures from beginning to end. Partial or full absence from a lecture without a valid reason may hamper chances for securing good grades. University's attendance requirements must be met in order to appear in the final exam.
3. Late submission of assignments is NOT allowed.
4. Students are encouraged to take full advantage of instructor's office hours. Any doubts regarding concepts covered in class or any questions regarding quizzes, assignments, etc. may be clarified during office hours. In case a student is not able to make it during office hours, he/she may schedule an appointment with the instructor for another time slot.
5. Quizzes may be announced or unannounced. A quiz will usually be about 5 – 15 minutes long and it may be given anytime during the lecture. Students missing a quiz will NOT be given a make-up quiz.
6. Students are encouraged to finish the assigned readings BEFORE the lecture. This is likely to improve lecture comprehension and class participation.
7. Students can contest their grades on quizzes and assignments ONLY within a week of the release of grades. Exams will be available for review according to university policies.
8. Students are expected to demonstrate the highest degree of moral and ethical conduct. Any student caught cheating, copying, plagiarizing, or using any other unfair means will be strictly dealt-with in accordance with university policies.

Academic Integrity

- Plagiarism and Cheating against academic integrity. Both parties involved in such cases will face strict penalty (negative marking, F grade, DC)
- CODE/ ASSIGNMENT SHARING is strictly prohibited.

- Keep in mind that by sharing your code/assignment you are not helping anyone rather hindering the learning process or the other person.
- No excuse will be entertained if your work is stolen or lost. To avoid such incidents
    - Keep back up of your code on safe online storage, such as Google Drive, Drop box or One drive.
    - Do not leave your work on university lab computer, transfer your work to online storage and delete from the university lab computer (empty recycle bin as well)

FAST National University of Computer and Emerging Sciences, Lahore Campus

Computer Science – Communication & Presentation Skills SS1008

Semester: Spring 2022
Credit Hours: 2

Course Goals
This course is designed to increase students' understanding of the principles of effective communication, dynamics of face-to-face communication by introducing elements for effective communication. The course aims to develop students' oral communication skills, decision making and problem solving and presentations skills in a variety of settings.

Course Objectives:
With the goal of enhancing students' general ability and confidence in oral expression, the students are expected to:

- Understand how communication works, the processes involved
- Gain active listening and responding skills
- Improve vocal delivery
- Understand and improve body language
- Select information appropriate for presentations
- Gain a clear sense of audience's needs and purpose
- Use graphics and visual information in presentations
- Prepare and deliver presentations in groups and individually

Class Room Courtesies:

- Dress code: Formal/Business Casual (for all class sessions)
- Cell phones must be switched off during class.
- The required readings should be completed before the class commences.
- Deadlines for all assignments, readings and presentations must be adhered to strictly.
- Consistent attendance, punctuality and participation are essential to your success.

Plagiarism / Academic Dishonesty:
All work submitted must be your own work. Cases of plagiarism shall be sent to the Disciplinary Committee.

Textbook:
Communicate, 15th Edition
by Kathleen S. Verderber, Deanna D. Sellnow, Rudolph F. Verderber

Marking Criteria:

Presentations	15%
Class Participation	5%
Quiz	10%
Midterm I & II	20%
Final	50%

NB: Relative Grading will be applicable.

FAST National University of Computer and Emerging Sciences, Lahore Campus

Weekly Schedule:

Week	Contents	Assignments	Chapters
1	**Presentation Skills** Foundations of Communication • Communication Process • Communication Principles	- Activities for Practice	1
2	**Verbal Adaptation** • Presentational Aids	Making PowerPoint presentation slides - Make groups - Assign topics from chapter: 4 & 5	13 & 14
3	**Visual Adaptation & Speech Apprehension** • Delivery • Tone • Body language	Activity and Group discussion - Assign topics from chapter: 4 & 5 - Reading Ch: 4 & 5	15
4	**Communicating Nonverbally & Verbally**	Group Presentations: Assigned topics from the chapter (max. 20 mins./group) - Assign topics from chapter: 6 **Quiz I**	4 & 5
5	**Listening** • Types of Listening • Steps in the Listening Process • Barriers in Listening	- Group Presentation and pop quiz:	6
	Midterm I		
6	**Informative and Persuasive Speaking**	- Practice Short Presentations - Peer Evaluation through rubric	16 & 17
7	**Communicating in Groups** • Stages of Group Development • Types of Groups	- Case Studies (questions assigned in groups to be presented later). Provide sample answers. - Assign Group Presentation from Ch: 3 (assign countries, Ss incorporate areas from the chapter) -	9
8	**Communicating in Groups** - Problem Solving in Groups	Group Presentations - Assign groups and topics for final presentations	10
9	**Intercultural Communication** • Characteristics • Barriers	Group Presentations	2

	• Strategies	**Quiz II**	
10	Intercultural Communication	Group Presentations	9 & 10
11	Impromptu Presentation	Individual Presentations	16
12	Impromptu Presentation	Individual Presentations **Quiz III**	17
	Midterm II		
13	Perception of Self and Others & Self Disclosure	Activity: Personality Test + analysis + questions	2 & 7
14	Group Presentations on Social Issues	Persuasive topics	
15	Viva – Final exam assessment		

National University

of Computer & Emerging Sciences

Department	Department of Sciences and Humanities	Dept. Code	CS
Course Title	Psychology	Course Code	SS 2003
Grading policy	Relative grading	Credit Hrs.	3
Course Instructor	Raheela Tariq Asst.Professor	Moderator	Ms. Raheela Tariq

Level: I = Introduction, R = Reinforcement, E = Evaluation.

Tool: A = Assignment, Q = Quiz, M = Midterm, F = Final, SP = Project, A = Assignment.

Course Objectives	*This course will provide students with basic theoretical knowledge with an emphasis on how psychological theory relates to the "real world", including understanding of different cognitive processes, role of motivation in life and jobs, improving mental health and inter-personal relations. On completion of this course, students will be able to handle the intricacies and complexities of human behavior more skillfully in everyday life as well as in job organization.*

No.	Course Learning Outcome (CLO) Statements	Assessment Tools
1.	Understanding and applying main perspectives of psychology in daily lives.	Q1, M1, M2,SP,F
2.	Role of Bio- psycho-social factors in our behavior.	Q3,M2, F
3.	Thought processes and its impacts	Q2,M2,F
4.	Mental health, psychopathology and coping strategies.	Q3,M2, F
5.	Testing different domains of behavior.	SP,A2

Text Book(s)	Title	*Psychology themes and variations.*	
	Author	Wayne Weiten	
Ref. Book(s)	Title	Understanding psychology	Psychology.
	Author	Robert S Feldman	David G. Myers

Classroom Courtesies	All quizzes and exams according to dates announced by university. Deadlines must be observed for all semester work.
Grading policy	**Relative grading** .All work submitted must be the student's own work- No plagiarism will be accepted. Research format follows standard documentation APA guidelines

Week	Course Contents/Topics	Chapter*	CLO*
1-2	*Introduction to Course* *Brief history of how psychology evolved. The six perspectives of psychology. Application & Research methodology.*	**1**	**1**
3	*The biology and underlying behavior* *Neurons, the elements of behavior. Role of neurotransmitters. Structure and functions of central and peripheral nervous system. The endocrine system.*	**2**	**1,2,4**
4	*Types of learning. Conditioning: Classical and operant. Factors influencing learning.*	**3**	**1**
5	*Memory and Forgetting, Encoding, storage and retrieval of memory. Types and methods of memories. How to improve memory. Forgetting: when memory fails, impairments.*	**4**	**3,4**
	MID-TERM 1		
6-7	*Cognitive processes. Tools of thought, Types of Thinking. Reasoning. Problem solving. Creative thinking. Intelligence: IQ&EQ.*	**5**	**3,5**
7-8	*Personality. Nature & Nurture, Theories of personality. Psychodynamic and Big five Model. Assessing personality.*	**6**	**1,2,5**
9-10	*Stress, coping and health: Different types of Conflict & frustration. Stress & Health Types, causes, symptoms, strategies. Anger and Management.*	**7**	**2,4,5**
10-11	*Psychopathology: Different psychological Disorders: Neurosis, types, causes, symptoms. Psychosis. Types, Causes, symptoms, treatment. Psychotherapy.*	8	2,4
12-13	*Motivation. Types of motivation. Unlearned and Acquired. Theories of motivation, Maslow, McClelland, Stacy Adams and Victor vroom.*	9	1
13-14	*Social Psychology. Social Perception. Attitude and Prejudice.* *Group Dynamics. Leadership.*	10	1

Assessment Tool	Weightage
Final	50%
Midterm (I+II)	30%
Quiz.1,2,3	09%
Assignment.	03%
Survey project &Presentation	08%

National University of Computer & Emerging Sciences

Department of Computer Science

CS3002: Information Security

Fall 2022

Instructor

Name: Dr. Ammar Haider

TA Name: TBA

Email address: ammar.haider@nu.edu.pk

Office Location: Block F, First floor, Room 26

Office Hours: Open

Course Objectives/Goals

This course serves as a comprehensive overview to the field of information security at senior undergraduate level. At the end of the course the students will be able to:

	BT Level	PLO Mapping
1. **Explain** key concepts of information security such as design principles, cryptography, risk management.	2	1
2. **Discuss** legal, ethical, and professional issues in information security.	2	6
3. **Analyze** real world scenarios, model them using security measures, and apply various security and risk management tools for achieving information security and privacy.	3	2
4. **Identify** appropriate techniques to tackle and solve problems of real life in the discipline of information security.	4	3

The course will broadly cover the following topics:

- Information security foundations
- Security design principles and mechanisms
- Symmetric and asymmetric cryptography
- Hash functions, digital signatures, key management,
- Authentication and access control
- Software security, vulnerabilities and protections, malware
- Database security
- Network security, firewalls
- Intrusion detection
- Security policies, policy formation and enforcement

- Risk assessment
- Cybercrime, law and ethics in information security
- Privacy and anonymity of data

Reference Textbooks

- Computer Security: Principles and Practice (SPP), 4th ed. by William Stallings and Lawrie Brown
- Cryptography and Network Security (CNS), 8th ed. By William Stallings
- Principles of Information Security, 6th ed. by M. Whitman and H. Mattord
- (ISC)^2 CISSP: Official Study Guide, 8th edition
- Computer Security, 3rd edition by Dieter Gollmann
- Computer Security Fundamentals, 3rd edition by William Easttom

Tentative Grading Criteria

- 3-4 Assignments — 10%
- 4 Quizzes — 10%
- 2 Midterm Exams — 25%
- Course Project — 10%
- Final Exam — 45%

Grading Scheme: Absolute

Tentative Weekly Schedule

Timeline	Content Covered
Lecture 1	**Course Introduction** • Introducing syllabus, policies, and projects. • An overview of basic information security principles (with practical examples): confidentiality, integrity, availability, authentication, authorization and non-repudiation. • Component of an Information system
Lecture 2	**Security Design Principles** Discussion and evaluation of following primitives: Least-privilege, fail-safe defaults, complete mediation, separation of privilege, economy of mechanism, open design
Lecture 3	**Cryptography** Introduction to Cryptography: Symmetric cipher model, Substitution techniques (Caesar cipher, Monoalphabetic cipher)
Lecture 4	**Cryptography-II** Substitution techniques (Vigenere cipher, One-time pad) Transposition techniques (Rail fence cipher, Row transposition cipher)
Lecture 5	**Cryptography-II** Block cipher structure and design principle, Feistel cipher structure, the data encryption standard, DES (encryption, key generation)

Lecture 6	**Cryptography-III** AES structure, transformation, key expansion mechanism, AES example and implementation Stream ciphers introduction
Lecture 7	**Cryptography-IV** Introduction to Public Key cryptography RSA: principles, RSA algorithm Diffie-hellman key exchange algorithm with example, Man-in-the-middle attack in diffie-hellman
Lecture 8	**Cryptography-V** Hash functions, applications, Hash properties (preimage resistant, second preimage resistant, collision resistant) Message authentication code, requirements & properties of MAC HMAC algorithm & structure
Lecture 9	**Cryptography-VI** Digital Signature, requirements & properties of DS Public key infrastructure (PKI), elements of PKI, X.509, Digital certificates
Lecture 10	**Revision**
First Mid-term Exam	
Lecture 11	**Software Security** Malware, types of malware (virus, worms, trojan horse, adware, spyware, backdoor, ransomware, rootkits, bootkits), malware analysis & countermeasures
Lecture 12	**Software Security-II** Control Hijacking: Integer overflow String format vulnerabilities & countermeasures
Lecture 13	**Software Security-III** Control Hijacking: Buffer overflow countermeasures
Lecture 14	**Database Security** Basics SQL Injection Attack, techniques, types of attack Countermeasures, database access control
Lecture 15	**Database Security-II** Database inference attacks & counter measures Database encryption methods
Lecture 16	**Web Security** Background

	Cross Site Request Forgery (CSRF) Attack Countermeasures (STP, origin header, referrer header)
Lecture 17	**Web Security-II** Cross Site Scripting (XSS) Attack Types of XSS (reflected, stored, DOM based) countermeasures (encoding, validation, input handling contexts, secure input handing)
Lecture 18	**User Authentication** Types (password, biometric, symmetric/asymmetric) Kerberos (overview, key exchange protocol)
Lecture 19	**Access Control** Access control policies Discretionary and Role-based Access Control
Lecture 20	**Revision**
Second Mid-term Exam	
Lecture 21	**Network Security** Secure Socket Layer (SSL) SSL certificate, architecture, handshake
Lecture 22	**Network Security-II** IP security (IPSec) IPsec modes (transport, tunnel), architecture, AH, ESP
Lecture 23	**Network Security-III** Intrusion Detection Systems (IDS) Components of IDS, classification of IDS (anomaly, signature, hybrid), types (host-based, network based)
Lecture 24	**Network Security-IV** Firewalls, Types of firewall (packet-filtering, stateful packet inspection, application proxy, circuit-level proxy) Location of firewall
Lecture 25	**Theoretical models of Access Control** Confidentiality policies (BLP model) Integrity policies (Biba Model) Integrity policies (Clark-Wilson model) Hybrid policies (Chinese Wall model)
Lecture 26	**Cybercrime Laws and Ethics** Pakistan cybercrime act and the role of investigative agencies. Ethical perspective of research studies and experimentation (data privacy and anonymization techniques). Intellectual property, copyright, patent, trade secret.

Lecture 27 - onwards	**Revision & Project Evaluations**
Final Examination	

NATIONAL UNIVERSITY
of Computer & Emerging Sciences, Lahore

Department of Computer Science

CS3006 – Parallel and Distributed Computing

FALL 2022 (BCS-6E, BCS-6F)

Instructor Name: Dr. Syed Mohammad Irteza	**TA Name:** M Taha (BCS-6E) / M Anas Tanvir (BCS-6F)
Instructor Email: m.irteza@nu.edu.pk	**TA Email:** BCS-6E l215289@lhr.nu.edu.pk
Alt. Email: mohammad.irteza@lhr.nu.edu.pk	**TA Email:** BCS-6F l215678@lhr.nu.edu.pk
Office Location/Number: F-36 (New Building)	**Office Location/Number:** N/A
Office Hours: Mon & Thu 14:00 - 15:00	**Office Hours:** available upon request

Course Information

Program:	BS	**Credit Hours:**	3
Type:	Core	**Pre-requisites:**	CS220
Website: BCS-6E		https://classroom.google.com/c/Njg3OTE2Nzk3Mjc5	
Website: BCS-6F		https://classroom.google.com/c/NzQ1ODQ3ODYwMzM0	
Class Meeting Time:		Mon and Wed (8:30am-10:00am BCS-6F); (10:00am-11:30am BCS-6E)	
Class Venue:		NB-209	

Course Description/Objectives/Goals:

This course covers a broad range of topics related to parallel and distributed computing, including parallel and distributed architectures and programming paradigms of parallel and distributed systems. Basic goal of this course is to understand the fundamental concepts of parallel and distributed computing, analyze different problems and develop programming solutions of parallel problems.

Initially we will discuss an introduction to parallel and distributed systems and the categorization of multiprocessor systems according to Flynn's Taxonomy. Overall the course is divided into two parts. The first part covers parallel shared memory systems and programming shared memory machines with P-threads and OpenMP. The second part covers distributed systems, distributed system architectures, types of distributed systems (Clusters, Grid and Cloud computing), fault tolerance techniques and finally programming distributed systems using MPI.

Program Learning Outcomes (PLOs):

This course covers the following PLOs:

PLO#	PLO Name	PLO Description
PLO 2	Knowledge for Solving Computing Problems	Apply knowledge of computing fundamentals, knowledge of a computing specialization, and mathematics, science, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements
PLO 3	Problem Analysis	Identify, formulate, research literature, and solve complex computing problems reaching substantiated conclusions using

		fundamental principles of mathematics, computing sciences, and relevant domain disciplines
PLO 4	Design/ Development of Solutions	Design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations

Course Learning Outcomes (CLOs):

At the end of the course students will be able to:

CLO #	CLO description	BT domain / BT Level	PLO #
CLO 1	Demonstrate understanding of various concepts involved in parallel and distributed computer architectures.	C3 (Applying)	PLO 2
CLO 2	Implement different parallel and distributed programming paradigms and algorithms using Message-Passing Interface (MPI) and OpenMP.	C3 (Applying)	PLO 4
CLO 3	Perform analytical modelling, dependence, and performance analysis of parallel algorithms and programs.	C4 (Analyzing)	PLO 3

Course Textbook

- **[AAGV]** Introduction to Parallel Computing, 2nd Edition by Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar
- **[KLEP]** Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems, by Martin Kleppmann, ISBN-13 : 978-1449373320
- Using OpenMP: Portable Shared Memory Parallel Programming by Barbara Chapman, Gabriele Jost, Ruud van der Pas.

Reference books

- **[MA]** Distributed Systems, 4th edition (version 4.02, dated Feb 2024) by Maarten Van Steen and Andrew Tanenbaum (Freely available at: https://www.distributed-systems.net/index.php/books/ds4/ds4-ebook/)
- Distributed and Cloud Computing: Clusters, Grids, Clouds, and the Future Internet, K Hwang, J Dongarra and GC. C. Fox, Elsevier, 1st Ed.
- Distributed Systems: Concept and Design by George Coulouris, Jean Dollimore, Tim Kindberg, and Gordon Blair, 5th edition

Tentative Lecture Schedule

Lecture	Topics to be covered
1	**Course Introduction** Introduction to parallel and distributed systems, Motivating parallelism (evolution, need, and future) **[AAGV – Chapter 1]**
2	The scope of parallel computing in commercial, scientific, and engineering and design applications, Scalability issues, Flynn's Taxonomy **[AAGV – Chapter 2 and 5]**
3	Amdahl's law, Karp-Flatt Metric, Gustafson's law, Processor to memory connection strategies
4	Network topologies for parallel architectures; Evaluating static inter-connections in-terms of diameter, arc-connectivity, bisection width, and cost. Cut-through Routing and Cost-

	performance tradeoffs **[AAGV – Chapter 2 and 5]**
5	Principles of parallel algorithm design, Dependency Graphs, Granularity, Concurrency **[AAGV – Chapter 3]**
6	Decomposition Techniques, Task Interaction Graph, Mapping Techniques **[AAGV – Chapter 2 and 5]**
7	Programming Shared Address Space Platforms using POSIX Thread API and OpenMP (Thread Basics, Motivation, Synchronization Primitives)
8	Shared memory programming with OpenMP
9	Parallel programming with OpenMP, work sharing constructs, Synchronization Constructs in OpenMP, OpenMP Library Functions, Environment variables
10	**Revision**
11	Introduction to Distributed Systems, Types of Distributed System Architectures such as clusters, grids, cloud and utility computing
12	Distributed Operating Systems Case study 1: Kubernetes Scheduling: Taxonomy, Ongoing Issues and Challenges (https://dl.acm.org/doi/pdf/10.1145/3539606) Case study 2: Large-scale Cluster Management at Google with Borg (https://dl.acm.org/doi/pdf/10.1145/2741948.2741964)
13	Wrapping-up case studies from last lecture Chapter 8 of **[KLEP]:** The trouble with distributed systems
14	Chapter 8 of **[KLEP]:** The trouble with distributed systems
15	Basic Communication Operations (Broadcast, Reduction, Scatter, Gather and Circular Shift) **[AAGV – Chapter 4]**
16	Parallel Cost analysis for the operations over Ring, 2D-Mesh, Hypercube, and 3D-cube **[AAGV – Chapter 4]**
17	Parallel Cost analysis for the operations over Hypercube and 3D-cube **[AAGV – Chapter 4]**
18	Programming Distributed machines using Message passing interface (MPI)
19	Collective Communication and Computation Operations: Barrier, Broadcast, reduction
20	Collective Communication and Computation Operations: prefix, Gather, scatter, All-to-All
21	**Revision**
22	Fault Tolerance Techniques: Hardware Redundancy, Information Redundancy, Time Redundancy
23	GRPC and Protocol Buffers (https://grpc.io/docs/what-is-grpc/introduction/)
24	MapReduce, and GFS (Hadoop and, HDFS as open-source examples of the above two) MapReduce: https://static.googleusercontent.com/media/research.google.com/en//archive/mapreduce-osdi04.pdf Google File System (GFS): https://static.googleusercontent.com/media/research.google.com/en//archive/gfs-sosp2003.pdf
25	Logical Clocks, Vector Clocks. Raft Consensus https://www.cs.princeton.edu/courses/archive/fall24/cos316/lectures/L11-concurrency-time.pdf https://www.cs.princeton.edu/courses/archive/fall24/cos316/lectures/L12-vc.pdf https://www.cs.princeton.edu/courses/archive/fall24/cos316/lectures/L13-consistency.pdf
26	Raft Consensus. RAFT: election process https://raft.github.io/raft.pdf

	https://www.cs.princeton.edu/courses/archive/spring21/cos418/docs/L13-consensus-raft.pdf
27 onwards	**Revisions and Project Evaluations**

(Tentative) Grading Criteria

1. Assignments and Project (15%)
2. Quizzes (10%)
3. 2 Midterm Exam(s) (30%)
4. Final Exam (45%)

Grading scheme

The grading scheme followed will be **absolute** in accordance with the university standards.

Passing Criteria

Students need to score a minimum of **50%** to pass the course.

Course Policies

1. Students are expected to attend all sessions. However, they might avail 20% leaves in emergency situations. Beyond this the student will not be allowed to appear in the final exam.
2. Plagiarism is not tolerable in any of its form. Minimum penalty would be an 'F' grade in the course. Automated tools may be deployed to detect pirated copies. Students bear all the responsibility for protecting their assignments. In case of cheating, both parties will be considered equally responsible.
3. Assignments must be submitted in time. No late submissions will be accepted and/or awarded. REMEMBER that the overall submission time allowed includes the extra time given during which SLATE/Google Classroom doesn't work. Therefore, deadlines are firm.
4. Rechecking of quizzes/assignments must be done within one week of it being uploaded on FLEX. In case they are shown to you during the class, the week starts thereon.

NATIONAL UNIVERSITY
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Department of Computer Science

CS 3009 –Software Engineering

Fall 2022

Instructor Name: Muhammad Zeeshan Nazar
Email address: zeeshan.nazar@lhr.nu.edu.pk
Office Location: 1st Floor, New Building
Office Hours: M, T, W: 2:00 – 3:30.
Telephone extension: 588

TA Name: TBD
Email address: TBD
Office Location: See Google classroom
Office Hours: See Google classroom

Course Information

Program: BS **Credit Hours:** 3 **Type:** Core
Pre-requisites (if any): CS 3004 – Software Design and Analysis (SDA)
Course Website (if any): Google classroom will be used for announcements and course material
Class Meeting Time: Section F: M, W 10:00 – 11:20 Section K: M, W 08:30 – 09:50
Section G: T, T 10:00 – 11:20 Section K: T, T 11:30 – 12:50
Class Venue: Section F: NB-210 Section K: NB-208
Section G: NB-210 Section H: NB-209
Exams: See Date sheet

Course Description/Objectives/Goals:

Objective of this course is to introduce the BS Computer Science (SE) students with the Software Engineering (SE) process, activities, concepts and its need. The students will be familiarized with the well- known software development process models, their key practices, and their salient features. The students will be introduced with common method (for example analysis and design diagrams such as data flow diagram, decision table etc.) to analyze and express the requirements of a moderately sized software product. The students will also be informed about the responsibilities of a Software Engineer, the steps involved in modeling of requirements, design of architecture, design of modules, programming guidelines, and testing.

Course Learning Outcomes (CLOs):

At the end of the course students will be able to:	Domain	BT* Level	PLO
1. Select an appropriate software development process for a software project	C	4	3
2. Develop a model of requirements for a software system	C	4	4
3. Design architecture of a software system by choosing the most appropriate architecture styles	C	4	4
4. Design test cases for a software system	C	4	4
5. Construct reasonable sized software in team setting	C	4	4

* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain.

Bloom's taxonomy Levels: 1. Knowledge, 2. Comprehension, 3. Application, 4. Analysis, 5. Synthesis, 6. Evaluation

Course Textbook(s)

1. Roger S. Pressman, Software Engineering A Practitioner's Approach, 9th Edition. McGrawHill
2. Shari PFleeger, Joanne Atlee, Software Engineering: Theory and Practice, 4th Edition
3. Ian Sommerville, Software Engineering, 10th Edition
4. Roger S. Pressman, Software Engineering A Practitioner's Approach, 6th Edition. McGrawHill

Additional references and books related to the course:

5. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, Fundamentals of Software Engineering, 2nd Edition. Pearson
6. Dick Hamlet, Joe Maybee, The Engineering of Software: Technical Foundations for the Individuals. Addison Wesley
7. Ivan Marsic, Software Engineering. Rutgers

Tentative Weekly Schedule

Week	Topics to be covered	Readings
1	Course Introduction. SE Introduction. Software Process Models	[1] Chapter 1, 15 [2] Chapter 1
2	Software Process Models. Systems Engineering	[1] Chapter 2, 3 [2] Chapter 2
3	Software Project Management.	[1] Chapter 24, 25 [2] Chapter 3 [3] Chapter 5
4	Requirements Engineering	[1] Chapter 7, 8 [2] Chapter 4 [4] Chapter 6, 8
5	Requirements Engineering	[1] Chapter 7, 8 [2] Chapter 4
6	**Mid I**	
7	Architecture Design	[1] Chapter 9, 10 [2] Chapter 5
8	Architecture Design	[1] Chapter 9, 10 [4] Chapter 10
9	UI Design. Detailed Design: Principles	[1] Chapter 11, 12
10	Detailed Design: Principles. Component Based Design. Component Interfaces and Module Contracts	[1] Chapter 11 [3] Chapter 17
11	Writing Programs. Testing	[2] Chapter 7, 8, 9 [3] Chapter 7, 8
12	**Mid II**	
13	Testing	[1] Chapter 19, 20
14	Testing	[1] Chapter 24, 25 [2] Chapter 3, 10

15	Delivering and Deploying the System	[1] Chapter 24, 25 [2] Chapter 3
16	Project Presentations	

Details of the topics in the tentative weekly schedule are as follows:

Software Process Models:
Waterfall, V-Model, Prototyping, Spiral, Incremental, Rapid Application Development, Unified Process, Agile (Scrum, XP). Kanban boards. Project Velocity

Systems Engineering:
Identification of objects and activities as part of the system, identifying boundary of the system to be developed

Software Project Management:
Work Breakdown Structure, Activity Graphs (Activity on Node), Determining minimum project duration using Critical Path Method, Gantt Chart. Effort and Cost Estimation, COCOMO, Object points and function points. Story Points

Requirements Engineering (RE):
Types of requirements (Functional/Non Functional), Characteristics of requirements, Testable requirements, RE activities s.a. Inception, Elicitation, Elaboration etc., Scenario based, class based, flow based, behavioral models (i.e. DFD (principles of refinement, refining from level to 2 to 3), Use case Diagram (Recap only), ER-Diagram (Recap only), State Diagram (Recap only), Sequence Diagram (Recap only), CRC cards, Class Diagram (Recap only), Swimlane diagram), Petrinets

Design:
Functional Decomposition, Architecture styles including Call-Return, Pipe-Filter, Client-Server, Peer-to- Peer, Publish-Subscribe, Repositories, Layering. Architecture Evaluation (Tradeoff analysis, cost-benefit analysis). Mapping data flow into architecture (Transaction flow, Transform flow). Component-Component Interfaces, Design by Contract, Component Diagram (Internal and External Views). Continuous integration.

Design Principles:
Modularity (Coupling, Cohesion), Interfaces, Information Hiding, Incremental Development, Abstraction, Generality.

UI Design:
Golden Rules, UID Process (Interface Analysis, Interface Design, Interface Construction, Interface Validation)

Software Testing:
Test Case Structure, White Box, Black Box. Control Flow Testing (Cyclomatic Complexity), Equivalence Class Partitioning, Boundary Value Analysis, Integration and System Testing. Acceptance Testing. Automated testing, continuous testing.

Deployment:
Deployment activities, documentation, types of users etc. Continuous delivery

(Tentative) Grading Criteria

Grading scheme: Absolute

1. Assignments + Class Activities + Project (20%)
2. 5-6 Quizzes (10%)
3. Two Midterm Exam(s) (30%)
4. Final Exam (40%)

Course Policies

1. Quizzes may be un-announced.
2. No makeup for missed quiz or assignment.
3. 80% attendance
4. Zero tolerance to plagiarism. All the parties involved will be awarded negative or Zero in first instance. Repeat of the same offense will result in (F) grade.

NATIONAL UNIVERSITY
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Department of Computer Science

CS4001 – Professional Practices In IT

Fall 2022

Instructor Name: Mehwish Mumtaz
Email address: mehwish.mumtaz@lhr.nu.edu.pk
Office Location/Number:
Office Hours: After Class/Email

TA Name (if any):
Email address:
Office Location/Number: NA
Office Hours: NA

Course Information

Program: BS **Credit Hours:** 3 **Type:** Core
Pre-requisites (if any):
Course Website (if any):
Class Meeting Time:

Course Description/Objectives/Goals:

The course is designed to prepare students for adequately responding to issues faced during the professional life

Computing Profession, Computing Ethics, Philosophy of Ethics. The Structure of Organizations, Finance and Accounting, Anatomy of a Software House, Computer Contracts, Intellectual Property Rights, The Framework of Employee Relations Law and Changing Management Practices, Human Resource Management and IT, Health and Safety at Work, Software Liability, Liability and Practice, Computer Misuse and the Criminal Law, Regulation and Control of Personal Information. Overview of the British Computer Society Code of Conduct, IEEE Code of Ethics, ACM Code of Ethics and Professional Conduct, ACM/IEEE Software Engineering Code of Ethics and Professional Practice. Accountability and Auditing, Social Application of Ethics.

Course Textbook

1. Professional Issues in Software Engineering by Frank Bott, Allison Coleman, Jack Eaton and Diane Rowland, CRC Press; 3rd Edition (2000). ISBN-10: 0748409513

2. Computer Ethics by Deborah G. Johnson, Pearson; 4th Edition (January 3, 2009). ISBN-10: 0131112414

3. A Gift of Fire: Social, Legal, and Ethical Issues for Computing and the Internet (3rd Edition) by Sara Baase, Prentice Hall; 3rd Edition (2008). ISBN-10: 0136008488

4. Applied Professional Ethics by Gregory R. Beabout, University Press of America (1993). ISBN-10: 0819193747.

Additional references and books related to the course:

a) Professional Issues in Information Technology (Second Edition) – Frank Bott et al

b) Ethics in Information Technology - George W. Reynolds

c) The Art of Unix Programming
d) The Pragmatic Programmer
e) "The Art of Unix Programming"
f) Peopleware 3rd Edition" by Timothy Lister and Tom DeMarco.
g) "WINNING" by Jack Welch

Tentative Weekly Schedule

S#	Topic	Week(s)	[1]Readings	Project Deliverables
1	Computing Ethics, Philosophy of Ethics	1	Chapter 1[2] Chapter 2 [2]	
2	Introduction and appreciation to the course. Basics of Law. Profession, Computing Profession, Professional Bodies	2-3	Chapter 1 [a] Chapter 1 [1] Chapter 2 [a]	Assignment 1
3	Organization, Legal Status of organization, Structure and management of Organization Financing a startup-company, Finance and Accounting, Accountability and Auditing	3, 4,5	Chapter 2[1] Chapter 3,4[2] Chapter 3[1] Chapter 5,6[a]	Assignment 2

[1] Numbers in square brackets correspond to books numbered in "Reference Material" section.

	Investment Appraisal		Chapter8[a]	
4	Anatomy of Software House	6	Chapter 4 [1]	
5	Computer Contracts	7	Chapter 5 [1]	
6	Intellectual Property Rights	8	Chapter 6 [1] Chapter 6 [b]	Quiz 1
7	The Framework of Employee Relations Law and Changing Management Practices	9	Chapter 7 [1]	
8	Human Resource Management and IT	10	Chapter 8 [1] Chapter 10 [a]	
9	Health and Safety at Work	11	Chapter 9 [1]	
10	Software Liability, Liability and Practice, Computer Misuse and the Criminal Law	12	Chapter 10 [1] Chapter 7 [b] Chapter 11 [1] Chapter 3 [b]	
11	Regulation and Control of Personal Information / Privacy Freedom of expression	13	Chapter 12 [1] Chapter 4 [b] Chapter 5 [5b]	Quiz 2
12	Time Management, Critical Thinking, Spotting Fake News, Logical Fallacies, Software version Control, SEO Tips etc	14		Assignment 3

(Tentative) Grading Criteria

Assignments/Project/Presentation/Quizzes/Class Activities: 30
Mid Exams, Final Exam: 15+15, 40

Course Policies

Announcements

Announcements related to different aspects of this course (e.g. lectures, quizzes, exams, etc.) will be posted on google classroom, students are expected to check regularly.

Attendance
All students are expected to attend all lectures from beginning to end. Partial or full absence from a lecture may hamper chances for securing good grades.

Exams
Exams will be closed-book and closed-notes. Syllabus for the final exam will be comprehensive.

Office Hours
Students are encouraged to take full advantage of the instructor's office hours. Any doubts regarding concepts covered in class or any questions regarding quizzes, projects, etc. may be clarified during office hours. In case a student is not able to make it during office hours, he/she may schedule an appointment with the instructor for another time slot.

Quizzes
Quizzes may be announced or unannounced. A quiz will usually be about 5 – 10 minutes long and it may be given anytime during the lecture.

Reading Material
Students are encouraged to finish the assigned readings BEFORE the lecture. This is likely to improve lecture comprehension and class participation.

Revision of Grades
Students can contest their grades on quizzes and project deliverables ONLY within a week of the release of grades. Exams will be available for review according to university policies.

Unfair Means
Students are expected to demonstrate the highest degree of moral and ethical conduct. Any student caught cheating, copying, plagiarizing, or using any other unfair means will be strictly dealt-with in accordance with university policies.

Software Testing Course Outline

FAST-NU, Lahore

Course Code	CS497
Course Title	Software Testing
Credit Hours	3
Prerequisite	
Grading Criteria	Quizzes (10%), Assignments + Class Activities (25%), Mid Terms (25%), Final Exam (40%)
Semester	Fall 2022
Class and Exam Schedule	See TimeTable Exam: See date sheet
Course Instructor	Lehmia Kiran lehmia.kiran@nu.edu.pk
Instructor Office Hours	**TBD**
Course TA	TBD
Plagiarism Policy	All the parties involved will be awarded negative or Zero in first instance. Repeat of the same offense will result in (F) grade.
Textbook(s)	Naik and Tripathy, Software Testing and Quality Assurance: Theory and Practice. Wiley 2008
Reference Material	1. Code Complete by Steve McConnel (2nd Edition) 2. A Practitioners Guide to Software Test Design by Lee Copeland 3. Software Testing: A Craftsman's Approach by Paul C. Jorgensen 4. Anne MetteJonassen Hass, *Guide to Advanced Software Testing*, Artech House, 2008.

Course Goals	• Familiarize the students with the terms, software quality and software testing. • Introduce Software Quality Assurance Process and its steps to students • Explain complete process of testing to students • Familiarize the students with common methods used for testing • Familiarize the students different methods used for test case selection. • Familiarize students with software testing tools.
Learning Outcomes	After successful completion of the course, the students will be able to: 1. List different steps of a Software Quality Assurance Program. 2. Differentiate between black box and white box testing. 3. Design test cases for black box and white box testing. 4. Select appropriate number of test cases using an appropriate strategy. 5. Execute test cases using software testing tools. 6. Understand Software Testing Process
Programming Assignments Done in the Course	Yes

Tentative Topics and Course Plan (might be slightly changed)

Week #	Lecture #	Topics Covered
1	1	**Course Introduction.** **Software Lifecycle. Software development processes.** Where does testing phase fit in?
	2	**Software Quality Landscape:** What is quality? Characteristics of quality. Introduction of Defect Detection Techniques. Relationship among the quality characteristics, Types of quality characteristics, Improving Quality, Effectiveness of Defect Detection Techniques. General Quality Principle. Significance of testing. Test case Design.
2	3	**Unit Testing:** Debugging.
	4	**White box Testing:** Structural Testing, Basis Path Testing, Control Flow graph, Cyclomatic Number, Selection of minimum number of test cases, Test coverage (EclEmma, JUnit)
3	5	**White box Testing:**Structural Testing, Basis Path Testing, Control Flow graph, Cyclomatic Number, Selection of minimum number of test cases, Test coverage
	6	**White box Testing:**Structural Testing, Basis Path Testing, Control Flow graph, Cyclomatic Number, Selection of minimum number of test cases, Test coverage
4	7	**White box Testing:** Data flow testing
	8	**Black box testing:** Functional Testing, GUI Testing (SilkTest/Abbot)
5	9	**Black box testing:** Equivalence Class Partitioning
	10	**Black box Testing:** Boundary Value Analysis
6	**Midterm 1**	
7	11	**Black box testing:** Decision Table based testing, State transition

		testing.
	12	**Black box testing:** Pairwise Testing,
8	13	**Black box Testing:**
	14	**Black box Testing:** Use Case based Testing
9	15	**Levels of Testing:**Unit Testing, debugging, diagnosis. Integration Testing. Big Bang, Top Down, Bottom UP, Call Graph based
	16	**Levels of Testing:** Integration Testing. Integrating Component/Off-the-shelf components
10	17	**Levels of Testing:** System Testing, Performance Testing, Load and Stress Testing, Security Testing, Usability Testing
	18	**Levels of Testing:** Regression Testing. Acceptance Testing.
11	19	**Testing Process. Test Documentation**
	20	**Software Testing Tools: Automated Testing. Selenium.**
12	**Midterm 2**	
13	21	**Software Testing Tools:**
	22	**Presentations**
14	23	**Presentations**
	24	**Presentations**
15	25	**Presentations**
	26	**Presentations**
16	**Final**	

NATIONAL UNIVERSITY
Of Computer & Emerging Sciences, Lahore

Department of Computer Science

CS4032 – Web Programming
Spring 2023

Instructor Name: Muhammad Saifullah
Email address: saifullah.tanvir@nu.edu.pk
Office Location: F-71 (New CS Building)
Office Hours: Monday, Wednesday 1:00 PM - 02:00 PM (email me to schedule a meeting)

Course Information:

Program: BS (CS) **Credit Hours:** 3 **Course Type:** Elective

Course Description/Objectives/Goals:

- To introduce the fundamental concepts of web architecture and programming.
- To learn basics of client and server-side programming along with prevalent technologies and frameworks
- To introduce modern practices such as AJAX and Web services
- To discuss Web Engineering issues such as Performance and Security

Course Learning Outcomes (CLOs):

At the end of the course students will be able to:	**Domain**	**BT* Level**
Understand concepts of web architecture and programming	C	2
Learn basics of client and server side programming	C	3
Learn modern practices such as AJAX and Web services, along with prevalent technologies and frameworks	C	3
Learn Web Engineering issues such as Performance and Security	C	3

* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain
Bloom's taxonomy Levels: 1. Knowledge, 2. Comprehension, 3. Application, 4. Analysis, 5. Synthesis, 6. Evaluation

(Tentative) Weekly Schedule

Week 1	**Lecture 1** Principles of Web Architecture	**Lecture 2** HTTP Protocol and HTML
Week 2	**Lecture 1** CSS + HTML	**Lecture 2** CSS + HTML + JavaScript
Week 3	**Lecture 1** Bootstrap and JavaScript	**Lecture 2** JavaScript ES6 and JavaScript Engine
Week 4	**Lecture 1** Application of JavaScript in DOM manipulation	**Lecture 2** Application of JavaScript in DOM manipulation
Week 5	**Lecture 1** jQuery and Ajax	**Lecture 2** jQuery
MID 1		
Week 6	**Lecture 1** Web Architecture (MERN)	**Lecture 2** System Design
Week 7	**Lecture 1** Client-side programming (React)	**Lecture 2** Client-side programming (React)
Week 8	**Lecture 1** Client-side programming (React)	**Lecture 2** Client-side programming (React)
Week 9	**Lecture 1** State management techniques and issues (Hooks)	**Lecture 2** State management techniques and issues (Redux)
Week 10	**Lecture 1** Request / Response cycle (Client-Side)	**Lecture 2** Request / Response cycle (Client-Side)
MID 2		
Week 11	**Lecture 1** Server Side Programming (Node)	**Lecture 2** Server Side Programming (Node)
Week 12	**Lecture 1** MVC Architecture (Node)	**Lecture 2** Server Side Programming (Node)
Week 13	**Lecture 1** Request / Response cycle (Server-Side)	**Lecture 2** Request / Response cycle (Server-Side)
Week 14	**Lecture 1** Cookies and Sessions	**Lecture 2** Templates

(Tentative) Grading Criteria:

Assignments/Project (**25%)**
Quiz (**10 %)**
Midterms **(25 %)**
Final Exam **(40 %)**

Course Policies:

- **Plagiarism** in any work (Quiz, Assignment, Midterms, and Final Exam) from any source, Internet or a Student may result in **F** grade or deduction of absolute marks.
- 80% attendance is required for appearing in the Final exams.
- Minimum requirement to pass this course is to obtain at least 50% marks under application of CS department's grading policies.
- **Absolute grading** scheme will be used.

NATIONAL UNIVERSITY
of Computer & Emerging Sciences, Lahore

Department of Computer Science

CS4039 – Software for Mobile Devices
Spring 2023

Instructor Name: Usman Anwer
Email address: usman.anwer@nu.edu.pk
Office Location/Number: 23 (New Building)
Office Hours: Mon-Wed (10 am -1 pm)

TA Name: Hafsah Zulqarnain
Email address:

Course Information:

Program: BS (CS) **Credit Hours:** 3 **Course Type:** Elective

Pre-requisites: Database Systems (CS-219),
Object-oriented Analysis and Design (CS-309) / Software Design and Analysis (CS-324)

Class Meeting Time: Monday, Wednesday (1:00-2:20 PM)

Class Venue: NB-312, NB-306

Google Class Room: oj7prnw

Course Description/Objectives/Goals:

- Understanding the challenges of application development for mobile devices
- Understanding the user experience issues associated with mobile application development,
- Designing, developing, testing and deploying mobile applications using various tools and technologies

Course Learning Outcomes (CLOs):

At the end of the course students will be able to:	**Domain**	**BT* Level**
Discuss different architectures and frameworks for Mobile Application Development	C	1
Develop mobile applications using current software development environments	C	3
Compare user experience, performance and other trade-offs in mobile application development,	C	3

* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain
Bloom's taxonomy Levels: 1. Knowledge, 2. Comprehension, 3. Application, 4. Analysis, 5. Synthesis, 6. Evaluation

Course Textbook:

None

Additional references and books related to the course:

1. Android Developer Resources (http://developer.android.com)
2. Professional Android, Fourth Edition (2018) by Reto Meier, Ian Lake
3. Android Internals by Jonathan Levin
4. Android Notes for Professionals (https://books.goalkicker.com/AndroidBook/)
5. Mobile Developer's Guide to Galaxy, 18th Edition by Open Exchange
   https://www.open-xchange.com/resources/mobile-developers-guide-to-the-galaxy/

Tentative Weekly Schedule

Week 1 Introduction	**Lecture 1** Mobile Application Development	**Lecture 2** Kotlin for Android
Week 2 Android	**Lecture 1** Kotlin for Android	**Lecture 2** Java for Android
Week 3 Android	**Lecture 1** Java vs Kotlin	**Lecture 2** Layouts
Week 4 Android	**Lecture 1** Views and Layouts	**Lecture 2** Views and Layouts
Week 5 Engineering Issues	**Lecture 1** Responsive Design	**Lecture 2** Custom ListView
MID 1		
Week 6 Engineering Issues / Android	**Lecture 1** RecyclerView	**Lecture 2** RecyclerView
Week 7 Android	**Lecture 1** SharedPreferences	**Lecture 2** SQLITE
Week 8 Android	**Lecture 1** Processes, Threads and Asynchronous Programming	**Lecture 2** Services
Week 9 Android	**Lecture 1** ROOM	**Lecture 2** ROOM
Week 10 Android	**Lecture 1** Implicit Intents	**Lecture 2** Explicit Intents
MID 2		
Week 11 Android	**Lecture 1** Web connectivity	**Lecture 2** Firebase
Week 12 Android / Engineering Issues	**Lecture 1** Firebase	**Lecture 2** Firebase
Week 13 Android / Engineering Issues	**Lecture 1** Location-based services	**Lecture 2** Network Programming / Bluetooth
Week 14 Miscellaneous	**Lecture 1** Monetization and Analytics	**Lecture 2** Cross-platform development

(Tentative) Grading Criteria:

Assignments & Project **(30%)** Quiz **(5 %)** Midterms **(25 %)** Final Exam **(40 %)**

Course Policies:

- **Plagiarism** in any work (Quiz, Assignment, Midterms, and Final Exam) from any source, Internet or a Student may result in **F** grade or deduction of absolute marks.
- 80% attendance is required for appearing in the Final exams.
- Absolute Grading will be done, inline with department policies.

Advanced Programming

Course Outline (Spring 2023)

Email: umeraftab.nu@gmail.com

Piazza Signup Link: http://piazza.com/fast_lahore/fall2019/cs433seca

Access code for Signup: f19cs433

Objective

This course is designed for students with prior knowledge of programming techniques and object oriented concepts. It builds on the basic Java concepts, and goes deeper into programming topics that help you to understand the more advanced Programming concepts.

At the end of the course, you will have a clear understanding of each of the topics of Advanced Java Programming, which will allow you to go more in-depth with the concepts of your choice.

Prerequisites

Object-Oriented Programming Concepts, Data Structures and Basic Databases Concepts

Course Outline

Topics

• Introduction to JAVA and OOP concepts
• JAVA Tools and IDE : Write, compile (using tool and command line) and debug programs
• Data Types, Variables and Operators
• String and StringBuffer class
• Class Variables, methods and Blocks
  ○ Instance variables and static varibles
  ○ Instance methods and static methods
  ○ Static and non-static blocks
  ○ Inner classes
  ○ this and super keywords
• Packages and Access Control
  ○ Packages
  ○ Access Modifiers
  ○ Other Modifiers (final, static, abstract, native, synchronized, transient,

volatile)
- Abstract Classes and Interfaces
- Inheritance, Polymorphism and Encapsulation
  - Basics of Inheritance, Using super to call super class constructors and methods
  - Inheritance Hierarchy in Java and Universal superclass (The Object class)
  - Compile time (early binding) vs Runtime Polymorphism (late binding)

Advanced Topics

- Exception Handling
- Generic Classes and Collections
- JAVA GUI and Event Handling
- Multi-Threads Programming and Synchronization
- File Handling and Advanced Java Input/Output (NIO)
- Database Programming with JDBC
- JAVA RMI and CORBA
- JAVA Web Applications (JSP, Servelts etc.)
- Web application Frameworks (MVC: Struts, Hibernate)
- Enterprise JAVA Beans
- Design Patterns
- Intro to AWS
- Intro to Javascript, JQuery and AJAX

Evaluation

Assignments/Quiz(s)/Homeworks	20 - 25%
Projects and Presentation	10 - 15%
Midterms	25 - 30%
Final Exam	40%
Total:	**100 %**

Textbook(s) /Supplementary Readings

1. *Herbert Schildts, The Complete Reference Java, 9th Edition*
2. Deitels and Santry, Advanced Java 2 Platform How to Program
3. *Effective Java Second Edition by Joshua Bloch*
4. *www.tutoriaslpoint.com/java/*
5. *www.javatpoint.com/java-tutorial*
6. http://docs.oracle.com/javase/tutorial/java

Course Policies

- *Weightage of Assignments and Project will be added to your final score only if you score passing marks in other evaluations. For example, if a student gets full marks in*

Assignments and Projects but he fails to score 50% in Midterms and final score,he will not be eligible for his practical work marks.

- *Course outline may change 10-20% as we proceed in the semester*
- *Assignment deadlines for assignment and Project are hard.*
- *Quizzes will be unannounced. We may have any number of quizzes at any time during the semester.*
- *There will be no retake of quizzes or exams.*
- *Integrity in the assignments/quizzes is expected; otherwise result would be an F grade in the course or may be the case is forwarded to Disciplinary committee.*
- *Attendance MUST be ensured according to the University policy to avoid disqualification.*

NATIONAL UNIVERSITY
of Computer & Emerging Sciences, Lahore

Department of Computer Science

CS-4051-Information Retrieval

SPRING 2023

Instructor Name: Dr. Iqra Safder

TA Name (if any): **Muhammad Adeel** l217258@lhr.nu.edu.pk (Section A)

Haris Ali FastNU l181247@lhr.nu.edu.pk (Section B)

Email address: iqra.safder@nu.edu.pk **Email address:**
Office Location/Number: C-135 **Office Location/Number:**
Office Hours: Tuesday 1pm-2pm**,** Friday 10am – 11:30 am, Saturday 10am - 11:30am,

Course Information

Program: BSCS **Credit Hours:** 3 **Type:** CS Elective

Pre-requisites (if any): Programming competence, Data structures

Course Website (if any) : Google classroom
Class Meeting Time:

Course Description/Objectives/Goals:

Recent years have seen a dramatic growth of natural language text data, including web pages, news articles, scientific literature, emails, enterprise documents, and social media such as blog articles, forum posts, product reviews, and tweets. Text data are unique in that they are usually generated directly by humans rather than a computer system or sensors, and are thus especially valuable for discovering knowledge about people's opinions and preferences, in addition to many other kinds of knowledge that we encode in text.

This course will cover technologies, which play an important role in any data mining applications involving text data for two reasons. First, while the raw data may be large for any particular problem, it is often a relatively small subset of the data that are relevant, and a search engine is an essential tool for quickly discovering a small subset of relevant text data in a large text collection. Second, search engines are needed to help analysts interpret any patterns discovered in the data by allowing them to examine the relevant original text data to make sense of any discovered pattern. You will learn the basic concepts, principles, and the major techniques in text retrieval, which is the underlying science of search engines.

Course Learning Outcomes (CLOs):		
At the end of the course students will be able to:	**Domain**	**BT* Level**
Explain many basic concepts and multiple major algorithms in text retrieval and search engines.		C2
Explain how search engines and recommender systems work and how to quantitatively evaluate a search engine.		C2
Create a test collection, run text retrieval experiments, and experiment with ideas for improving a search engine.		C3

* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain.

Bloom's taxonomy Levels: 1. Knowledge, 2. Comprehension, 3. Application, 4. Analysis, 5. Synthesis, 6. Evaluation

Textbook(s) /Supplementary Readings:

The following book will be used as a primary text to guide some of the discussions, but it will be heavily supplemented with lecture notes and reading assignments from other sources.

- C. Zhai and S. Massung, Text Data Management and Analysis: A Practical Introduction to Information Retrieval and Text Mining, ACM Book Series, Morgan & Claypool Publishers, 2016.

Additional references and books related to the course:

- C. Zhai and S. Massung, Text Data Management and Analysis: A Practical Introduction to Information Retrieval and Text Mining, ACM Book Series, Morgan & Claypool Publishers, 2016. Chapters 10 - Section 10.4, Chapter 11.

Tentative Weekly Schedule (Phase wise)

Phase	Topics to be covered	Readings	Assignments /Projects?
1	• Part of Speech tagging, syntactic analysis, semantic analysis, and ambiguity • "Bag of words" representation • Push, pull, querying, browsing • Probability ranking principle • Relevance • Vector space model • Dot product • Bit vector *Recommended Readings:* • N. J. Belkin and W. B. Croft. 1992. Information filtering and information retrieval: Two sides of the same coin? Commun. ACM 35, 12 (Dec. 1992), 29-38. • C. Zhai and S. Massung, Text Data Management and Analysis: A Practical		

	Introduction to Information Retrieval and Text Mining, ACM Book Series, Morgan & Claypool Publishers, 2016. **Chapters 1 - 6**.		
2	• Term frequency (TF) • Document frequency (DF) and inverse document frequency (IDF) • TF transformation • BM25 • Inverted index and postings • Binary coding, unary coding, gamma-coding, and d-gap *Recommended Readings:* • C. Zhai and S. Massung, Text Data Management and Analysis: A Practical Introduction to Information Retrieval and Text Mining, ACM Book Series, Morgan & Claypool Publishers, 2016. **Chapter 6 - Section 6.3, and Chapter 8**. • Ian H. Witten, Alistair Moffat, and Timothy C. Bell. Managing Gigabytes: Compressing and Indexing Documents and Images, Second Edition. Morgan Kaufmann, 1999.		
3	• Evaluation methodology • Precision and recall • Average precision, mean average precision (MAP), and geometric mean average precision (gMAP) • Reciprocal rank and mean reciprocal rank • F-measure • Normalized Discounted Cumulative Gain (nDCG) • Statistical significance test *Recommended Readings:* • Mark Sanderson. Test collection based evaluation of information retrieval systems. Foundations and Trends in Information Retrieval 4, 4 (2010), 247-375. • C. Zhai and S. Massung, Text Data Management and Analysis: A Practical Introduction to Information Retrieval and Text Mining, ACM Book Series, Morgan & Claypool Publishers, 2016. **Chapter 9**		
4	• p(R=1|q,d), query likelihood, and p(q|d) • Statistical and unigram language models • Maximum likelihood estimate • Background, collection, and document language models • Smoothing of unigram language models • Relation between query likelihood and TF-IDF weighting • Linear interpolation smoothing		

	Recommended Readings: • C. Zhai and S. Massung, Text Data Management and Analysis: A Practical Introduction to Information Retrieval and Text Mining, ACM Book Series, Morgan & Claypool Publishers, 2016. **Chapter 6 - Section 6.4**		
5	• Relevance feedback • Pseudo-relevance feedback • Implicit feedback • Rocchio feedback • Scalability and efficiency • Spams • Crawler, focused crawling, and incremental crawling • Google File System (GFS) • MapReduce • Link analysis and anchor text • PageRank and HITS *Recommended Readings:* • C. Zhai and S. Massung, Text Data Management and Analysis: A Practical Introduction to Information Retrieval and Text Mining, ACM Book Series, Morgan & Claypool Publishers, 2016. **Chapters 7 & 10**		
6	• Learning to rank, features, and logistic regression • Content-based filtering • Collaborative filtering • Beta-Gamma threshold learning • User profile • Exploration-exploitation tradeoff		

(Tentative) Grading Criteria

Quizzes	10%
Assignments/Homeworks/Project	*15* - 25%
Midterms	25-30%
Final Exam	40 - 45%
Total:	**100 %**

Course Policies

- *Course outline may change 10-20% as we proceed in the semester. We may add and remove a few topics.*
- ***Grading scheme: Relative***
- Depending on the situation of COVID 19, this weightage of midterms can be reduced and added in assignments/homeworks/project.
- *Weightage of other evaluations can also be adjusted if needed.*

- *Assignment deadlines for assignment and Project are hard.*
- *NO Cell Phone usage in class, they must be turned off at all times.*
- *There will be no retake of quizzes or exams.*
- ***Integrity in the assignments/quizzes is expected; otherwise result would be an F grade in the course or may be the case is forwarded to Disciplinary committee.***
- *Attendance MUST be ensured according to the University policy to avoid disqualification.*

NATIONAL UNIVERSITY
of Computer & Emerging Sciences, Lahore

Department of Computer Science

CS-4084 – Quantum Computing

Fall 2023

Instructor Name: Dr. Faisal Aslam
Email address: faisal.aslam@lhr.nu.edu.pk
Office Location/Number:
Office Hours: TBA

TA Name (if any):
Email address:

Course Information

Program: BS~~/MS~~ **Credit Hours:** 3 **Type:** Elective
Pre-requisites (if any): Linear Algebra, Probability, Python
Class Meeting Time:
Class Venue:

Course Description/Objectives/Goals: The course is ideally suited for students interested in applications of beautiful mathematics and amazing concepts of quantum mechanics. Our journey will delve into the cutting-edge realm of quantum computation and information, learning the state-of-the-art advancements. Our exploration will encompass a comprehensive study of various quantum algorithms, coupled with hands-on implementations on both simulators and real quantum computers. By seamlessly blending theory and practicality, we will unlock a deep understanding of quantum computation. Additionally, we will unravel the essential principles underpinning quantum cryptography, quantum communication, and quantum complexity classes, further enriching our grasp of this captivating field.

Course Learning Outcomes (CLOs):

1. Grasp the fundamental principles of quantum information.
2. Attain a profound comprehension of quantum computation and its associated algorithms.
3. Acquire practical proficiency in utilizing quantum simulators and engaging with tangible quantum computing platforms through Qiskit and OpenQASM.
4. Embark on an exploration of quantum cryptography, encompassing the principles of secure communication and key distribution.
5. Cultivate a comprehensive understanding of quantum complexity classes, delving into the intricacies of computational complexity within the quantum realm.

Course Textbooks

- Nielsen, Michael A., and Isaac L. Chuang. "Quantum computation and quantum information." Phys. Today 54.2 (2001): 60.
- John Watrous, "Quantum Computation Lecture notes", University of Waterloo

Tentative Lecture Plan

Topics to be covered	#Lectures
➿ Dirac's (Bra-Ket) notation and Tensor Product	1
➿ Qubits ➿ Superposition and pure states ➿ Full and Partial Measurements	1
➿ Unitary and Hermitian matrices ➿ Quantum gates Quantum circuits	2
➿ Quantum entanglement ➿ Bell states ➿ GHZ states	1
➿ No-cloning theorem ↘ Two different proofs ➿ Quantum teleportation	1
➿ Superdense coding	1
➿ Introduction to Qiskit and OpenQASM ➿ IBM Simulators ➿ IBM Quantum computer	1-2
➿ Simon's Algorithm ➿ Qiskit implementation	1
➿ Grover's Algorithm ➿ Correctness and optimality proof ➿ Qiskit implementation	2
➿ Fast Fourier Transformation ➿ Quantum Fourier Transformation (QFT) ➿ Properties of QFT ➿ Qiskit implementation	2
➿ Period Finding Algorithm ➿ Qiskit implementation	1
➿ Phase Estimation Algorithm ➿ Iterative and Hamiltonian Phase Estimation ➿ Qiskit implementations	3

➓ Order Finding Algorithm ➓ Shor's Prime Factorization Algorithm ➓ Qiskit implementation	2
➓ Shor's Discrete Logarithm Algorithm ➓ Qiskit implementation	1
➓ Quantum Walk Search Algorithm ➓ Qiskit implementation	1
➓ Quantum Linear System of Equations ➓ Qiskit implementation	1
➓ Quantum Cryptography ↘ The BB84 Key Exchange Protocol ↘ Commitment	2
➓ Quantum computational complexity ➓ Promise Problems and Complexity Classes	2
➓ Advanced topics	4

(Tentative) Grading Criteria

1. Quizzes (10 at least): 18% (or 17%)
2. Assignments (5 at least): 5%
3. Group Project: 7% (or 8%)
4. Midterm: 30%
5. Final: 40%

Grading Scheme: Absolute

Absolute Grading Scheme:

Total Marks (%)	Grade
≥ 90	A+
86-89	A
82-85	A-
78-81	B+
74-77	B
70-73	B-
66-69	C+
62-65	C
58-61	C-
54-57	D+
50-53	D
≤ 49	F

Course Policies

1. Quizzes may be unannounced.
2. No makeup for missed quiz or assignment.
3. 80% attendance
4. 50% passing marks

Academic Integrity

- Plagiarism and Cheating against academic integrity. Both parties involved in such cases will face strict penalty (negative marking, F grade, DC)
- CODE/ ASSIGNMENT SHARING is strictly prohibited.
- Keep in mind that by sharing your code/assignment you are not helping anyone rather hindering the learning process or the other person.
- No excuse will be entertained if your work is stolen or lost. To avoid such incidents
    - Keep back up of your code on safe online storage, such as Google Drive, Drop box or One drive.
    - Do not leave your work on university lab computer, transfer your work to online storage and delete from the university lab computer (empty recycle bin as well)

Course Policies

1. Announcements related to different aspects of this course (e.g. lectures, quizzes, exams, etc.) may be posted on SLATE (http://slate.nu.edu.pk/portal) and google classroom. Students are expected to view the announcements section of SLATE and google classroom regularly.
2. All students are expected to attend all lectures from beginning to end. Partial or full absence from a lecture without a valid reason may hamper chances for securing good grades. University's attendance requirements must be met in order to appear in the final exam.
3. Quizzes may be announced or unannounced. A quiz will usually be about 5 – 15 minutes long and it may be given anytime during the lecture. Students missing a quiz will NOT be given a make-up quiz.
4. Students can contest their grades on quizzes and assignments ONLY within a week of the release of grades. Exams will be available for review according to university policies.
5. Students are expected to demonstrate the highest degree of moral and ethical conduct. Any student caught cheating, copying, plagiarizing, or using any other unfair means will be strictly dealt-with in accordance with university policies.

FAST School of Computing, National University of Computer and Emerging Sciences, Lahore

COURSE OUTLINE

Course Title:	Technical and Business Writing			
Course Code:	SS-2007	**LEC:**	100% Theory	Credit Hours: 3

COURSE OBJECTIVES:

After successful completion of the course, students should be able to

1. Compose structured technical documents in multiple industrial settings.
2. Advocate effectively during instructions, interviews, negotiation skills, decision-making and collaborative work.
3. Combine features of communication skills for effective, informative and assertive technical communication.

COURSE PREREQUISITE(S):

Expository Writing

PLAGIARISM POLICY:

All work submitted must be the student's own work. Cases of plagiarism shall be sent to the Disciplinary Committee. Research format is expected to follow standard documentation APA guidelines.

REQUIRED TEXTBOOK(S):

Title: Technical Communication: A Practical Approach
Edition: 8th
Author: William S. Pfeiffer

GRADING CRITEIA:

Assessment Item	**Number**	**Weight (%)**
Assignments	3	10
Quizzes	3	5
Formal Report	1	5
Mid Exam	2	30
Final Exam	1	50

Grading Policy: Relative Grading

FAST School of Computing, National University of Computer and Emerging Sciences, Lahore

COURSE OUTLINE

COURSE CONTENTS:

Week	Class	Topic	Chapters	Assigned Tasks
1	1st	Course Introduction: Difference between Technical and Academic Writing Purpose, Tone, Style & Vocabulary	1	Read about Email guidelines
	2nd	Culture in Organizations Ethical Guidelines for Work- Writing Ethics	1	
2	1st	Letters	6	Letter Writing
	2nd	Types of Letters	6	
3	1st	Informal Reports: Informative Reports • Progress Report • Trip/ Activity Report	10, 11	
	2nd	Memorandum	6. 10	
4	1st	**Informal Reports:** Analysis Reports • Feasibility Studies • Problem Analysis/Investigative • Equipment Evaluation	10, 11	
	2nd			
		Quiz 1		
5	1st	**Research & Documentation:** Visuals	9	
	2nd	Plagiarism: In-text Citation, Referencing	9	
		Midterm 1		
6	1st	**Cover Letter** CV/Resume – Job Description (JD) – sample/websites	16	
	2nd	**Formal Report:** Sections	11	
7	1st	**Quiz 2**		
	2nd	**Formal Report**		
8	1st	Formal Report: Intro & Conclusion	11, 12	Project
	2nd	**Presentation Skills**	15	
9	1st	Proposal Writing	12	
	2nd	Business Proposal Presentation I	15	Business Idea Presentations
10	1st			
	2nd	Difference between Proposal and Feasibility studies	12	
11	1st	Elevator/Sales Pitch		CV
	2nd			
12		**Midterm 2**		
13	1st	**Interview Skills**	16	
	2nd	Mock Interviews	16	
14	1st	**Quiz 3**		
	2nd			
15		Proposal Writing Presentations II		

Department	FAST School of Computing	**Dept. Code**	FSC
Course Title	Foreign Policy of Pakistan	**Course Code**	SS4002
Pre-requisite(s)		**Credit Hrs.**	3
Moderator			
Course Instructors			

Course Objective	The course on Pakistan's Foreign Policy has been designed to provide a dynamic and robust understanding of the process of foreign policy making in Pakistan, key focus of Pakistan's foreign relations across the globe including key foreign policy challenges and opportunities for Pakistan. The course is designed to inculcate an informed understanding of Pakistan's foreign policy perspectives, challenges, and opportunities as well as to equip participants to evaluate and offer practical recommendations for foreign policy reform.

No.	Assigned Program Learning Outcome (PLO)	Level	Tool
01			

A = Assignment, Q = Quiz, M = Midterm, F=Final, P=Project

No.	Course Learning Outcome (CLO) Statements	Tools
01	Describe the concept of Foreign Policy	Q1,A1,M1,F
02	Explain the basics and foundations of Pakistan's Foreign Policy	Q2,M1,M2, F
03	Analyze the relations of Pakistan with neighboring and Global Powers	A2,M2,F
04	Evaluate the emerging challenges to Pakistan's Foreign Policy	Q3,A3, F

Week	Course Contents/Topics		
01	Concept and Introduction of Foreign Policy Historical background of Pakistan's Foreign Policy Readings:- https://www.brookings.edu/wp-content/uploads/2016/07/Chapter-One-30.pdf https://cscr.pk/pdf/perspectives/Pakistan%E2%80%99s-Foreign-Policy-In-Transition-Driving-Factors-And-Emerging-Trends.pdf		
02	Foreign Policy and its determinants a) Internal b) External Readings:- https://www.researchgate.net/publication/330476527_The_Study_of_Foreign_Policy_in_International_Relations https://dailytimes.com.pk/856998/pakistans-instruments-of-foreign-policy/ https://journals.sagepub.com/doi/pdf/10.1177/097152311201700208		
03	Pakistan's Relations with neighboring countries a) India Readings:- https://core.ac.uk/reader/297012520 https://journals.sagepub.com/doi/pdf/10.1177/2347797018823964		
04	Pakistan's Relations with neighboring countries b) China https://www.isas.nus.edu.sg/wp-content/uploads/2021/12/WP-357-1-1.pdf https://www.researchgate.net/publication/272645548_Pakistan-China_Relations_Where_They_Go_from_Here		
05	Pakistan's Relations with neighboring countries c) Afghanistan d) Iran Readings:- https://qurtuba.edu.pk/thedialogue/The%20Dialogue/4_1/02_ashraf.pdf https://iramcenter.org/d_hbanaliz/pakistan-iran-relations-economic-and-political-dimensions.pdf		

06	Pakistan's Relations with USA Readings:- https://issi.org.pk/wp-content/uploads/2020/02/4-SS_Mahrukh_Khan_No-4_2019-1.pdf		
07	Pakistan's relations with Russia Readings:- https://www.researchgate.net/publication/340165623_Pak-Russia_Relations_Lost_Opportunities_and_Future_Options		
08	Kashmir Issue Palestine Issue Readings:- https://www.cartercenter.org/documents/1439.pdf https://margallapapers.ndu.edu.pk/site/article/view/48/29 https://www.britannica.com/event/Arab-Israeli-wars https://thefridaytimes.com/29-Aug-2023/diminishing-prospects-of-resolving-the-kashmir-conflict https://criterion-quarterly.com/kashmir-dispute-is-there-a-viable-solution/ https://www.hrw.org/world-report/2024/country-chapters/israel-and-palestine		
09	CPEC Challenges and opportunities Readings:- https://www.lse.ac.uk/ideas/Assets/Documents/The-China-Pakistan-Economic-Corridor.pdf https://southasianvoices.org/ten-years-of-cpec-a-decade-of-disappointments/		
10	Regional Organizations ECO, Connectivity with CARs Readings:- http://www.eco.int/parameters/eco/modules/cdk/upload/content/general_content/3624/150814561891935csfdk3kfgkbqp3np70hjp595.pdf		
11	Regional Organizations SAARC SCO Readings:- https://www.jstor.org/stable/pdf/resrep19209.7.pdf https://www.ipinst.org/wp-		

	content/uploads/publications/ipi_e_pub_shanghai_cooperation.pdf http://pu.edu.pk/images/journal/history/PDF-FILES/14_58_2_21.pdf		
12	Successes and failures of Pakistan's foreign policy Readings:- https://www.annualreviews.org/doi/pdf/10.1146/annurev.polisci.3.1.167		
13	Foreign Policy Challenges Options, Block Formation, Global and Regional Changes, Need to reshape FP https://www.dawn.com/news/1746724 https://strategicthought.ndu.edu.pk/site/article/view/22		
14	**Presentations**		
15	**Presentations**		
16	**Final Exams**		

Title	Pakistan's Foreign Policy: A Reprisal
Author	Shahid M. Amin
Title	Concise History of Pakistan's Foreign Policy
Author	Abdul Sattar
Title	Geo Strategic Environment of Pakistan **(Reference Book)**
Author	Dr Hassan Askari Rizvi
Author/Editor	Ghulam Ali
	Pakistan's Foreign Policy Contemporary Developments and Dynamics **(Reference Book)**
	Supplement readings including book chapters, research articles and newspaper articles will also be shared.

Evaluation Procedure & Marks Distribution:

Assessment Tools	Weightage
Quizzes (3)	10%
Individual Assignment (2)	4%
Group Term Paper and Presentations (1)	6%
Midterm I	15%
Midterm II	15%
Final Exam	50%

Grading Policy:

Relative grading Scheme will be followed for grading

Academic Journals:

Pakistan Horizon (back issues available at Jstor) Contemporary South Asia Third World Quarterly, Security Studies, Security Dialogue, Regional Studies Quarterly, Foreign Affairs, The Washington Quarterly

Internet Sources:

www.pildat.org
http://www.pildat.org/Publications/publication/FP/ForeignPolicyProcessinPakistanproceedings_04_2004. pdf
http://www.pildat.org/Publications/publication/FP/RoleofParliamentsinFormulationandOversightof Foreig nPolicy-3rdPakAfghanWorkshop.pdf
http://www.pildat.org/Publications/publication/FP/ProposalsforResolvingtheKashmirDispute.pdf
http://www.pildat.org/Publications/publication/FP/CaseStudyonRecognitionofTaliban.pdf
http://www.pildat.org/Publications/publication/FP/PakistanForeignPolicy-AnOvreview.pdf
http://carnegieendowment.org/ (South Asia) http://www.e-ir.info/ http://thediplomat.com/
http://www.cfr.org/
http://ipripak.org
www.usip.org
www.ips.org
https://www.brookings.edu/
issi.org.pk
https://www.visualcapitalist.com/visualizing-the-brics-expansion-in-4-charts/

NationalUniversity

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Department	FAST School of Computing	**Dept. Code**	FSC
Course Title	Introduction to Public Policy	**Course Code**	SS4003
Pre-requisite(s)		**Credit Hrs.**	3
Moderator	Muhammad Tahir Rashid, Ph.D		
Course Instructors	Dr. Raza Zaidi		

Course Objective	This course will provide students with an understanding of how the process of policy making works in practice and how governments decide which policies to pursue or avoid. Students will gain an understanding of important theories of public policy. Through analysing how ideas and institutions shape public policy, students will have the opportunity to search for solutions to real-world policy problems. Students will gain an understanding of the essential elements of policy development: from how policy is formed to how policy can be evaluated. A strong focus of this course is on equipping students to communicate public policy to diverse audiences.

No.	Assigned Program Learning Outcome (PLO)	Level	Tool
01			

A = Assignment, Q = Quiz, M = Midterm, F=Final, , P=Project

No.	Course Learning Outcome (CLO) Statements	Tools
01	Describe the concept and idea of public policy	Q1,A1,M1,F
02	Explain the public policy formulation process	Q2,M1,M2,F
03	Evaluate the culture, economics, politics, and institutions are instrumental in the policy making	A2,M2,F
04	Analyse policies in Pakistan's context	Q3,A3, F

Week	Course Contents/Topics	Detailed Discussion Points	Chapter	CLO

01	**Introduction and basic concepts**
	• Introduction and basic concepts
	• Significance of public policy for ICT students
		• Overview of Policy Functions
		  ○ Agenda-Setting
		  ○ Policy Formulation
		  ○ Decision-Making
		  ○ Implementation
		  ○ Evaluation
		• Understanding public policy problems and processes
			1**	1

02	• Identification of problems and agenda setting	• Definition • Identification of problem	3* & Readings	1

	○ Process of setting policy agenda • Introduction to policy writings (Policy briefs)	• Process of agenda setting • Systematic agenda • Institutional agenda • Policy window		
03	Policy Formulation • Policy proposals, Policy options, • Policy Instruments	• Policy design • Policy tools • Technical analysis and policy process • Setting the goals • Policy alternatives	9**	2
04	Classification of Public Policies • Levels of Policy • Typologies	• Level of policy ○ Constitution ○ Statutory ○ Regulatory ○ Operating Procedures • Distributive Policies • Redistributive Policies • Substantive Policies • Procedural Policis	7**	2
05	The policy-makers • The public officials • Non-governmental participants in policy process	• Public officials ○ Legislature ○ Executive ○ Administrators and governmental agencies ○ Courts • Non-governmental participants ○ Interest groups ○ Political Parties ○ Research Organizations ○ Media	2*	2
06	Policy advocacy • Use of research evidence to push for change • Approaches to advocacy • Types of advocacy group	• Approaches to policy advocacy • Lobbying • Campaigning • Activism • Advising • Types of Advocacy groups	5** & Readings	3
07	Process of policy adoption • Decision Making • Decision making models • Challenges in decision making	• Models of Decision Making ○ Rational, Incremental, and Garbage Can model • Styles of Decision making ○ Bargaining ○ Persuasion ○ Command	4*	2

		○ Parliamentary majority • Decision criteria • Public interest		
08	Policy Implementation • Approaches to the study of implementation • Administrators and administrative organization • How policy memos shaped the world	• Who implements the policy • Administrative politics • Rule making • Adjudication • Program operations • Techniques of control • Policy memo writing • Significance of policy memos	6*	2
09	Policy impact • Policy Evaluation • Strategies for policy evaluation	• Types of policy evaluation • Scope of policy evaluation • Challenges • Evaluation design	7* & 6***	3
10	• The policy ecosystem • The policy communities and networks	• Introduction of concepts • Policy ecosystem for ICT related policies • Role of stakeholders in defining the direction.	5** & Readings	3
11	• Information and communication technologies (ICT) and public policy	• ICT and governance • Best practices globally • ICT policies in Pakistan	Readings	4
12	• Principles of Policy in the Constitution of Islamic Republic of Pakistan	• Principles of policy ○ Promotion of local Government institutions. ○ Prejudices to be discouraged ○ Full participation of women in national life ○ Promotion of minorities ○ Promotion of social and economic well-being of the people	Readings	4
13	• Policy making in Pakistan	• Overview of policy making in Pakistan • Role of politicians, media, and civil society in Pakistan's context	Readings	4
14	**Presentations**	Students are supposed to analyse a policy and write a memo addressing government officials/agency proposing alternative solutions. Policy memo is supposed to be	Group Project	

		submitted in writing and to be presented in class.		
15	**Presentations**	Students are supposed to analyse a policy and write a memo addressing government officials/agency proposing alternative solutions. Policy memo is supposed to be submitted in writing and to be presented in class.	Group Project	
16	**Final Exams**			

Title	Public Policymaking: An Introduction *
Author	James E. Anderson
Title	An Introduction to the Policy Process **
Author	Thomas A. Birkland
Title	The Public Policy Primer: Managing the Policy Process **(Reference Book) *** **
Author	Xun Wu, M.Ramesh, M. Howlett, and S. Fritzen
	Supplement readings including book chapters, research articles and newspaper article will also be shared with the students

Evaluation Procedure & Marks Distribution:

Assessment Tools	Weightage
Quizzes (3)	10%
Individual Assignment (2)	4%
Group Term Paper and Presentations (1)	6%
Midterm I	15%
Midterm II	15%
Final Exam	50%

Grading Policy:

Relative grading Scheme will be followed for grading