COURSE DESCRIPTION FORM

INSTITUTION National University of Computers and Emerging Sciences

BS Computer Science

PROGRAM (S) TO BE EVALUATED

A. Course Description

(Fill out the following table for each course in your computer science curriculum. A filled-out form should not be more than 2-3 pages.)

Course Code	CS1002
Course Title	Programming Fundamentals
Credit Hours	3+1
Prerequisites by Course(s) and Topics	None
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	**Mid-1:15** **Mid-2:15** **Assignment: 10 (Three Assignments)** **Quizzes: 10 (Three Quizzes)** **Final:50**
Course Coordinator	Muhammad Shahzad
URL (if any)	
Current Catalog Description	
Textbook (or **Laboratory Manual** for Laboratory Courses)	Name: C How to Program with an Introduction to C Global Edition - 7th Edition Authors: Paul Deitel, Harvey Deitel Publisher: Pearson Name: Problem Solving and Program Design in C - 7th Edition Authors: Maureen Sprankle , Jim Hubbard Publisher: Prentice Hall
Reference Material	Name: Working with C / Let us C

	Author(s): YashwantKanetkar Publisher: BPB Publications Name: Waite Group's Turbo C - Programming for the PC Authors: Robert Lafore Publisher: SAMS
Course Goals	

A. Course Learning Outcomes (CLOs)	Level
CLO 1: Describe fundamental concepts of structured and procedural programming, use pseudo-codes and simple programs to understand control structures, iterative structures and functions using C language.	**C3, PLO1**
CLO 2: Examine code writing, compiling, debugging and program execution.	**C3, PLO5**
CLO 3: Justify problem solving techniques and analytical thinking by identifying the concepts and properties of algorithms.	**C5, PLO2**
CLO 4: Design basic problems of the real world through small/medium size programs given as course projects.	**C6, PLO5**

B. Program learning outcomes (PLO)			
PLO 1	Computing Knowledge	Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of complex computing problems.	☐
PLO 2	Problem Analysis	Identify, formulate, research literature, and analyse complex computing problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing sciences.	☐
PLO 3	Design/Develop Solutions	Design solutions for complex computing problems and design systems, components, and processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.	
PLO 4	Investigation& Experimentation	Conduct investigation of complex computing problems using research-based knowledge and research-based methods	
PLO 5	Modern Tool Usage	Create, select, and apply appropriate techniques, resources and modern computing tools, including	☐

		prediction and modelling for complex computing problems.	
PLO 6	Society Responsibility	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues relevant to context of complex computing problems.	
PLO 7	Environment and Sustainability	Understand and evaluate sustainability and impact of professional computing work in the solution of complex computing problems	
PLO 8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of computing practice.	
PLO 9	Individual and Team Work	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.	
PLO 10	Communication	Communicate effectively on complex computing activities with the computing community and with society at large.	
PLO 11	Project Management and Finance	Demonstrate knowledge and understanding of management principles and economic decision making and apply these to one's own work as a member or a team.	
PLO 12	Life Long Learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological changes.	

C. Relation between CLOs and PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

		PLOs											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CLOs	1	?											
	2					?							
	3		?										
	4					?							

Topics Covered in the Course, with Number of Lectures on Each

Week	Topics	CLO	Assessment

Topic (assume 15-week instruction and one-hour lectures)	**Week 1**	Discussion of the course outline, Introduction to problem solving, what is algorithm, how to write pseudo code, programming structures, problem solving with the sequential structures and, Basic Flowchart, IPO and PAC	**1**		
	Week 2	Problem solving with decisions and iterative structures, Basic Computer Organization, Intro to IDE (compiled program, text editors, debuggers, etc.), Program structure and Execution, First Program with Input and Output	**1,2**	***Project Announcement***	
	Week 3	1. Constant, Variables, Keywords, Escape sequence 2. Format Specifiers, Data types, Data manipulation 3. Library, Linking, Compiling & Loading	**2,3**	***Quiz no 1 Assignment 1 Friday Release Week 3***	
	Week 4	1. Decision Control Structures: If statements and if-else statement 2. Basic switch statements 3. Some working examples	**2,3**		
	Week 5	1. Nested if statements & switch statements 2. Logical & Conditional Operators 3. Working examples	**2,3,5**	***Assignment 1 submission Monday Week 5*** ***Quiz no 2***	
	Week 6	**MID I Examination**			
	Week 7	1. Introduction to Loops Design 2. For, while and do-while loops 3. Some working examples	**2,3,5**	***Assignment 2 Friday Release Week 7***	
	Week 8	1. Nested Loops 2. Break and Continue Statement 3. Working examples	**2,3,4,5**		
	Week 9	1. Introduction to 1D Arrays 2. Multiple subscripted arrays 3. Working examples	**2,3,4,5**	***Assignment 2 submission Monday Week 9*** ***Quiz no 3***	

	Week 10	1. Functions: Declaration, Definition and Calling, passing values to functions, Passing arrays to functions 2. Standard library string functions 3. 2D array of characters	**2,3,4,5**	
	Week 11	**MID II Examination**		
	Week 12	1. Recursion 2. Introduction to Structures and Structure array 3. Working examples	**3,4,5**	***Assignment 3 Friday Release Week 12***
	Week 13	1. Nested structures, Passing structure function 2. Filing in C 3. Introduction to pointers	**3,4,5,6**	
	Week 14	1. Pointers and Arrays 2. Dynamic memory allocation 3. Void pointers 4. Examples	**2,3,4,5, 6**	***Assignment 3 submission Monday Week 14***
	Week 15	**Revision**	**3,5**	***Project Submissions in 12th LAB and Finalization of Sessional marks***
	Week 16	**Final Exam**		
Laboratory Projects/Experiments Done in the Course	**Week 1**	Problem solving with sequential structure using Scratch		***Announce Project***
	Week 2	Problem solving with the decision and iterative structures using Scratch		
	Week 3	Introduction to IDE and Basic Programming Constructs		
	Week 4	Introduction of operators and math.h library functions		
	Week 5	Basic Decision Structure (if, if- else and Switch Statements)		
	Week 6	**THEORY MID I Examination**		
	Week 7	Nested Decision Structures		

	Week 8	Iterative Statements in C			
	Week 9	**Lab Mid**			
	Week 10	Nested Iterations, Arrays Multiple Dimension Array (2D,3D) in C			
	Week 11	**THEORY MID II Examination**			
	Week 12	Functions, Strings and Recursion			
	Week 13	Introduction to Structures & Nested Structure			
	Week 14	Introduction to file processing and basic operations on files and Introduction to Pointers			
	Week 15	Accessing Arrays using pointer Dynamic Memory Management			
	Week 16	**Project Submission**			

Programming Assignments Done in the Course	Assignment related to Functions, Arrays, Pointers, Structures, Dynamic Memory and File Processing will be done			
Class Time Spent on (in credit hours)	**Theory**	**Problem Analysis**	**Solution Design**	**Social**
	15%	50%	30%	5%
Oral and Written Communications	Every student is required to submit at least _1_ written reports of typically _2_ pages and to make _1_ oral presentations of typically _10_ minute's duration. Include only material that is graded for grammar, spelling, style, and so forth, as well as for technical content, completeness, and accuracy.			

Instructor Name _ ____

Instructor Signature _____

Date _____

National University

of Computer and Emerging Sciences

Department	Computer Science	**Dept. Code**	CS
Course Title	English Composition and Comprehension	**Course Code**	SS150
Pre-requisite(s)	None	**Credit Hrs.**	2+1
Course Objective:	The course will acquaint students with more concise, lucid, and correct expression of English. The aims are to: achieve proficiency in language use, develop skills in reading comprehension, improve reading efficiency, use the conventions of standard written English with skill and assurance, build-up vocabulary, and summarize clearly and accurately the ideas of others etc. It will illustrate the force and effectiveness of simple and direct English. The course is intended to be interesting in itself.		

PLO	**Program Learning Outcome (PLO) Statement**	
10	Communication	Communicate effectively on complex computing activities with the computing community and with society at large.
12	Life-long Learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological changes.

CLO	**Course Learning Outcome (CLO)**	**Domain**	**Taxonomy Level**	**PLO**	**Tools**
01	Demonstrate effective academic writing style	Cognitive	2	10	**CPA, M**
02	Plan their ideas and build effective essay outlines.	Cognitive	3	10	**A, M, CPA**
03	Construct academic essays on variety of topics	Cognitive	3	12	**FP, F**

Tool: A = Assignment, M = Midterm, F=Final, CPA =Class Participation Activity ,FP = Final Project

Text Book(s)	**Title**	College Writing Skills
	Author	John Langan
	Publisher	McGraw Hill
Ref. Book(s)	**Title**	Oxford Practice Grammar
	Author	John Eastwood
	Publisher	Oxford University Press
	Title	English Vocabulary in use
	Author	Michael McCarthy
	Publisher	Cambridge University Press

Weeks	Contents/Topics	CLOs
1	Orientation Class. The Difference between Speech and Writing;	1
2	Features of Written English	1
3	Written English- Phrases, Clauses; Conjunctions	1
4	Introduction to Academic Writing. The Writing Process: Generating Ideas	2
5	The Academic Essay. Writing Process and making outlines **Assignment 1: Writing Process and Body Paragraph (Deadline: week 6)**	2
6	**Midterm 1**	
7	Types of Paragraphs- The Body Paragraph	2
8	Writing Introduction Paragraph & Conclusion Paragraph	2
9	Revision: Unity, Coherence, and Development of Ideas. Editing: Sentential Errors; Fragments	1
10	Modifiers (misplaced and dangling), parallelism.	1
11	Argumentative and Persuasive Essay	3
12	**Midterm 2**	
13	Compare and Contrast Essay **Assignment 2: Argumentative or Compare and Contrast Essay (Deadline week:14)**	3
14	Problem Solution Essay	3
15	Cause and Effect Essay **Project: Scenario on Week 14 & 15 topics (Deadline: week 16)**	3
16	Revision	

Assessment

Particulars	% Marks
1. Assignments	10 %
2. Class Participation Activities	5%
3. Final Project	5 %
4. Mid-Terms	30 %
5. Final Exam	50 %
Total:-	**100**

National University

of Computer and Emerging Sciences

Department	Computer Science	**Dept. Code**	CS
Course Title	English Composition and Comprehension-Lab	**Course Code**	SL150
Pre-requisite(s)	None	**Credit Hrs.**	2+1
Course Objective:	The course will acquaint students with more concise, lucid, and correct expression of English. The aims are to: achieve proficiency in language use, develop skills in reading comprehension, improve reading efficiency, use the conventions of standard written English with skill and assurance, build-up vocabulary, and summarize clearly and accurately the ideas of others etc. It will illustrate the force and effectiveness of simple and direct English. The course is intended to be interesting in itself.		

PLO	Program Learning Outcome (PLO) Statement	
10	Communication	Communicate effectively on complex computing activities with the computing community and with society at large.
12	Life-long Learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological changes.

CLO	Course Learning Outcome (CLO)	Domain	Taxonomy Level	PLO	Tools
01	Uses relevant vocabulary in a variety of professional and social situations.	Affective	1	10	**CPA, M**
02	Infers a variety of field related and general texts.	Affective	2	10	**A, M, CPA**
03	Demonstrate the grammatically effective academic reading and writing style	Affective	2	12	**FP, F**

Tool: A = Assignment, M = Midterm, F=Final, CPA =Class Participation Activity ,FP = Final Project

Text Book(s)	**Title**	College Writing Skills
	Author	John Langan
	Publisher	McGraw Hill
Ref. Book(s)	**Title**	Oxford Practice Grammar
	Author	John Eastwood
	Publisher	Oxford University Press
	Title	English Vocabulary in use
	Author	Michael McCarthy
	Publisher	Cambridge University Press

Assessment

Particulars	% Marks
1. Assignments	10 %
2. Project	10 %
3. Mid-Terms	30 %
4. Final Exam	50 %
Total:-	**100**

Weeks	Contents/Topics	CLOs
1	Orientation. Ice-breaking activities. Introduction to Reading; Skimming and Scanning. Reading Activities.	1,2,3
2	Practice Speech and Writing. Formal and Informal English (Practice Activities) Inferential Reading: Fables. **Reading and Vocabulary Assignment Topic: Formal and Informal**	1,2,3
3	Inferential Reading: Prediction, Author's Purpose. **Reading and Vocabulary Assignment Topic: Finance**	1,2,3
4	Exercise on Sentence Structures. Inferential Reading: Tone of the text. **Reading Assignment and Vocabulary Practice Topic: Education**	1,2,3
5	Critical Reading of the texts: **Reading and Vocabulary Activity Topic: Politics**	1,2,3
6	**Midterm 1**	
7	Evaluative Reading. **Reading and Vocabulary Activity Topic: Weather**	1,2,3
8	Critical Reading: Fact or Opinion? **Reading and Vocabulary Activity Topic: Food.**	1,2,3
9	Run-on Critical Thinking: Identifying Underlying Assumptions. Reading and Vocabulary Activity. **Reading and Vocabulary Activity Topic: Leisure.**	1,2,3
10	Subject Verb Agreement Activities on Revision and Editing. Critical Reading: Drawing Conclusions; Implications. **Reading and Vocabulary Activity: Logic-Love is a Fallacy.**	1,2,3
11	Technical Description: Bar Charts **Online Assignment on Editing.** Vocabulary and Reading Practice for Argumentative and Persuasive Essays.	1,2,3
12	**Midterm 2**	
13	Technical Description: Line Graphs Vocabulary and Reading Practice for Descriptive Essays. **Reading and Vocabulary Activity Topic: Transport.**	1,2,3
14	Technical Description: Pie Chart Technical Descriptive Writing **(Project; Deadline: week 16)** **Reading and Vocabulary Activity Topic: Social Concerns**	1,2,3
15	Review Writing **Reading and Vocabulary Activity Topic: Tourism**	1,2,3
16	Revision	

INSTITUTION National University of Computer & Emerging Sciences, Islamabad

PROGRAM (S) TO BE EVALUATED Computer Science (BS) – Fall 2023

Course Description

Course Code	CL1001
Course Title	Introduction to Information and Communication Technologies
Credit Hours	1 (3 Lab contact hours)
Prerequisites by Course(s) and Topics	None
Grading Policy	Absolute as per NUCES grading policy
Policy about missed assessment items in the course	Retake of missed assessment items (other than midterm/ final exam) will not be held. For a missed mid-term/ final exams, an exam retake/ pre-take application along with necessary evidence are required to be submitted to the department secretary. The examination assessment and retake committee decides the exam retake/ pre-take cases.
Course Plagiarism Policy	Plagiarism in project or midterm/ final exam may result in F grade in the course. Plagiarism in an assignment will result in zero marks in the whole assignments category.
URL (if any)	http://slate.nu.edu.pk
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	1 credit, 3 hours contact labs Breakdown Assessment Items

Assessment Item	Number	Weight (%)
Assignments/HWs	2	5
Quizzes	2	5
Project	1	5
Lab Work	Best 10 labs	10
Mid Exam	1	25
Final Exam	1	50

Course Committee	Dr. Ejaz Ahmed (ISB), Dr. Farrukh Syed (KHI), Mr. Waqas Manzoor (LHR), Musadaq Mansoor (PWR), Dr. M. Ahmad (CFD)
Current Catalog Description	History of Computer Systems, Hardware, Software and Architectures. Introduction to Information Systems. Basic Number Systems Arithmetic. Learning of Applications Software such as Document Processing, Spreadsheet, Presentation and Database. System Software Development Web and Internet Services. Introduction to Operating System, Computer Networks and related emerging technologies.
Textbook (or **Laboratory Manual**	1. Charles S. Parker, Understanding Computers: Today and Tomorrow, Course Technology, 25 Thomson Place, Boston, Massachusetts 02210, USA

<table>
<tr><td>for Laboratory Courses)</td><td>2. Livesley, Robert Kenneth. An introduction to automatic digital computers. Cambridge University Press, 2017.</td></tr>
<tr><td>Reference Material</td><td>3. Zawacki-Richter, Olaf, and Colin Latchem. "Exploring four decades of research in Computers & Education." Computers & Education 122 (2018): 136-152.
4. Sinha, Pradeep K., and Priti Sinha. Computer fundamentals. BPB publications, 2010.
Goel, Anita. Computer fundamentals. Pearson Education India, 2010.</td></tr>
<tr><td>Course Detailed Description & CLOs</td><td>Brief history of Computer, Four Stages of History, Computer Elements, Processor, Memory, Hardware, Software, Application Software its uses and Limitations, System Software its Importance and its Types, Types of Computer (Super, Mainframe, Mini and Micro Computer), Introduction to CBIS (Computer Based Information System), Methods of Input and Processing, Class2. Organizing Computer Facility, Centralized Computing Facility, Distributed Computing Facility, and Decentralized Computing Facility, Input Devices. Keyboard and its Types, Terminal (Dump, Smart, Intelligent), Dedicated Data Entry, SDA (Source Data Automation), Pointing Devices, Voice Input, Output Devices. Soft- Hard Copies, Monitors and its Types, Printers and its Types, Plotters, Computer Virus and its Forms, Storage Units, Primary and Secondary Memories, RAM and its Types, Cache, Hard Disks, Working of Hard Disk, Diskettes, RAID, Optical Disk Storages (DVD, CD ROM), Magnetic Types, Backup System, Data Communications, Data Communication Model, Data Transmission, Digital and Analog Transmission, Modems, Asynchronous and Synchronous Transmission, Simplex. Half Duplex, Full Duplex Transmission, Communications, Medias (Cables, Wireless), Protocols, Network Topologies (Star, Bus, Ring), LAN, LAN, Internet, A Brief History, Birthplace of ARPA Net, Web Link, Browser, Internet Services provider and Online Services Providers, Function and Features of Browser, Search Engines, Some Common Services available on Internet.

The Course Learning Objective (CLOs) is to prepare students to become effective users of ICT so as to support their life-long learning, as well as to provide a pathway into the workforce. After completion of the course, the student shall be able to:
1. Learn and understanding of Information, Computer Systems Software and Hardware Technologies.
2. Learning of basic logic, algorithms and number system arithmetic.
3. Understanding and practical knowledge of Applications Software.
4. Learning and experience of basic Web Software Development with internet.
5. Knowledge of Operating System and Network Communication Technologies.

<table>
<tr><td>PLO 1</td><td>Computing Knowledge</td><td>Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of complex computing problems.</td><td>✔</td></tr>
<tr><td>PLO 2</td><td>Problem Analysis</td><td>Identify, formulate, research literature, and analyze complex computing problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing sciences.</td><td>✔</td></tr>
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PLO 3	Design/ Develop Solutions	Design solutions for complex computing problems and design systems, components, and processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.	
PLO 4	Investigation & Experimentation	Conduct investigation of complex computing problems using research based knowledge and research based methods	✔
PLO 5	Modern Tool Usage	Create, select, and apply appropriate techniques, resources and modern computing tools, including prediction and modelling for complex computing problems.	✔
PLO 6	Society Responsibility	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues relevant to context of complex computing problems.	
PLO 7	Environment and Sustainability	Understand and evaluate sustainability and impact of professional computing work in the solution of complex computing problems	
PLO 8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of computing practice.	
PLO 9	Individual and Team Work	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.	
PLO 10	Communication	Communicate effectively on complex computing activities with the computing community and with society at large.	✔
PLO 11	Project Management and Finance	Demonstrate knowledge and understanding of management principles and economic decision making and apply these to one's own work as a member or a team.	
PLO 12	Life Long Learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological changes.	✔

C. Mapping of CLOs on PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

		PLOs											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CLOs	1	✔	✔								✔		
	2	✔	✔		✔								

	3	✔			✔	✔					✔		✔
	4	✔	✔		✔	✔					✔		✔
	5	✔				✔					✔		✔

Topics Covered in the Course/Lab, with Number of Labs on Each Topic

Topics to be covered in the lab:

List of Topics	No. of Weeks	Contact Hours	CLOs
Introduction and brief history of computer, information systems and its applications	2	6	1
Computer Hardware & Architecture	1	3	1
Number Systems and their conversions	1	3	2
Introduction to Operating Systems, Files & Control Panel	1	3	3
Preparing Professional Documents using Microsoft Word	2	6	3
Format & Organize Data using Microsoft Excel	2	6	3
Preparing Professional Presentations using MS Power Point	1	3	3
Developing Databases Forms & Reports using MS Access	1	3	4
Introduction to Communications & Computer Networks	1	3	5
Basic Web Template Development using HTML, CSS	1	3	4
Javascript and Web development	1	3	4
Basic Flowcharts & Algorithms	1	3	2
AI based Prompt Engineering with AI Model's behavior	1	2	3
Total	16	48	

Laboratory Projects/Experiments Done in the Course

Hands on practical experience of MS OS and Ubuntu/ Lynux, MS Word, MS Excel, MS Access, MS Power Point, Dreamweaver, WordPress

Programming Assignments Done in the Course

Preparing professional documents and Presentation Slides, Basic Data Management, Quick Web Development, Basic Operating System & Network Trouble Shouting

Class Time Spent on (in credit hours, Hrs/Min)	**Theory**	**Problem Analysis**	**Solution Design**	**Social and Ethical Issues**
	1.5/90	1.2/70	1.2/70	0.1/10

Oral and Written Communications

Demo, Presentations, Group Discussions

COURSE CONTENTS (Lab/ Practical):			
Weeks	**Contents/Topics**	****Courseware Events** (MM/ IT Lab/Case Study/ Assignment/ Presentation etc.)	**Comments (if any)**
Week-01	Introduction and brief history of computer and its software applications		
Week-02	Information Systems, Computer Hardware & Architecture		
Week-03	Computer peripherals, Memory and Software	Quiz 1	
Week-04	Number Systems Arithmetic		
Week-05	Introduction to Operating System Windows/ Lynux, Files & Control Panel. File names, extensions, searching files, folders, file copy, file delete, restore file, rename file etc.	Assignment 1	
Week-06	Microsoft Word create document, text for editing, move copy and delete text, undo commands, wizards, multi columns, tables, boarders, spell check, trouble shouting with printing.	Quiz 2, Lab Task 1	
Week-07	Microsoft Word Formatting documents, graphics, charts, thesaurus, header/ footer, margins, print preview, insert pictures., page layout, printing trouble shooting and usage of shortcut keys	MID Exam	
Week-08	Microsoft Excel, enter labels, formula, functions, bullets, boarders, format data with cells, copy values and formulas, absolute referencing, use auto formats and	Lab Task 3	
Week-09	Microsoft Excel styles. Sort data, charts, spellings, margin, print preview, header/ footer, page layout, printing trouble shooting and usage of shortcut keys	Quiz 3	
Week-10	Creating Microsoft Power point presentations, samples, bullet list, graphic, chart, tables, slide sorter, transitions, animation, check spelling, presentation as a web pages	Assignment 2	
Week-11	Introduction to Databases/ DBMS and creating tables, key columns, data insertion, relationships, basic SQL, Forms and Reports using MS Access	Quiz 5	
Week -12	HTML, CSS, Javascript using DreamWeaver		
Week 13	Web development using Wordpress	Assignment 3, Lab Task 4	
Week-14	Introduction to Communications & Computer Networks, network topologies, components, protocol, ip-address, connection with internets, emails, servers etc.	Quiz 5, Project	

Week-15	Flow Charts and Logic Building		
Week-16	Introduction to Prompt Engineering and study of AI based Model's Behaviors for desired responses.	Lab Task 5	

COURSE DESCRIPTION FORM

INSTITUTION Fast National University of Computer and Emerging Sciences

PROGRAM (S) TO BE EVALUATED Computer Science/ Artificial Intelligence

A. Course Description

(Fill out the following table for each course in your computer science curriculum. A filled-out form should not be more than 2-3 pages.)

Course Code	SS-1003
Course Title	Pakistan Studies
Credit Hours	3
Prerequisites by Course(s) and Topics	Pakistan Studies
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	Assignments, Quizzes, Presentations, MidTerm1, MidTerm2 and Final Exam.
Course Coordinator	Dr. Muhammad Shahnawaz Khan
URL (if any)	
Description	This course is designed to increase students' awareness of "Pakistan in the Global Village" in 21st Century. This course aims to strengthen students' knowledge about creation of Pakistan, leaders who struggled for it during the freedom movement and strived for its progress after its emergence. This goal will be achieved through objective study and analysis of history, geography, demographics, culture, politics and economics of Pakistan. Students will also do comparative analyses of various internal and international aspects of Pakistan that will enhance their understanding about the significance of Pakistan in the "Global Village".
Textbook (or **Laboratory Manual** for Laboratory Courses)	1. Pakistan A Historical and Contemporary Look by Farooq Naseem Bajwa, Oxford Publisher. 2. Pakistan Studies/Pakistan Affairs by Ikram Rabbani. Caravan series book house. 3. Constitutional and Political Development of Pakistan by Hamid Khan Oxford Publisher.
Reference Material	1. A Concise History of Pakistan by Shahid M. Amin Institute of Business Management Karachi Publisher. 2. Pakistan foreign policy by Shahid M. Amin Oxford Publisher.
Course Learning outcomes CLO	1. Explain how history shapes societies and discuss Pakistan's geographical importance and its strategic location. 2. Compare military and democratic regimes and their domestic – foreign policies in four different phases of Pakistan's history.

	3. Propose solutions for contemporary social, religious and political problems of Pakistan in present scenario.
Topics Covered in the Course, with Number of Lectures on Each Topic (assume 15-week instruction and one-hour lectures)	

Week	Course Contents/Topics	CLO	Tools
01	**Colony, British Colonialism in Subcontinent** • British Imperialism with special reference to Sub Continent • War of Independence & its impacts on the politics of Sub-Continent. • Sir Syed Ahmed Khan and Muslim Nationalism	1	Q1, M1
02	**Historical Background of Muslim Nationalism** • An Evolution of Muslim Nationalism in India • Major Political and Constitutional Developments of Sub-continent 1857-1940.	1	Q1, A1
03	**Muslim Struggle for creation of Pakistan (1940-1947)** • World War-II, Pakistan Resolution 1940 • Road to Independence 1940-1947 • 3rd June Plan and Creation of Pakistan	1	M1
04	**Jinnah and Iqbal** • Ideology, Two Nation Theory and the making of Pakistan. • Initial problems of Pakistan and their solutions	1	M1
05	**Political & Constitutional History of Pakistan 1947-58** • Reasons of delay and making of first constitution • Decade of Instability	1,2	A2, F
06	**1st Mid Term Examination**		
07	**Ayub Era 1958-1969** • Failure of Democracy (1947-1956) • Introduction of Presidential form of Government • Decade of Development	1,2	M2, F
08	• **Project Presentations**	2 ,3	P1
09	**Yahya Era and Dismemberment of Pakistan 1969-1971** • General Elections 1970 • Fall of Dhaka 1971 **Z.A Bhutto 1971-1977** • Parliamentary Form of Government • Constitution of 1973	1,2	M2, F
10	**Zia-Ul-Haq Era 1977-1988** • Authoritarianism	2,3	

		• Islamization under Zia-ul-Haq • Afghan War 1979		F
	11	**2nd Mid Term Examination**		
	12	**Decade of Democracy (1988-1999)** • Political Infightings • Instability during 90's	2,3	M2, F
	13	**Musharraf Era (1999-2008)** • War on terror and Pakistan • Pakistan under Musharraf • Elections of 2008 **Zardari Era (2008-2013)** • CPEC and Economic development • 18th Amendment 2010	1,3,	F
	14	**Contemporary context of Pakistan** • Geo strategic importance of Pakistan • Foreign Policy of Pakistan • Pakistan and its neighbors; India and Afghanistan	2,3	F, A3
	15	**Society and the Futuristic Outlook of Pakistan** • Concept of Welfare State • Social Problems of Pakistan.	2,3	Q3, F
	16	**Rise of Provincialism in Pakistan; Baluchistan, Sindh, Punjab & Khyber Pakhtunkhwa.**	1,2	F

Laboratory Projects/Experiments Done in the Course	N/A			
Programming Assignments Done in the Course	N/A			
Class Time Spent on (in credit hours)	**Theory**	**Problem Analysis**	**Solution Design**	**Social and Ethical Issues**
	40	0	0	20
Oral and Written Communications	Every student is required to submit at least one written report of typically 5-6 pages and to make one oral presentations of typically ten minute's duration. It Includes only material that is graded for grammar, spelling, style, and so forth, as well as for technical content, completeness, and accuracy.			

Instructor Name: Mr. Tahir Khan

Instructor Signature: Tahir Khan

Date: 06-12-2023

COURSE DESCRIPTION FORM

INSTITUTION National University of Computer and Emerging Sciences

PROGRAM (S) TO BE EVALUATED Computer Science

A. Course Description

Course Code	NS1001
Course Title	APPLIED PHYSICS
Credit Hours	3
Prerequisites by Course(s) and Topics	-
Assessment Instruments with Weights (assignments, quizzes, midterms, final)	Assessment with the weight.

Assessment Type	Weight
Assignments and Quizzes	20 (10+10)
Mid-Terms	30 (15 each)
Final	50

Course Coordinator	Rabia Tabassum
URL (if any)	
Current Catalog Description	**Part A:** Adding Vectors, Components of Vectors, Unit Vectors, Vector & Scalar Products, Position & Displacement (2/3 dimensions), Average/Instantaneous Velocity/Acceleration, Projectile Motion, Uniform Circular Motion, Newton Laws of Motion, Forces (1D/2D/3D): Gravitational, Friction, Tension, Weight. **Part B:** Simple Harmonic Motion, the Force Law for SHM, Angular SHM, Simple Pendulum, Damped SHM, Circular Motion & SHM, Types of Waves, Sinusoidal Waves, Wavelength and Frequency **Part C:** Electric Charge, Coulomb's Law, Electric Field, Electric Field Due To Point Charge, Due To Electric Dipole, Gauss' Law, Flux Of Electric Field, Cylindrical/Planar/Spherical Symmetries, Capacitance, Parallel Plate/Cylindrical/Spherical Capacitors, Capacitors In Parallel And In Series, Electric Current, Current Density, Drift Speed, Resistance & Resistivity, Ohm's Law, Magnetic Fields And Field Lines, Hall Effect, Circulating Charge Particles, Magnetic Force On Current Carrying Wire, Magnetic Field Due To Current, Ampere's Law, Magnetic Field Inside/Outside Wire/Between Parallel Wires
Textbooks	1. ***Halliday & Resnick* Fundamentals of Physics (Extended 10th Edition),** Jearl Walker, © 2013 John Wiley & Sons Inc.
Reference Books/ Material	1. **Physics for Scientists and Engineers with Modern Physics (6th Edition),** Raymond A. Serway & John W. Jewett, © 2004 Thomson books/cole US 2. **Physics for Scientists and Engineers (6th Edition),** Paul A Tipler and Gene Mosca, W.H. Freeman and Company 3. **Physics for Scientists and Engineers (3rd Edition),** Fishbane, Gasiorowicz, Thornton, Pearson Prentice Hall. 4. **Physics for Engineers & Scientists (3rd Edition Extended),** Hans C. Ohanian and John T. Markert, W. W. Norton & Company New York. London

Course Goals

A. Course Learning Outcomes (CLOs)

1. To add vectors geometrically, find their components along with scalar and vector products.
2. Apply vector analysis to find position, displacement, velocity, acceleration in 1, 2 & 3 dimensions in numerical problems or Python simulation code/programming.
3. Learn projectile motion with the application of vector analysis to calculate horizontal/vertical motions, equation of the path and horizontal range in numerical problems or Python simulation code/programming.
4. Apply Newton's Laws along with vector notations to evaluate different types of forces: gravitational/weight/normal/tension/friction in numerical problems or Python simulation code/programming.
5. Verify SHM in learning different oscillations (simple, angular, damped, uniform circular motion) for different pendulums/oscillators (torsional, simple, damped).
6. Lean Different Types of Waves, Sinusoidal Waves, Wavelength and Frequency
7. To understand electric charge, electric current, resistance 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 Python simulation code/programming.
8. To understand different types & combinations of capacitances and calculate capacitances along with the other associated physical quantities in numerical problems.
9. To understand magnetic fields & magnetic forces, their application as Hall's effect and in circulating charges to calculate related physical quantities in numerical problems or Python simulation codes.
10. 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 in numerical problems or Python simulation codes.

B. Program Learning Outcomes

For each attribute below, indicate whether this attribute is covered in this course or not. Leave the cell blank if the enablement is little or non-existent.

1. Academic Education:	To prepare graduates as computing professionals	✔
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.	✔ ✔
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.	✔
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.	✔

5. Modern Tool Usage:	Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.	✔
6. Individual and Team Work:	Function effectively as an individual and as a member or leader in diverse teams and in multi-disciplinary settings.	✔
7.Communication:	Communicate effectively with the computing community and with society at large about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.	
8. Computing Professionalism and Society:	Understand and assess societal, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practice.	
9. Ethics:	Understand and commit to professional ethics, responsibilities, and norms of professional computing practice.	
10. Life-long Learning:	Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.	

C. Relation between CLOs and PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

		PLOs									
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
CLOs	1	✔	✔	✔			✔				
	2	✔	✔	✔	✔		✔				
	3	✔	✔	✔			✔				
	4	✔	✔	✔			✔				
	5	✔	✔	✔			✔				
	6	✔	✔	✔	✔	✔	✔				
	7	✔	✔	✔	✔	✔	✔				

Topics Covered in the Course, with Number of Lectures on Each Topic

1. Topics to be covered:

List of Topics	No. of Weeks	Contact Hours	CLO
Adding Vectors, Components of Vectors, Unit Vectors, Vector & Scalar Products,	1	3	1
Position & Displacement (2/3 dimensions)	1	3	2
Average/Instantaneous Velocity/Acceleration, Uniform Circular Motion	1	3	2
Projectile Motion, horizontal/vertical motions, equation of the path and horizontal range	1	3	3
Newton Laws of Motion, Forces (1D/2D): Gravitational, Friction, Tension, Weight.	1	3	4
Simple Harmonic Motion, the Force Law for SHM, Angular SHM	1	3	5
Simple Pendulum, Damped SHM, Circular Motion & SHM,	1	3	5
Types of Waves, Sinusoidal Waves, Wavelength and Frequency	1	3	6
Electric Charge, Coulomb's Law, Electric Field, Electric Field Due To Point Charge	1	3	7
Gauss' Law, Flux, Flux Of Electric Field, Gauss's Law, Equivalency of Gauss's Law And Coulombs' Law	1	3	7
Cylindrical Symmetry, Planar Symmetry, Spherical Symmetry	1	3	8
Capacitance, Parallel Plate, Cylindrical & Spherical Capacitors, Capacitors In Parallel And In Series	1	3	8
Electric Current, Current Density and Drift Speed, Resistance & Resistivity, Ohm's Law	1	3	7
Magnetic Fields And Field Lines, Crossed Fields: Hall Effect, Circulating Charge Particles, Magnetic Force On Current Carrying Wire	1	3	9
Magnetic Field Due To Current, Ampere's Law, Magnetic Field Inside/Outside Wire, Solenoids & Toroids & Between two Parallel Wires	1	3	10
Total	**15**	**45**	

Laboratory Projects/Experiments Done in the Course

-

Programming Assignments Done in the Course

Yes, Algorithms in PYTHON will be developed in order to understand the Physics concepts in more detail.

Class Time Spent on (in credit hours)

Theory	Problem Analysis	Solution Design	Social and Ethical Issues
20	20	5	0

Oral and Written Communications

COURSE DESCRIPTION FORM

INSTITUTION National University of Computer and Emerging Sciences (NUCES-FAST)

PROGRAM (S) TO BE EVALUATED BS (CS/SE/AI/CY)

Course Description

(Fill out the following table for each course in your computer science curriculum. A filled out form should not be more than 2-3 pages.)

Course Code	MT-1003
Course Title	Calculus and Analytic Geometry
Credit Hours	03
Prerequisites by Course(s) and Topics	None
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	Mid-term: 30 Assignments:10 Quizzes: 10 Final: 50
Course Coordinator	Miss Urooj
URL (if any)	
Current Catalog Description	Limits and Continuity; Introduction to functions, Introduction to limits, Techniques of funding limits, Indeterminate forms of limits, Continuous and discontinuous functions and their applications, Differential calculus; Concept and idea of differentiation, Geometrical and Physical meaning of derivatives, Rules of differentiation, Techniques of differentiation, Rates of change, Tangents and Normal lines, Chain rule, implicit differentiation, linear approximation, Applications of differentiation; Extreme value functions, Mean value theorems, Maxima and Minima of a function for single-variable, Concavity, Integral calculus; Concept and idea of Integration, Indefinite Integrals, Techniques of integration, Riemann sums and Definite Integrals, Applications of definite integrals, Improper integral, Applications of Integration; Area under the curve, Identify and determine the behavior of sequence and series.
Textbook (or **Laboratory Manual** for Laboratory Courses)	Title: Calculus Early Transcendental 11th Edition **Author:** Howard Anton, IRl Bivens, Stephen Davis **Publisher:** JOHN WILEY

Reference Material	1. Calculus and Analytic Geometry by Kenneth W. Thomas. 2. Calculus by Stewart, James. 3. Calculus by Earl William Swokowski; Michael Olinick; Dennis Pence; Jeffery A. Cole.
Course Goals	**A. Course Learning Outcomes (CLOs)** 1. Solve algebraic equations and inequalities by using properties of absolute values. 2. Analyze and identify the function and sketching the curve by using tools of calculus. 3. Express the ideas of rate of change, derivatives and anti-derivatives using the concept of limits and continuity. 4. Apply derivatives and integrals for solving different problems arising in daily life. 5. Identify and determine the behavior of sequence and series.

B. Program Learning Outcomes

For each attribute below, indicate whether this attribute is covered in this course or not. Leave the cell blank if the enablement is little or non-existent.

1. Academic Education:	To prepare graduates as computing professionals	
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.	
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.	☐
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.	
5. Modern Tool Usage:	Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.	
6. Individual and Team Work:	Function effectively as an individual and as a member or leader in diverse teams and in multi-disciplinary settings.	
7.	Communicate effectively with the computing community and with society at large about	

Communication:	complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.	
8. Computing Professionalism and Society:	Understand and assess societal, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practice.	
9. Ethics:	Understand and commit to professional ethics, responsibilities, and norms of professional computing practice.	
10. Life-long Learning:	Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.	

C. Relation between CLOs and PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

		PLOs									
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
CLOs	1	☐									
	2	☐									
	3	☐									

Topics Covered in the Course, with Number of Lectures on Each Topic
(assume 15-week instruction and one-hour lectures)

1. Topics to be covered:

List of Topics	No. of Weeks	Contact Hours	CLO
Interval, Inequality, Relation and Functions, One-One and onto function.	**01**	**03**	**01**
vertical line test, Piecewise, Absolute value, Introduction to functions, Domain and Range, Symmetry, Even/odd function, Asymptote	**01**	**03**	**02**

	Concepts of limit. Evaluation of limits. Continuity and points of discontinuity. Types of discontinuity.	**01**	**03**	**03**	
	Rules and techniques of differentiation. Product and quotient rule. Derivative of trigonometric and logarithm function,	**01**	**03**	**03**	
	Chain rule Implicit differentiation. Indeterminate forms, L' Hospital Rule	**01**	**03**	**03, 04**	
	Application of derivatives, Role's and Mean Value's Theorem	**01**	**03**	**04**	
	Concavity, Increasing and Decreasing. Relative Extreme (1st and 2nd derivative test) Absolute Maxima and Minima	**01**	**03**	**04**	
	Riemann sums	**01**	**03**	**03**	
	Techniques of integration, Basic Integration, Integration by parts Reduction formula, Trigonometric substitution	**01**	**03**	**03**	
	Area bounded by the curves. Volume by Disk and washer method	**02**	**06**	**04**	
	Integration of Rational function by Partial fraction, u= tan(x/2) substitution, Improper integrals.	**01**	**03**	**03**	
	Infinite Sequences and Series, Introduction to Sequences Infinite series, The integral test	**02**	**06**	**05**	
	Comparison tests, Absolute convergence, The ratio and root test	**02**	**06**	**05**	
Laboratory Projects/Experiments Done in the Course					
Programming Assignments Done in the Course					

Class Time Spent on (in credit hours)	Theory	Problem Analysis	Solution Design	Social and Ethical Issues
	15	15	05	0
Oral and Written Communications				

Instructor Name: Urooj

Instructor Signature: *Urooj*

Date: 22 December, 2023

COURSE DESCRIPTION FORM

INSTITUTION National University of Computer and Emerging Sciences (NUCES-FAST)

PROGRAM (S) TO BE EVALUATED BS(CS), BS(CY), BS(SE), BS(AI)

A. Course Description

Course Code	CS-1004
Course Title	Object-oriented Programming
Credit Hours	3+1
Prerequisites by Course(s) and Topics	Programming Fundamentals (CS-1002)
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	Mid-1: 15 Mid-2: 15 Quizzes: 10 (3 total) Participation: 3 Assignments: 7(3 total) Final: 50
Course Coordinator	Miss. Nida Munawar
URL (if any)	-
Current Catalog Description	-
Textbook (or **Laboratory Manual** for Laboratory Courses)	**Textbook:** 1. "Problem Solving with C++", 9e Global Edition, Walter Savitch, ISBN-13:9781292018249, Addison-Wesley, 2015. 2. C++ How to program By Deitel & Deitel. **Reference books:** 1. The C++ Programming Language by Bjarne Stroustrup.

	2. Object Oriented Software Engineering by Jacobson. 3. C# 4.0: The Complete Reference by Herbert Schildt
Reference Material	Uploaded on Google Classroom link for the course: [Code: tlhqqc5]
Course Goals	**A. Course Learning Outcomes (CLOs) with Bloom's Taxonomy Levels** 1. **Discuss** knowledge of underlying concepts of object-oriented paradigm like abstraction, encapsulation, polymorphism, inheritance etc. (C-2) 2. **Identify** real world problems in terms of objects rather than procedure. (C-4) 3. **Illustrate** Object-Oriented design artifacts and their mapping to Object-Oriented Programming using C++. (C-3) 4. **Design** and assess small and medium scale C++ / C# programs using object-oriented programming principles. (C-6) **5. Synthesize** programs using Generic Programming and exception handling. (C-6)

B. Program Learning Outcomes

1. Computing Knowledge	Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of complex computing problems.	✔
2. Problem Analysis	Identify, formulate, research literature, and analyze complex computing problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing sciences.	✔
3.Design/Develop Solutions	Design solutions for complex computing problems and design systems, components, and processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.	✔
4. Investigation & Experimentation	Conduct investigation of complex computing problems using research-based knowledge and research-based methods	
5. Modern Tool Usage	Create, select, and apply appropriate techniques, resources and modern computing tools, including prediction and modelling for complex computing problems.	
6. Society Responsibility	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues relevant to context of complex computing problems.	
7. Environment and Sustainability	Understand and evaluate sustainability and impact of professional computing work in the solution of complex computing problems	

8. Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of computing practice	
9. Individual and Team Work	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.	
10.Communication	Communicate effectively on complex computing activities with the computing community and with society at large.	
11. Project Management and Finance	Demonstrate knowledge and understanding of management principles and economic decision making and apply these to one's own work as a member or a team.	
12. Life Long Learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological changes.	

C. Relation between CLOs and PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

		PLOs											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CLOs	1	✔											
	2	✔											
	3		✔										
	4			✔									
	5		✔										

Topics Covered in the Course, with Number of Lectures on Each Topic (assume 15-week instruction and one-hour lectures)

Week	Topic	CLO	Lab Topic	Assessment
1	Introduction to OO paradigm	1	Introduction to IDE, skeleton of C++ program, pointers, array (1D and 2D),Dynamic memory allocation & deallocation (new & delete)basic I/O in C++, String input through getline()	
	Comparison from sequential & procedural paradigms	1		
	Data Abstraction	1		
2	Encapsulation	1,2	C++ data types, functions (built in and user defined),Recursion, reference variables(Pass by reference)	Assignment 1 Quiz 1 Week 3
	Introduction to Objects in real world	1,2		

			struct revisited	
3	Introduction to classes and objects	1,2,3	Classes & Objects , getter & setters ,functions inside & outside the class body (scope resolution operator), difference between classes and structure, UML class diagram	
	Access Control	1,2,3		
	Constructors & its types	1,3,4		
4	Destructor	1,3,4	Working with classes and Constructors, types of constructors (default, parametrized & copy constructor)	
	Member initialization list	1,3		
	Constants, Constants with pointers, constant functions	1,3		
5	Static data and member functions,	1,3	Working with access modifiers, this pointer ,static and constant keywords, some examples to revise concepts of classes and objects, constructors & destructors	
	Inline functions, Inheritance concept and syntax	1,3		
6	**Mid I Exam**			
7	Types of inheritance	1,2,3,4	Working with Static functions, constants, constant function , inline functions and member initialization list	Assignment 2 Quiz 2 Week 7 Quiz 3 Week 10
	Data and code hiding	1,2,3,4		
	Polymorphism in OOP	1,2,3,4		
8	Function overloading	1,2,3,4	Inheritance & types of inheritanc	
	Function overriding	1,2,3,4		
		1,2,3,4		
9	Friend function	1,2,3,4	Polymorphism, Function overloading and overriding	
	Operator overloading	1,2,3,4		
10	Multiple inheritance & its issues (Diamond Problem)	1,2,3,4	Friend classes, Friend functions, operator overloading(using classes and friend)	
	Virtual inheritance	1,2,3,4		
	Virtual functions	1,2,3,4		
11	Abstract classes & Interfaces	1,2,3,4	Abstract Classes and virtual functions	
12	**Mid II Exam**			
13	Introduction to filing	1,2,3,4	Multiple inheritance (Diamond problem), virtual keyword,	
14	Generics	5	Filing and I/O stream (formatted & unformatted) Working with template(function and classes)	Quiz 4 w13
	Introduction to exception handling	5		
15	Introduction to C#	1,2	Project Submission &	

		Properties in C#	1,2	Project demo	
		GUI	1,2,4		
	16	Linking window forms & Exception handling in C#, Revision	1,2,4	Final lab exam	
		Final Exam			

Laboratory Projects/Experiments Done in the Course	1			
Programming Assignments Done in the Course	2 Assignments			
Class Time Spent on (in credit hours)	**Theory**	**Problem Analysis**	**Solution Design**	**Social and Ethical Issues**
	15	15	13	0
Oral and Written Communications	Every student is required to submit at least __1__ written report of typically _2__ pages and to make _1__ oral presentations of typically __10__ minute's duration. Include only material that is graded for grammar, spelling, style, and so forth, as well as for technical content, completeness, and accuracy.			

Instructor Name: **Miss.** Nida Munawar

Instructor Signature: _____

Date: **21 August 2023**

COURSE DESCRIPTION FORM

INSTITUTION National University of Computer and Emerging Sciences (NUCES-FAST)

PROGRAM (S) TO BE EVALUATED BS(CS), BS(CY), BS(SE), BS(AI)

A. Course Description

Course Code	CL-1004
Course Title	Object-oriented Programming
Credit Hours	3+1
Prerequisites by Course(s) and Topics	Programming Fundamentals (CL-1002)
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	Lab Work:20 Mid: 20 Project: 10 Final: 50
Course Coordinator	Miss. Nida Munawar
URL (if any)	-
Current Catalog Description	-

Textbook (or **Laboratory Manual** for Laboratory Courses)	**Textbook:** 1. "Problem Solving with C++", 9e Global Edition, Walter Savitch, ISBN13:9781292018249, Addison-Wesley, 2015. 2. C++ How to program By Deitel & Deitel. **Reference books:** 1. The C++ Programming Language by Bjarne Stroustrup.

	2. Object Oriented Software Engineering by Jacobson. 3. C# 4.0: The Complete Reference by Herbert Schildt
Reference Material	Uploaded on Google Classroom link for the course: [Code: tlhqqc5]
Course Goals	**A. Course Learning Outcomes (CLOs) with Bloom's Taxonomy Levels** 1. **Discuss** knowledge of underlying concepts of object-oriented paradigm like abstraction, encapsulation, polymorphism, inheritance etc. (C-2) 2. **Identify** real world problems in terms of objects rather than procedure. (C-4) 3. **Illustrate** Object-Oriented design artifacts and their mapping to Object-Oriented Programming using C++. (C-3) 4. **Design** and assess small and medium scale C++ / C# programs using objectoriented programming principles. (C-6) 5. **Synthesize** programs using Generic Programming and exception handling. (C-6)

B. Program Learning Outcomes

1. Computing sciences, Knowledge specialization to the	Apply knowledge of mathematics, natural computing fundamentals, and a computing solution of complex computing problems.	✔
2. Problem Analysis	Identify, formulate, research literature, and analyze complex computing problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing sciences.	✔
3.Design/Develop Solutions	Design solutions for complex computing problems and design systems, components, and processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.	✔

4. Investigation & Experimentation	Conduct investigation of complex computing problems using research-based knowledge and research-based methods	
5. Modern Tool Usage	Create, select, and apply appropriate techniques, resources and modern computing tools, including prediction and modelling for complex computing problems.	
6. Society Responsibility	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues relevant to context of complex computing problems.	
7. Environment Sustainability	Understand and evaluate sustainability and impact and of professional computing work in the solution of complex computing problems	
8. Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of computing practice	
9. Individual and Team Work	Function effectively as an individual, and as a member or leader in diverse teams and in multi disciplinary settings.	
10.Communication	Communicate effectively on complex computing activities with the computing community and with society at large.	
11. Project Management and Finance	Demonstrate knowledge and understanding of management principles and economic decision making and apply these to one's own work as a member or a team.	
12. Life Long Learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological changes.	

C. Relation between CLOs and PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

	PLOs											
	1	2	3	4	5	6	7	8	9	10	11	12

CLOs	1	✔												
	2	✔												
	3		✔											
	4			✔										
	5		✔											

Topics Covered in the Course, with Number of Lectures on Each Topic (assume 15-week instruction and onehour lectures)

Week	Topic	CLO	Lab Topic	Assessment
1	Introduction to OO paradigm	1	Introduction to IDE, skeleton of C++ program, pointers, array (1D and 2D),Dynamic memory allocation & deallocation (new & delete)basic I/O in C++, String input through getline()	
	Comparison from sequential & procedural paradigms	1		
	Data Abstraction	1		
2	Encapsulation	1,2	C++ data types, functions (built in and user defined),Recursion, reference variables(Pass by reference)	Assignment 1 Quiz 1 Week 3
	Introduction to Objects in real world	1,2		
			struct revisited	
3	Introduction to classes and objects	1,2,3	Classes & Objects , getter & setters ,functions inside & outside the class body (scope resolution operator), difference between classes and structure, UML class diagram	
	Access Control	1,2,3		
	Constructors & its types	1,3,4		
4	Destructor	1,3,4	Working with classes and Constructors, types of constructors (default, parametrized & copy constructor)	
	Member initialization list	1,3		
	Constants, Constants with pointers, constant functions	1,3		
5	Static data and member functions,	1,3	Working with access modifiers, this pointer	

	Inline functions, Inheritance concept and syntax	1,3	,static and constant keywords, some examples to revise concepts of classes and objects, constructors & destructors	
6	**Mid I Exam**			
7	Types of inheritance	1,2,3,4	Working with Static functions, constants, constant function , inline functions and member initialization list	Assignment 2 Quiz 2 Week 7 Quiz 3 Week 10
	Data and code hiding	1,2,3,4		
	Polymorphism in OOP	1,2,3,4		
8	Function overloading	1,2,3,4	Inheritance & types of inheritanc	
	Function overriding	1,2,3,4		
		1,2,3,4		
9	Friend function	1,2,3,4	Polymorphism, Function overloading and overriding	
	Operator overloading	1,2,3,4		
10	Multiple inheritance & its issues (Diamond Problem)	1,2,3,4	Friend classes, Friend functions, operator overloading(using classes and friend)	
	Virtual inheritance	1,2,3,4		
	Virtual functions	1,2,3,4		
11	Abstract classes & Interfaces	1,2,3,4	Abstract Classes and virtual functions	
12	**Mid II Exam**			
13	Introduction to filing	1,2,3,4	Multiple inheritance (Diamond problem), virtual keyword,	
14	Generics	5	Filing and I/O stream (formatted & unformatted) Working with template(function and classes)	Quiz 4 w13
	Introduction to exception handling	5		
15	Introduction to C#	1,2	Project Submission &	
	Properties in C#	1,2	Project demo	
	GUI	1,2,4		
16	Linking window forms & Exception handling in C#, Revision	1,2,4	Final lab exam	
	Final Exam			

Laboratory Projects/Experiments Done in the Course	1

Programming Assignments Done in the Course	2 Assignments			
Class Time Spent on (in credit hours)	**Theory**	**Problem Analysis**	**Solution Design**	**Social and Ethical Issues**
	15	15	13	0
Oral and Written Communications	Every student is required to submit at least __1__ written report of typically _2__ pages and to make _1__ oral presentations of typically __10__ minute's duration. Include only material that is graded for grammar, spelling, style, and so forth, as well as for technical content, completeness, and accuracy.			

Instructor Name: **Miss.** Nida Munawar

Instructor Signature: _____

Date: **21 August 2023**

COURSE DESCRIPTION FORM

INSTITUTION National University of Computer and Emerging Sciences (NUCES-FAST)

PROGRAM (S) TO BE EVALUATED BS(CS)

A. Course Description

(Fill out the following table for each course in your computer science curriculum. A filled out form should not be more than 2-3 pages.)

Course Code	MT-1006
Course Title	Differential Equations
Credit Hours	3
Prerequisites by Course(s) and Topics	MT-1001 (Calculus & Analytical Geometry)
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	Mid-I: 15 Mid-II: 15 Assignments: 10 Quizzes: 10 Final: 50
Course Coordinator	Mr. Muhammad Jamilusmani
URL (if any)	
Current Catalog Description	This is an introductory course of the Differential equations which includes an in-depth coverage of methods of solving differential equations and mathematical modeling with differential equations. This course based primarily on differential equations. The focus of this course will be on the solution of first and higher order differential equations and applications of ordinary differential equations (ODE's) to problems from the physical, biological, and social sciences.
Textbook (or **Laboratory Manual** for Laboratory Courses)	1) A first course in Differential Equations (DE) with modeling applications/ Dennis G. Zill ,11E, 2017. 2)Differential Equations with Boundary-Value Problems/ Dennis G. Zill 9th E

Reference Material	Elementary Differential Equations (DE) with applications. C. H. Edwards. David, E. 6th E,2007
Course Goals	

A. Course Learning Outcomes (CLOs)

CLO	Course Learning Outcome (CLO) Statements	Domain	Taxanomy Level	PLO	Tools
01	Solution of different type of ODE's using different methods. Solution of some basic ODE's like Linear, Exact, Bernoulli etc.	Cognitive	03	02	Q1, A1, M1, F
02	Existence/Independence of solutions of Initial/Boundary value problems for first & second order ODE's through different techniques Solution of 2nd and higher order differential equations	Cognitive	02	02	A2, Q2, M2, F
03	Solution of PDE's by Fourier series using orthogonal set of functions	Cognitive	02	02	Q3, A3, M2, F

Tools: I = Introduction, R = Reinforcement, E = Evaluation. A = Assignment, Q = Quiz,/ M = Midterm, F=Final, DE=Differential Equation.

(Approved in 23rd Academic Council; 30th December 2019)

B. Program Learning Outcomes

PLO 1	Computing Knowledge	Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of complex computing problems.	
PLO 2	Problem Analysis	Identify, formulate, research literature, and analyse complex computing	

			problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing sciences.	
	PLO 3	Design/Develop Solutions	Design solutions for complex computing problems and design systems, components, and processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.	
	PLO 4	Investigation & Experimentation	Conduct investigation of complex computing problems using research based knowledge and research based methods	
	PLO 5	Modern Tool Usage	Create, select, and apply appropriate techniques, resources and modern computing tools, including prediction and modelling for complex computing problems.	
	PLO 6	Society Responsibility	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues relevant to context of complex computing problems.	
	PLO 7	Environment and Sustainability	Understand and evaluate sustainability and impact of professional computing work in the solution of complex computing problems	

PLO 8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of computing practice.	
PLO 9	Individual and Team Work	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.	
PLO 10	Communication	Communicate effectively on complex computing activities with the computing community and with society at large.	
PLO 11	Project Mgmnt and Finance	Demonstrate knowledge and understanding of management principles and economic decision making and apply these to one's own work as a member or a team.	
PLO 12	Life Long Learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological	

C. Relation between CLOs and PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

		PLOs											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CLOs	1		✔										
	2		✔										
	3		✔										
	4		✔										
	5		✔										
	6												
	7												
	8												

Topics Covered in the Course, with Number of Lectures on Each Topic (assume 15-week instruction and one-hour lectures)

1. Topics to be covered:

List of Topics	No. of Weeks	Contact Hours	CLO
1st Order DE Basic concepts, formation and solution of differential equations Initial value problems	**1**	**3**	**1**
Separable variables Linear Equations. Exact Equations Solution by Substitution Equations (Homogeneous & Bernoulli's DE) reducible to linear equations	**3**	**9**	**1**
Modelling with 1st Order Differential Equations: (Linear and Nonlinear) 1st Order DE arising from real life	**1**	**3**	**1**
========== *MID 1* ==========			
2nd and Higher Order DE Initial and Boundary value problem, Existence of a unique solution. Homogeneous DEs', Linear Dependence and Independence. Wronskian and non-homogeneous Linear Differential Equation	**1**	**3**	**2**
Reduction of order. Homogeneous Linear Equations with Constant Coefficients. Undetermined coefficients-Superposition approach The operator D, Inverse operator 1/ D, Solution of differential equations by operator D methods, Special cases. Undetermined coefficients-Annihilator approach. Variation of parameters. Cauchy Euler equation. Chain rule and Extrema for function of two variables	**4**	**12**	**2**
========== *MID 2* ==========			
Orthogonal Functions and Fourier Series Orthogonal Functions Fourier Series Fourier Cosine & Sine Series (Periodic functions and expansion of periodic functions in Fourier series and Fourier coefficients.)	**2**	**6**	**3**

	Partial Differential Equations Basic concepts and formation of partial differential equations. Linear homogeneous partial differential equations and relations to ordinary differential equations. Classical Equations & Boundary Value Problems. Heat Equation. Wave Equation. Laplace Equation.	**3**	**9**	**3**
	Review	**1**	**3**	**1,2,3**
	Total	**16**	**48**	

Laboratory Projects/Experiments Done in the Course	Nil			
Programming Assignments Done in the Course	Nil			
Class Time Spent on (in credit hours)	**Theory**	**Problem Analysis**	**Solution Design**	**Social and Ethical Issues**
	30	10	5	0
Oral and Written Communications	Every student is required to submit at least __3__ Quizzes of typically _25__ minutes each and to make _3__ assignments of typically __1__ week duration. Include only material that is graded for grammar, spelling, style, and so forth, as well as for technical content, completeness, and accuracy.			

Instructor Name __Mr. Muhammad Jamilusmani

Instructor Signature _____

Date February 1, 2023

COURSE DESCRIPTION FORM

INSTITUTION National University of Computer and Emerging Sciences (NUCES-FAST)

BS(CS)

PROGRAM (S) TO BE EVALUATED

A. Course Description

(Fill out the following table for each course in your computer science curriculum. A filled out form should not be more than 2-3 pages.)

Course Code	EE227
Course Title	Digital Logic Design (DLD)
Credit Hours	3+1
Prerequisites by Course(s) and Topics	(EE117) Applied Physics
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	**Assessment Tools (AT) & Criteria**

AT	Description	Weight
1	Mid Term I and II	30
2	Assignments	10
3	Quizzes	10
4	Final Examination	50

AT to CLO Mapping

	AT 1	AT 2	AT 3	AT 4	Weight
CLO 1	5	2	2.5	5	17

CLO 2	10	2	2.5	10	22
CLO 3	15	2	2.5	10	28
CLO 4		2	2.5	25	33

AT to PLO Mapping

	AT1	AT 2	AT 3	AT 4	Weight
PLO 1					
PLO 2	15	7		15	37
PLO 3	15	8	5	35	63
PLO 4					
PLO 5					
PLO 6					
PLO 7					
PLO 8					
PLO 9					
PLO 10					
PLO 11					
PLO 12					

Course Coordinator	Rabia Tabassum
URL (if any)	
Current Catalog Description	The goal of this course is to introduce concepts & tools for the design of digital electronic circuits using sequential and combinational logic to the freshmen computer science students.

Textbook (or **Laboratory Manual** for Laboratory Courses)	Digital Fundamentals , 11th Edition, Floyd and Jain
Reference Material	1. Digital Systems Principles and Applications 8th Ed, Tocci, Widmer and Moss 2. Digital Design by Moris Mano
Course Goals	**Course Learning Outcomes (CLO)**

No.	Course Learning Outcomes (CLO)	Domain	Taxonomy Level	PLO
1	Identify and explain fundamental concepts of digital logic design including basic and universal gates, number systems, binary coded system, basic components of combinational and sequence circuits.	Cognitive	**2**	**2**
2	Demonstrate the acquired knowledge to apply techniques related to the design and analysis of digital electronics circuits , including Boolean Algebra and Multi-variable Karnaugh map methods.	Cognitive	**3**	**2**
3	Analyze small –scale combinational digital circuits.	Cognitive	**3**	**3**
4	Design small-scale combinational and synchronous sequential digital circuit using Boolean Algebra and K-map.	Cognitive	**3**	**3**

Relevant Program Learning Outcomes (PLOs):

PLO 1	Computing Knowledge	Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of complex computing problems.

PLO 2	Problem Analysis	Identify, formulate, research literature, and analyse complex computing problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing sciences.
	Solutions	ign solutions for complex computing problems and design systems, components, and processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
PLO 4	Investigation & Experimentation	Conduct investigation of complex computing problems using research based knowledge and research based methods
PLO 5	Modern Tool Usage	Create, select, and apply appropriate techniques, resources and modern computing tools, including prediction and modelling for complex computing problems.
PLO 6	Society Responsibility	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues relevant to context of complex computing problems.
PLO 7	Environment and Sustainability	Understand and evaluate sustainability and impact of professional computing work in the solution of complex computing problems
PLO 8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of computing practice.
PLO 9	Individual and Team Work	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
PLO 10	Communication	Communicate effectively on complex computing activities with the computing community and with society at large.
PLO 11	Project Mgmnt and Finance	Demonstrate knowledge and understanding of management principles and economic decision making and apply these to one's own work as a member or a team.
PLO 12	Life Long Learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological changes.

Relation between CLOs and PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

		PLOs											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CLOs	1		✔										
	2		✔										
	3			✔									
	4			✔									

Topics Covered in the Course, with Number of Lectures on Each Topic (assume 15-week instruction and one-hour lectures)

Week No.	Course Contents/Topics	Chapter	CLOs	Tools
1	**INTRODUCTORY CONCEPTS** Digital and Analog Quantities, Binary Digits, Logic Levels, and Digital Waveforms, Basic Logic Functions, Combinational and Sequential Logic Functions	1	1	M1, F
2	**NUMBER SYSTEMS, OPERATIONS, AND CODES** Decimal Numbers, Binary Numbers, Decimal-to-Binary Conversion, Binary Arithmetic, Complements of Binary Numbers, Signed Numbers, Arithmetic Operations with Signed Numbers, Hexadecimal Numbers, Octal Numbers , Binary Coded Decimal (BCD), Digital Codes (Gray code with conversion)	2	1	A1,M1,F
3	**LOGIC GATES** The Inverter, The AND Gate, The OR Gate, The NAND Gate, The NOR Gate, The Exclusive-OR and Exclusive- NOR Gates	3	2	A2,P,M1,F
4-5	**BOOLEAN ALGEBRA AND LOGIC SIMPLIFICATION** Boolean Operations and Expressions, Laws and Rules of Boolean Algebra, DeMorgan's Theorems, Boolean Analysis of Logic Circuits, Logic Simplification Using Boolean Algebra, Standard Forms of Boolean Expressions, Boolean Expressions and Truth Tables, The Karnaugh Map, Karnaugh Map SOP Minimization, Karnaugh Map POS Minimization	4	2	A2,P,M1,F
6	**Mid-Term I**			

	7-8	**COMBINATIONAL LOGIC ANALYSIS** Basic Combinational Logic Circuits, ombinational Logic, The Universal Property of NAND and NOR gates, Combinational Logic Using NAND and NOR Gates, Pulse Waveform Operation	5	3	A3,M2,P,F
	9-10	**FUNCTIONS OF COMBINATIONAL LOGIC** Half and Full Adders, Parallel Binary Adders, Ripple Carry, Comparators, Decoders, Encoders, Code Converters, Multiplexers, Demultiplexers	6	3	A4,M2, P,F
	11	**Mid-Term II**			
	12	**LATCHES, FLIP-FLOPS, AND TIMERS** Latches, Flip-Flops, Flip-Flop Operating Characteristics, Flip-Flop Applications, One-Shots, The Astable Multivibrator	7	4	A5,P,F
	13	**SHIFT REGISTERS** Shift Register Operations, Types of Shift Register Data I/Os, Bidirectional Shift Registers, Shift Register Counters, Shift Register Applications	8	4	A6,P,F
	14-15	**COUNTERS** Finite State Machines, Asynchronous Counters, Synchronous Counters, Up/Down Synchronous Counters, Design of Synchronous Counters, Cascaded Counters, Counter Decoding	9	4	A7,P,F
	16	**Presentations**			
		Final Examination			
Laboratory Projects/Experiments Done in the Course					

Programming Assignments Done in the Course				
Class Time Spent on (in credit hours)	**Theory**	**Problem Analysis**	**Solution Design**	**Social and E**
	30	10	5	
Oral and Written Communications	Every student is required to submit at least __1__ written report of typically _2__ pages and to make _1__ oral presen typically __10__ minute's duration. Include only material that is graded for grammar, spelling, style, and so forth, as technical content, completeness, and accuracy.			

Instructor Name: Rabia Tabassum

Instructor Signature

Date 16-01-24

COURSE DESCRIPTION FORM

INSTITUTION National University of Computer and Emerging Sciences (NUCES-FAST)

PROGRAM (S) TO BE EVALUATED **BS Computer Science**

Digital Logic Design Lab

A. Course Description

(Fill out the following table for each course in your computer science curriculum. A filled out form should not be more than 2-3 pages.)

Course Code	EL - 1005
Course Title	Digital Logic Design Lab
Credit Hours	3+1
Prerequisites by Course(s) and Topics	(EE117) Applied Physics
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	Lab Activities 20 Mid-20 Project: 10 Final: 50
Course Coordinator	Engr. Kashan Hussain
URL (if any)	
Current Catalog Description	The goal of this course is to introduce concepts & tools for the design of digital electronic circuits using sequential and combinational logic to the freshmen computer science students.
Textbook (or **Laboratory Manual** for Laboratory Courses)	Self-designed Lab Manuals Digital Fundamentals Thomas L. Floyd.
Reference Material	1. Digital Systems Principles and Applications 8th Ed, Tocci, Widmer and Moss 2. Digital Design by Moris Mano
Course Goals	**A. Course Learning Outcomes (CLOs)**

1. Identify and explain fundamental concepts of digital logic design including basic and universal gates, number systems, binary coded system, basic components of combinational and sequence circuits.

2. Demonstrate the acquired knowledge to apply techniques related to the design and analysis of digital electronics circuits, including Boolean Algebra and Multi-variable Karnaugh map methods.

3. Analyze small –scale combinational digital circuits.

4. Design small-scale combinational and synchronous sequential digital circuit using Boolean Algebra and K-map.

B. Program Learning Outcomes

For each attribute below, indicate whether this attribute is covered in this course or not. Leave the cell blank if the enablement is little or non-existent.

1. Academic Education:	To prepare graduates as computing professionals	
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.	
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.	✔
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.	✔
5. Modern Tool Usage:	Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.	

6. Individual and Team Work:	Function effectively as an individual and as a member or leader in diverse teams and in multi-disciplinary settings.	
7. Communication:	Communicate effectively with the computing community and with society at large about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.	
8. Computing Professionalism and Society:	Understand and assess societal, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practice.	
9. Ethics:	Understand and commit to professional ethics, responsibilities, and norms of professional computing practice.	
10. Life-long Learning:	Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.	

C. Relation between CLOs and PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

		PLOs											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CLOs	1		*										
	2		*										
	3		*										
	4			*									

Topics Covered in the Course, with Number of Lectures on Each Topic (assume 15-week instruction and one-hour lectures)

1. Topics to be covered:

List of Topics	No. of Weeks	Contact Hours	CLO
Lab 01 Introduction to DLD Equipment's	**2**	**6**	**1**
Lab 02 Introduction to Logic Works Software and Primary Logic Gates (AND, OR, and NOT) Implementation in Logic Works	**2**	**6**	**2**
Lab 03 Secondary Gates (NAND AND NOR)- More Secondary Gates and Boolean Algebra OR, and NOT) Implementation in Logic Works software	**1**	**3**	**3**
Lab 04 Secondary Gates (NAND AND NOR)- More Secondary Gates and Boolean Algebra	**1**	**3**	**3**
Lab 05 Simplification Of Digital Circuits	**2**	**6**	**2**
Lab 06 Half Adder, Full Adder, Half Subtractor and Binary Multiplication Implementation in Hardware.	**2**	**6**	**3**
Lab 07 Half Adder, Full Adder, Half Subtractor and Binary Multiplication Implementation in Logic Works	**2**	**6**	**3**
Lab 08 Binary Decoders and Encoder Implementation in Hardware			
Lab 09 Binary Decoders and Encoder Implementation in Logic Works	**2**	**6**	**3**
========== *Lab MID* ==========			
Lab 10 Multiplexer HW	**2**	**6**	**3**
Lab 11 Multiplexer SW	**2**	**6**	**3**
Lab 12 Latches and Flip Flops HW	**2**	**6**	**4**
Lab 13 Latches Flip Flops SW	**2**	**6**	**4**
Lab 14 Digital Counters and Registers HW-SW	**2**	**6**	**4**
Lab 15 Project Presentations Demo			

	Lab 16 Final Exam	**1**	**3**	
	Total			

Laboratory Projects/Experiments Done in the Course				
Programming Assignments Done in the Course				
Class Time Spent on (in credit hours)	**Theory**	**Problem Analysis**	**Solution Design**	**Social and Ethical Issues**
	30	30	120	0
Oral and Written Communications	Every student is required to submit at least __1__ written report of typically _2__ pages and to make _1__ oral presentations of typically __10__ minute's duration. Include only material that is graded for grammar, spelling, style, and so forth, as well as for technical content, completeness, and accuracy.			

Instructor Name: Muhammad Nadeem Ghouri

Instructor Signature: *Muhammad Nadeem*

Date 23rd Jan 2023

COURSE DESCRIPTION FORM

INSTITUTION National University of Computer and Emerging Sciences (NUCES-FAST)

BS(CS)

PROGRAM (S) TO BE EVALUATED

A. Course Description

(Fill out the following table for each course in your computer science curriculum. A filled out form should not be more than 2-3 pages.)

Course Code	SS-152
Course Title	Communication and Presentation Skills
Credit Hours	2+1
Prerequisites by Course(s) and Topics	English Composition and Comprehension
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	Mid-I: 15 Mid-II: 15 Assignments: 10 Project: 10 Final: 50
Course Coordinator	Sameera Sultan
URL (if any)	
Current Catalog Description	This practical course is designed to enable students to understand the communication process from a scientific perspective. It will allow students to identify potential communication problems, construct productive approaches to communication, and develop strategies to develop effective communication skills. It will introduce students to the basics of interpersonal and business communication, equipping them to communicate more effectively and with greater awareness and skill in both personal and business environments. It is designed to help students heighten their awareness of the function and value of communication. The subject aims to equip students with the ability to use the communication skills required in meetings, group discussions, interviews, and presentations.

Textbook (or **Laboratory Manual** for Laboratory Courses)	The Business Communication Handbook by Judith Dwyer (fourth edition)
Reference Material	Business Communication Today, 2016 by Bovee, Courtland L, John V. Thill & Barbara E. Schatzman.
Course Goals	

A. Course Learning Outcomes (CLOs)

No.	Course Learning Outcome (CLO) Statements	Domain	Taxonomy level	PLO
01	Use the theoretical knowledge of communication to accomplish communication objectives efficiently both as a speaker and writer.	Cognitive	3	10
02	Demonstrate sensitivity to the audience and the context of communication when listening and interacting with others.	Affective	3	9
03	Prepare and deliver effective formal and informal presentations/speeches in different business and academic situations.	Affective	4	10
04	Display effective communication skills to meet business objectives in meetings, interviews, and small group communication.	Affective	5	9

B. Program Learning Outcomes

For each attribute below, indicate whether this attribute is covered in this course or not. Leave the cell blank if the enablement is little or non-existent.

PLO 1	Computing Knowledge	Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing	

		specialization to the solution of complex computing problems.
PLO 2	Problem Analysis	Identify, formulate, research literature, and analyse complex computing problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing sciences.
PLO 3	Design/Develop Solutions	Design solutions for complex computing problems and design systems, components, and processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
PLO 4	Investigation & Experimentation	Conduct investigation of complex computing problems using research based knowledge and research based methods
PLO 5	Modern Tool Usage	Create, select, and apply appropriate techniques, resources and modern computing tools, including prediction and modelling for complex computing problems.
PLO 6	Society Responsibility	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues relevant to context of complex computing problems.
PLO 7	Environment and Sustainability	Understand and evaluate sustainability and impact of professional computing work in the solution of complex computing problems
PLO 8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of computing practice.
PLO 9	Individual and Team Work	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
PLO 10	Communication	Communicate effectively on complex computing activities with the computing community and with society at large.
PLO 11	Project Mgmnt and Finance	Demonstrate knowledge and understanding of management principles and economic decision making and apply these to one's own work as a member or a team.
PLO 12	Life Long Learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological changes.

C. Relation between CLOs and PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

	PLOs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**

CLOs	1										✔		
	2									✔			
	3												
	4										✔		
	5									✔			

Topics Covered in the Course, with Number of Lectures on Each Topic (assume 15-week instruction and one-hour lectures)

Weeks	Contents/Topics	CLO	Assessment
1	Orientation. Difference between Normal Conversation and Public Speaking. Presentation Skills-Content Generation	3	
2	Script Development and Story Boarding Preparing audio visual aids	3	
3	Presentation Delivery Skills Communication-Definition, Forms, Types	2,1	
4	Process of Communication, Common Barriers, Overcoming the communication Barriers	2,1	
5	Rules of Effective Communication: Completeness, Concreteness	1	
6	**MID I**		
7	Consideration, Courtesy	1	
8	**Presentation Project**	3	
9	Conciseness, Professional Meetings-Types of Meetings, Preparing for meetings,	1,4	
10	Developing Agenda	4	
11	**MID II**		
12	Minutes of the Meeting	4	
13	Professional letters-Block Format, Positive messages	1,2	
14	Negative Messages, Job Interviews	1,2,4	
15	Job Interviews	4	
16	**Revision**		

Laboratory Projects/Experiments Done in the Course				
Programming Assignments Done in the Course				
Class Time Spent on (in credit hours)	**Theory**	**Problem Analysis**	**Solution Design**	**Social and Ethical Issues**
	30	10	5	0
Oral and Written Communications	Every student is required to submit at least __1__ written report of typically _2__ pages and to make _1__ oral presentations of typically __10__ minute's duration. Include only material that is graded for grammar, spelling, style, and so forth, as well as for technical content, completeness, and accuracy.			

Instructor Name __Sameera Sultan

Instructor Signature _____

Date __June 8, 2023

COURSE DESCRIPTION FORM

INSTITUTION National University of Computer and Emerging Sciences (NUCES-FAST)

PROGRAM (S) TO BE EVALUATED BS(CS)

A. Course Description

(Fill out the following table for each course in your computer science curriculum. A filled out form should not be more than 2-3 pages.)

Course Code	SS-152
Course Title	Communication and Presentation Skills Lab
Credit Hours	2+1
Prerequisites by Course(s) and Topics	English Composition and Comprehension
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	Mid-I: 15 Mid-II: 15 Assignments: 17 Quiz: 3 Final: 50
Course Coordinator	Sameera Sultan
URL (if any)	
Current Catalog Description	This practical course is designed to enable students to understand the communication process from a scientific perspective. It will allow students to identify potential communication problems, construct productive approaches to communication, and develop strategies to develop effective communication skills. It will introduce students to the basics of interpersonal and business communication, equipping them to communicate more effectively and with greater awareness and skill in both personal and business environments. It is designed to help students heighten their awareness of the function and value of communication. The subject aims to equip students with the ability to use the communication skills required in meetings, group discussions, interviews, and presentations.
Textbook (or **Laboratory Manual**	The Business Communication Handbook by Judith Dwyer (fourth edition)

for Laboratory Courses)	
Reference Material	Business Communication Today, 2016 by Bovee, Courtland L, John V. Thill & Barbara E. Schatzman.
Course Goals	**A. Course Learning Outcomes (CLOs)**

No.	Course Learning Outcome (CLO) Statements	Domain	Taxonomy level	PLO
01	Shares ideas effectively in interpersonal and public communication considering the content of the message.	Affective	3	10
02	Displays the ability to bond, network, and build rapport through both spoken communication and active listening.	Affective	5	9
03	Comprehends the native English accent efficiently.	Cognitive	2	10

B. Program Learning Outcomes

For each attribute below, indicate whether this attribute is covered in this course or not. Leave the cell blank if the enablement is little or non-existent.

PLO 1	Computing Knowledge	Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of complex computing problems.
PLO 2	Problem Analysis	Identify, formulate, research literature, and analyse complex computing problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing sciences.
PLO 3	Design/Develop Solutions	Design solutions for complex computing problems and design systems, components, and processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
PLO 4	Investigation & Experimentation	Conduct investigation of complex computing problems using research based knowledge and research based methods
PLO 5	Modern Tool Usage	Create, select, and apply appropriate techniques, resources and modern computing tools, including prediction and modelling for complex computing

		problems.
PLO 6	Society Responsibility	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues relevant to context of complex computing problems.
PLO 7	Environment and Sustainability	Understand and evaluate sustainability and impact of professional computing work in the solution of complex computing problems
PLO 8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of computing practice.
PLO 9	Individual and Team Work	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
PLO 10	Communication	Communicate effectively on complex computing activities with the computing community and with society at large.
PLO 11	Project Mgmnt and Finance	Demonstrate knowledge and understanding of management principles and economic decision making and apply these to one's own work as a member or a team.
PLO 12	Life Long Learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological changes.

C. Relation between CLOs and PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

		PLOs											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CLOs	1										✔		
	2									✔			
	3												
	4										✔		
	5									✔			

Topics Covered in the Course, with Number of Lectures on Each Topic (assume 15-week

Weeks	Contents/Topics	CLO	Assessment
1	What is Communication? Let's Discover! Course Introduction	1	
2	Conversational Skills: Small Talk,	2	

instruction and one-hour lectures)

	Maintaining and Ending Conversation. Practice.		
3	The Sounds of English-IPA Symbols Experiencing Public Speaking- Impromptu speech (Who am I?)	3	
4	Word and Sentence Stress + Presentation Skills- Content generation and delivering practice	1	
5	English Intonation + Presentation Skills- Using support material effectively	1	
6	**Mid 1**		
7	LAB MID	1	
8	Listening Lesson, Persuasive skill	1,3	
9	Listening Lesson, Demonstrative Speech	1,3	
10	Listening Lesson, Business Meetings	2,3	
11	**Mid 2**		
12	Listening Lesson, Reporting Skills	2,3	
13	Listening Lesson, Business Meetings Practice	2,3	
14	Final Listening Exam,	3	
15	Demonstrative Speech Marked task	1	
16	Business Meetings. Marked task	2	

Laboratory Projects/Experiments Done in the Course				
Programming Assignments Done in the Course				

Class Time Spent on (in credit hours)	**Theory**	**Problem Analysis**	**Solution Design**	**Social and Ethical Issues**
	30	10	5	0

Oral and Written Communications	Every student is required to submit at least __1__ written report of typically _2__ pages and to make _1__ oral presentations of typically __10__ minute's duration. Include only material that is graded for grammar, spelling, style, and so forth, as well as for technical content, completeness, and accuracy.

Instructor Name __Sameera Sultan

Instructor Signature _____

Date __June 8, 2023

National University

Of Computer & Emerging Sciences
Karachi

Course Outline of BS (CS/EE) Degree Program

Course Instructor	Kashif Ahmed	**Semester**	Fall 2023
Batch/Section(s)	Batch 2023 BS(CS/EE) Section: 1N (A, B, C, D, E, F, G, and H)	**Year**	2023
Course Title	Ethics for Non-Muslims (SS-1007/SS-1002)	**Credit Hours**	2
Prerequisite(s)	None	**Course TA**	--

Text Book(s)

Title of book	ETHICS: Theory and Practice		
Author(s)	Theroux Jacques	Publisher	Prentice Hall, NJ, USA
Title of book	Ta'aruf-e-Akhlaqiat		
Author(s)	Sayed, S.M.A	Publisher	BCC&T Karachi University

Reference Book(s)

The Metaphysics of Morals (Summaries)		
An Introduction to Ethics		
William Lille	Publisher	Methuen & Co, London

Course Objective:

This course introduces contemporary and controversial ethical issues facing the professional community. Topics include moral reasoning, moral dilemmas, law and morality, equity, justice and fairness, ethical standards, and moral development. Upon completion, students should be able to demonstrate an understanding of their moral responsibilities and obligations as members of the workforce and society.

S.No.	CLO's	Taxanomy Level	Programme Learning Outcome
1	**Explain** the ethical teachings of the world's major religions.	C2	Ethics
2	**Describe** the importance and implications of ethics on individuals and societies	C2	Ethics

Tentative Weekly Lectures Schedule:

Week	Contents/Topics
Week 1	Introduction to Ethics (Meaning and Scope)
Week 2	Relation of Ethics and; • Religion • Science • Law
Week 3	Historical Development of Morality • Instinctive Morality • Customary Morality • Reflective Morality
Week 4	Moral Theories
Week 5	
Week 6	1st Mid Term Exam
Week 7	Moral Ethics and Society • Freedom and Responsibility • Tolerance • Justice • Punishment
Week 8	
Week 9	Social Responsibilities • Individual • Collective behavior • Volunteerism
Week 10	Volunteer Activities
Week 11	2nd Mid Term Exam
Week 12	Teaching of Major Religions of the World
Week 13	
Week 14	Professional Ethics
Week 15	Islam's Attitude towards Minorities
Week 16	Pakistan and Ethical Issues of society (Discussions)
Week 17	Final Exams

Marks Distribution:

Particulars	% Marks
1. Class Participation, Attendance & Assignments	10
2. Surprise tests and Presentations	10
3. First Mid Exam	15
4. Second Mid Exam	15
5. Final Exam	50
Total:	**100**

Signature: _____ Date: 21-08-2023

COURSE DESCRIPTION FORM

INSTITUTION National University of Computer and Emerging Sciences (NUCES-FAST)

PROGRAM (S) TO BE EVALUATED BS(CS), BS(SE), BS(AI), and BS(CY)

A. Course Description

Course Code	CS1005
Course Title	Discrete Structures
Credit Hours	3+0
Prerequisites by Course(s) and Topics	None
Assessment Instruments with Weights (homework, quizzes, midterms, final, assignments etc.)	Midterm examination I: 15% Midterm examination II: 15% Assignments(Home tasks / Class activities/.Quizzes): 20% End-term examination: 50%
Course Coordinator	Mr. Shoaib Raza
URL (if any)	Google Classroom – Link has been provided
Current Catalog Description	Logic, relations, functions, basic set theory, counting, proof techniques, mathematical induction, graph theory, recursion, recurrence relations, number theory and sequence & series. All the topics will be taught in perspective of their applications in computing.
Textbook	Kenneth H. Rosen, Discrete Mathematics and Its Applications, McGraw Hill, 8th Edition, 2019.
Reference Material	Sussana S. Epp, Discrete Mathematics with Applications, Brooks Cole, Cengage Learning, 5th Edition, 2020.
Course Goals	A discrete mathematics course has more than one purpose. Students should learn a particular set of mathematical facts and how to apply them; more importantly, such a course should teach students how to think logically and mathematically. To achieve these goals, the focus of this course is on basic mathematical concepts in discrete mathematics and on applications of discrete mathematics in algorithms and data structures. The focus is also on teaching the problem-solving strategies, techniques, and tools and to show students how discrete mathematics can be used in modern computer science. In particular, this course is meant to introduce logic, proofs, sets, relations, functions, counting, and probability, with an emphasis on applications in Computer Science. Further, this course aims to develop understanding and appreciation of the finite nature inherent in most Computer Science problems and structures through study of combinatorial reasoning, abstract algebra, iterative procedures, predicate calculus, tree and graph structures.

A. Course Learning Outcomes (CLOs)

CLO	Course Learning Outcome (CLO)	Domain	Taxonomy Level	PLO	Tools
01	Explain the key concepts of Discrete Structures such as Mathematical Logic, Sets, Permutations, Relations, Graphs and Trees etc.	Cognitive	C2 (Understanding)	**1,6**	**A1, A2, A5, M1, F**
02	Construct formal logic proofs and/or informal, but rigorous, logical reasoning to real problems, such as predicting the behavior of software or solving problems such as puzzles.	Cognitive	C3 (Applying)	**2,3,4,6**	**A6, M2, F**
03	Use discrete structures in solving other computing problems such as formal specification, verification, databases, artificial intelligence, and cryptography.	Cognitive	C3 (Applying)	**1,2,3,4,5,6**	**A3, A4 M2, F**
04	Distinguish various discrete structures and their relevance within the context of computer science, in the areas of data structures and algorithms, in particular.	Cognitive	C4 (Analyzing)	**1,2,3,4,5,6**	**A5, A6, F**
Tool: A = Assignment, M = Mid-term, F=Final (End-term)					

B. Program Learning Outcomes

For each attribute below, indicate whether this attribute is covered in this course or not. Leave the cell blank if the enablement is little or non-existent.

1. Academic Education:	To prepare graduates as computing professionals	✔
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.	✔

	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.	✔
	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.	✔
	5. Modern Tool Usage:	Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.	✔
	6. Individual and Team Work:	Function effectively as an individual and as a member or leader in diverse teams and in multi-disciplinary settings.	✔
	7. Communication:	Communicate effectively with the computing community and with society at large about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.	
	8. Computing Professionalism and Society:	Understand and assess societal, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practice.	
	9. Ethics:	Understand and commit to professional ethics, responsibilities, and norms of professional computing practice.	
	10. Life-long Learning:	Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.	

C. Relation between CLOs and PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

		PLOs									
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
CLOs	1	✔	✔				✔				
	2	✔	✔	✔	✔		✔				
	3	✔	✔	✔	✔	✔	✔				
	4	✔	✔	✔	✔	✔	✔				

Topics Covered in the Course, with Number of Lectures on Each Topic (assume 15-week instruction and one-hour lectures)

1. Topics to be covered:

List of Topics	No. of Weeks	Contact Hours	CLO
Chapter 1: The Foundations: Logic and Proofs Introduction Propositional Logic, Applications of Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference **Chapter 2: Sets, Functions, Sequences and Sums** Sets, Set Operations, Functions, Sequences and Series **Chapter 9: Relations** Relations and their Properties, Applications of Relations, Representing Relations, Equivalence Relations, and Partial Orderings	**5**	**15**	**1,2,3**
========== ***MID 1*** ==========			
Chapter 2: Sequences and Sums ,Sequences and Series **Chapter 10 Graphs** Graphs and Graph Models, Terminologies, Types of Graphs, Representing Graphs and Isomorphism, Connectivity, Euler and Hamiltonian Paths, Planar Graphs, and Graph Coloring	**4**	**12**	**1,2, 3**

	Chapter 11 Trees Introduction, Applications, Tree Traversal, Spanning Trees and Minimum Spanning Trees			
	========== ***MID 2*** ==========			
	Chapter 4: Number Theory and Cryptography Divisibility and Modular Arithmetic, Integer Representation and Algorithms, Primes and Greatest Common Divisors, Congruences and Applications and Cryptography **Chapter 1** Introduction to Proofs and Proof Methods **Chapter 5: Induction and Recursion** Mathematical Induction and Recursive Algorithms **Chapter 6 and 8: Counting & Counting Techniques** Basics, Pigeonhole Principle, Permutations and Combinations, Binomial Coefficients and Recurrence Relations	**5**	**15**	**1,2, 3**
	========== ***END-TERM (FINAL) EXAM*** ==========			
	Review	**0.5**	**1**	**1,2,3,4**
	Total	**15**	**45**	

Laboratory Projects/Experiments	No Labs and Projects in this course.			
Programming	None			
Class Time Spent on (in contact hours)	**Theory**	**Problem Analysis**	**Solution Design**	**Social and Ethical Issues**
	10	15	20	0
Oral and Written Communications	Students need to participate in class discussion and class assignments.			

Instructor Name _**Mr. Shoaib Raza**__

Instructor Signature _____

Date: **23-01-23**

COURSE DESCRIPTION FORM

INSTITUTION National University of Computer and Emerging Sciences (NUCES-FAST) BS(CS),

PROGRAM (S) TO BE EVALUATED

A. Course Description

(Fill out the following table for each course in your computer science curriculum. A filled out form should not be more than 2-3 pages.)

Course Code	MT-1004
Course Title	Linear Algebra
Credit Hours	3
Prerequisites by Course(s) and Topics	
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	Mid-I: 15 Mid-II: 15 Assignments: 05 Quizzes:05 Final: 50
Course Coordinator	Dr Khusro Mian
URL (if any)	
Current Catalog Description	This is an introductory course of the Linear Algebra which includes an in-depth coverage of methods of solving system of linear equations and their applications in different computer science domains. Evaluating eigen vectors, decompositions of matrices and some other theories related to matrices is a part of course.
Textbook (or **Laboratory Manual** for Laboratory Courses)	Elementary Linear Algebra *by Howard Anton,* 12th Edition.
Reference Material	1) Linear Algebra and its applications by Gilbert Strang.

	2) Coding the Matrix: Linear Algebra through Applications to Computer Science by Philip N Klein.
Course Goals	

A. Course Learning Outcomes (CLOs)

CLO	Course Learning Outcome (CLO) Statements	Domain	Taxanomy Level	PLO	Tools
01	Interpreting and finding the solutions of linear equations in detail.	Cognitive	02	02	A1,A2,A3,M1,F
02	Understanding the core concepts of Euclidean vector spaces and matrix transformations.	Cognitive	02	02	A1,M1,F
03	Applying the basic linear algebra concepts in computer science.	Cognitive	03	02	A2,A3,M2,F

Tools: A = Assignment, Q = Quiz, M = Midterm, F=Final, P=Presentation/Project

(Approved in 23rd Academic Council; 30th December 2019)

B. Program Learning Outcomes

PLO 1	Computing Knowledge	Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of complex computing problems.	

PLO 2	Problem Analysis	Identify, formulate, research literature, and analyse complex computing problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing sciences.	✔
PLO 3	Design/Develop Solutions	Design solutions for complex computing problems and design systems, components, and processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.	
PLO 4	Investigation & Experimentation	Conduct investigation of complex computing problems using research based knowledge and research based methods	
PLO 5	Modern Tool Usage	Create, select, and apply appropriate techniques, resources and modern computing tools, including prediction and modelling for complex computing problems.	
PLO 6	Society Responsibility	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues relevant to context of complex computing problems.	

PLO 7	Environment and Sustainability	Understand and evaluate sustainability and impact of professional computing work in the solution of complex computing problems	
PLO 8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of computing practice.	
PLO 9	Individual and Team Work	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.	
PLO 10	Communication	Communicate effectively on complex computing activities with the computing community and with society at large.	
PLO 11	Project Mgmnt and Finance	Demonstrate knowledge and understanding of management principles and economic decision making and apply these to one's own work as a member or a team.	
PLO 12	Life Long Learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological	

C. Relation between CLOs and PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

		PLOs											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CLOs	1		✔										
	2		✔										
	3		✔										

	4												
	5												
	6												
	7												
	8												

Topics Covered in the Course, with Number of Lectures on Each Topic (assume 15-week instruction and one-hour lectures)

1. Topics to be covered:

List of Topics	No. of Weeks	Contact Hours	CLO
Introduction, System of Linear equations, Elementary row operation	**1**	**3**	**1**
Solving system of Linear equations: Gaussian Elimination and Gauss Jordan methods **Matrix Operations** Elementary Matrices, Methods for finding Inverse	**1**	**3**	**1**
Invertible Matrices, Diagonal, triangular, and symmetric matrices, (2) Matrix Transformations Application no 1: (3) Network Analysis	**2**	**6**	**2,3**
Determinants and their properties	**1**	**3**	**1**
========== *MID 1* ==========			
General Vector Space, Subspaces, Spanning Sets, Linear Independence,	**1**	**3**	**2**
Coordinates and Bases, Dimensions Change of basis	**1**	**3**	**2**
Bases for row, column, and null spaces,	**1**	**3**	**2**

Rank and Nullity				
Eigenvalues and Eigenvectors, Diagonalization	**1**	**3**	**2**	
========== *MID 2* ==========				
Application no 2: Markov Chains Internet Search Engines	**1**	**3**	**3**	
Inner product spaces, Orthogonal and orthonormal bases, Gram-Schmidt Process;	**2**	**3**	**2**	
QR-Decomposition. Orthogonal Matrices, Orthogonal Diagonalization, Quadratic Forms	**2**	**6**	**1**	
Review	**1**	**3**		
Total	**16**	**48**		

Laboratory Projects/Experiments Done in the Course				
Programming Assignments Done in the Course				
Class Time Spent on (in credit hours)	**Theory**	**Problem Analysis**	**Solution Design**	**Social and Ethical Issues**
	20	10	15	0
Oral and Written Communications				

Instructor Name: Dr Khusro Mian

Instructor Signature:

Date: August 18th , 2023

COURSE DESCRIPTION FORM

INSTITUTION National University of Computer and Emerging Sciences (NUCES-FAST)
BS(CS), BS(SE), BS(CY), BS(AI)

PROGRAM (S) TO BE EVALUATED

A. Course Description

Course Code	CS2001
Course Title	Data Structures
Credit Hours	3+1
Prerequisites by Course(s) and Topics	Object-oriented Programming (CS1004)
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	Midterm Exam 1: 15 (1 Hour written exam) Midterm Exam 2: 15 (1 Hour written exam) Project: 8 Quizzes: 12 (Quizzes and one hackathon) Final: 50 (3 Hours Written Exam)
Course Coordinator	Dr. Jawwad A Shamsi
URL (if any)	-
Current Catalog Description	-
Textbook (or **Laboratory Manual** for Laboratory Courses)	**Textbook:** Algorithms by Robert Sedgewick and Kevin Wayne Data Structures and Algorithms in C++ 4th Edition by Adam Drozdek **Reference books:** Data Structure and Algorithms Analysis in C++ Mark Allen Using C++ -- A Practical Implementation by Sachi Nandan Mohanty and Pabitra Kumar Tripathy

Reference Material	Data Structures Using C++ by VARSHA H. PATIL Oxford University Press Data Structures and Algorithm Analysis by Clifford A. Shaffer Open Data Structures in C++ Open Data Structures in Java
Course Goals	**A. Course Learning Outcomes (CLOs)** 1. *Use & explain* concepts related to basic and advanced data structures and describe their usage in terms of common algorithmic operations **[Bloom's Taxonomy Level:** 3**, Learning Domain:** Cognitive**]** 2. *Solve* recursive problems efficiently using Backtracking **[Bloom's Taxonomy Level:** 3**, Learning Domain:** Cognitive**]** 3. *Compare* different data structures in terms of their relative efficiency and *design* effective solutions and algorithms that make use of them. **[Bloom's Taxonomy Level:** 6**, Learning Domain:** Cognitive & Psychomotor**]** 4. *Transform* acyclic weighted graphs into acyclic tree structures for minimum cost traversal **[Bloom's Taxonomy Level:** 6**, Learning Domain:** Cognitive & Psychomotor**]**

B. Program Learning Outcomes		
1. Computing Knowledge	Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of complex computing problems.	CLO-1
2. Problem Analysis	Identify, formulate, research literature, and analyze complex computing problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing sciences.	CLO-2
3.Design/Develop Solutions	Design solutions for complex computing problems and design systems, components, and processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.	CLO-3
		CLO-4

	4. Investigation & Experimentation — Conduct investigation of complex computing problems using research based knowledge and research based methods

C. Relation between CLOs and PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

		PLOs											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CLOs	1	?											
	2		?										
	3			?									
	4				?								

Topics Covered in the Course, with Number of Lectures on Each Topic (assume 15-week instruction and one-hour lectures)

1. Topics to be covered:

List of Topics	No. of Weeks	Contact Hours	CLO
ADT, C++ Language Specification, Pointers revisited, Rule of Three, Dynamic Safe Arrays	**1**	**3**	**1**
Elementary Sorting Techniques	**1**	**3**	**1,3**

		List (Singly Linked List), List (Doubly Linked List), List (Circular Linked List)	**2**	**6**	**1, 3**	

	Recursion, it's types, issues and Backtracking (with examples)	**1**	**3**	**2**
	========== Mid-term 1 Exam ==========			
	Advanced Sorting Techniques and their issues, Linear, Binary & Interpolation Search	**1**	**3**	**3**
	Stack, Queue, their implementation strategies and applications(Simulation of recursion)	**1**	**3**	**1, 3**
	Binary trees and their properties (Full Binary Tree, Complete Binary Tree), Multi-way Trees/Tries Binary Search Trees, their operations and applications, skewness and issues	**2**	**7**	**1, 2, 3**
	Balance in Binary Search Trees, AVL Trees	**1**	**3**	**2, 3**
	========== Mid-term 2 Exam ==========			
	Priority Queues, Heaps as Priority Queues	**1**	**3**	**1, 3**
	Hashing, Hash Functions, Collision-resolution Techniques, Rehashing	**1**	**3**	**1, 3**
	Graphs and their representation and traversal, Shortest Path Problem,	**1**	**3**	**4**
	Minimum Spanning Trees, Graph Algorithms, Topological Sort	**1**	**3**	4
	========== Final Exam ==========			
	Total	**16**	**48**	

Laboratory Projects/Experiments Done in the Course	There will be weekly labs starting from the first week. The following is a summary of the Lab exercises given to Students: ● Introduction to Data Structures and their implementation. ● Writing & using dynamic safe arrays ● Solving recursive problems using Backtracking in programs ● Implementation of Linked Lists ● Linked List based implementation of primitive Data Structures ● Implementing Sorting Algorithms ● Implementing Binary Trees and writing functions for their properties ● Implementing Binary Search Trees using Structures and Classes ● Writing functions for tree traversal and maintaining balance ● Implementing graphs and writing functions for their traversal

Programming Assignments Done in the Course	Assignments related to Backtracking, Stacks & Queues, Binary Search Trees and traversal			
Class Time Spent on (in credit hours)	**Theory**	**Problem Analysis**	**Solution Design**	**Social and Ethical Issues**
	15	15	13	0
Oral and Written Communications	Every student is required to submit at least __1__ written report of typically _6__ pages and to make _1__ oral presentations of typically __10__ minute's duration. Include only material that is graded for grammar, spelling, style, and so forth, as well as for technical content, completeness, and accuracy.			

Instructor Name:

Instructor Signature: _____

Date:

COURSE DESCRIPTION FORM

INSTITUTION National University of Computer and Emerging Sciences (NUCES-FAST)

PROGRAM (S) TO BE EVALUATED BS (CS, SE, AI, CY)

A. Course Description

Course Code	CL-2001
Course Title	Data Structures-Lab
Credit Hours	1
Prerequisites by Course(s) and Topics	Object-oriented Programming Lab(CL-1004)
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	Mid exam:20 Lab Work: 40 Final: 40
Course Coordinator	Dr Jawad Shamsi
URL (if any)	-
Current Catalog Description	-
Textbook (or **Laboratory Manual** for Laboratory Courses)	**Textbook:** Data Structures and Algorithms in C++ 4th Edition by Adam Drozdek **Reference books:** Data Structures & Algorithms Made Easy 5th Edition by Narasimha Karumanchi Data Structures with C by Schaum's series
Reference Material	Uploaded on Google Classroom link for the course: [Code: svslnx3]

Course Goals

A. Course Learning Outcomes (CLOs) with Bloom's Taxonomy Levels

1. **Recall** prerequisite concepts for the implementation of data structures.
   [Bloom's Taxonomy Level: 1, Learning Domain: Cognitive]
2. **Comprehend** basic concepts related to data structures in terms of common algorithmic operations.
   [Bloom's Taxonomy Level: 2, Learning Domain: Cognitive]
3. **Compare & Contrast** basic and advanced data structures in terms of their relative efficiency.
   [Bloom's Taxonomy Level: 4, Learning Domain: Cognitive]
4. **Justify** selection of a particular data structure for solving real world problems. [Bloom's Taxonomy Level: 5, Learning Domain: Cognitive]

B. Program Learning Outcomes

1. **Computing Knowledge**	Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of complex Computing problems.	CLO-1
2. **Problem Analysis**	Identify, formulate, research literature, and analyze complex computing problems, reaching substantiated conclusions using first principles of Mathematics, natural sciences, and computing sciences.	CLO-2
3.**Design/Develop Solutions**	Design solutions for complex computing problems and design systems, components, and processes that meet specified needs with appropriate Consideration for public health and safety, cultural, societal, and environmental considerations.	CLO-3
4. Investigation & Experimentation	Conduct investigation of complex computing problems using research-based knowledge and research based methods	CLO-4

C. Relation between CLOs and PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

		PLOs											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CLOs	1	?											
	2		?										

	3			?										
	4				?									

Topics Covered in the Course, with Number of Lectures on Each Topic (assume 15-week instruction and three-hour lectures)

1. Topics to be covered:

List of Topics	No. of Weeks	Contact Hours	CLO
ADT, C++ Language Specification, Pointers revisited, Rule of Three	**1**	**3**	**1**
1D and 2D Dynamic Safe Pointers	**1**	**3**	**1**
Elementary Sorting Techniques	**1**	**3**	**2,4**
List (Singly Linked List), List (Doubly Linked List), List (Circular Linked List	**2**	**6**	**2,3**
Recursion, it's types, issues, and Backtracking (with examples)	**1**	**3**	**1,2**
Advanced Sorting Techniques and Binary Search	**1**	**3**	**2,3**
==========Mid Term ========== 1, 3			
Stack, Queue, their implementation strategies and applications	**2**	**6**	**2,4**
Priority Queues, Heaps as Priority Queues	**1**	**3**	**2,3,4**
Binary trees and their properties (Full Binary Tree, Complete Binary Tree), Binary Search Trees, their operations And applications.	**1**	**3**	**2,3,4**
Balance in Binary Search Trees, AVL Trees	**1**	**3**	**2,3,4**
Hashing, Hash Functions, Collision-resolution Techniques	**1**	**3**	**2,3,4**
Graphs and their representation	**1**	**3**	**2,3,4**
========== Final Exam ==========			
Total	**15**	**45**	

National Computing Education Accreditation Council

Laboratory Projects/Experiments Done in the Course	There will be weekly labs starting from the first week. The following is a summary of the Lab exercises given to Students: ● Revision of advanced OOP concepts and their implementation. ● Implementing dynamic safe arrays, Jagged Arrays. ● Solving recursive problems using Backtracking in programs ● Implementation of Linked Lists (Singly, Double, Circular). ● Implementing Sorting Algorithms. ● Implementing Binary Search. ● Introduction and Implementation to Stack and Queue. ● Introduction and Implementation of Priority Queues, Heaps as Priority Queues. ● Implementing Binary Trees and writing functions for their properties ● Implementing Binary Search Trees. ● Introducing and Writing functions for tree traversal and maintaining balance in AVL. ● Implementing graphs and writing functions for their traversal. ● Introduction and implementation to Hashing, Hash Functions, Collision-resolution Techniques.
Programming Assignments Done in the Course	Assignments and Lab activities related to Linked list, Stacks & Queues, Binary Search Trees and traversal.

Class Time Spent on (in credit hours)	**Theory**	**Problem Analysis**	**Solution Design**	**Social and Ethical Issues**
	10	20	15	0

Oral and Written Communications	Every student is required to submit their coding files for the tasks assigned and to appear in _1_viva of typically__10__minute's duration at the end of semester

Instructor Name: Safia Baloch

Instructor Signature: ***Safia Baloch***

Date: **19 August, 2023**

COURSE DESCRIPTION: EE-2003 Computer Organization & Assembly Language (COAL)

COURSE DESCRIPTION FORM

INSTITUTION FAST School of Computing, National University of Computer and Emerging Sciences, Karachi

PROGRAM TO BE EVALUATED	BS-School of Computing– Spring 2023

Course Description

Course Code	EE2003
Course Title	Computer Organization & Assembly Language
Credit Hours	3
Prerequisites by Course(s) and Topics	PF, DLD
Grading Policy	Absolute grading
Policy about missed assessment items in the course	Retake of missed assessment items (other than midterm/ final exam) will not be held. For a missed midterm/ final exam, an exam re-take/ pre-take application along with necessary evidence are required to be submitted to the department secretary. The examination assessment and retake committee will decide the exam re-take/ pre-take cases.
Course Plagiarism Policy	Plagiarism in project or midterm/ final exam may result in F grade in the course. Plagiarism in an assignment will result in zero marks in the **whole assignments** category.
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	***50% Theory 50% Practical*** Assessment Items

Assessment Item	**Number**	**Weight (%)**
Assignment	4	10% = 2*3.5+3
Quiz	3	10%= 2*3.5+3
Midterm Exam	2	30%= 2*15
Final Exam	1	50%

Course Instructors	Mr. Junaid Rabbani, Mr. Aashir Mahboob, Ms. Rabia Ahmed Ansari, Mr. Shoaib Rauf
Lab Instructors (if any)	Mr. Taha Ahmed, Mr. Areeb Ahmed, Mr. Shoaib Rauf
Course Coordinator	Muhammad Junaid Rabbani
URL (if any)	

Current Catalog Description	- Programming Methodology of low-level languages - How to access computer hardware directly - Overview of a user-visible architecture (of Intel 80x86 processors) - Intel 80x86 instruction set, assembler directives, macro, etc. - How programs interact with the operating system for various services including memory management and input/output services - How is it possible to interface high-level language and low-level language modules
Textbook (or **Laboratory Manual** for Laboratory Courses)	Assembly Language for Intel Based Computers K.Irvine 7th Edition MIPS Assembly Language Programming by Ed Jorgensen, Version 1.1.35 April 2018
Reference Material	Computer organization and design: the hardware/software interface by David A. Patterson and John L. Hennessy Computer Organization & Embedded Systems Hamacher et al. 6th Ed.

Course Learning Outcomes

A. Course Learning Outcomes (CLOs)

On successful completion of this course students will have to know how of:

CLO	Course Learning Outcome (CLO)	Domain	Taxonomy Level	PLO	Tools
01	Illustrate micro-architectures of x86 and RISC processors	Cognitive	3	02	A1, Q1, M1, F
02	Create basic assembly code using different type of addressing modes in x86 & RISC ISAs to solve simple-moderate problems	Cognitive	4	02	A2, Q1, M1, F
03	Apply translation of machine instructions into binary code and visa versa.	Cognitive	5	03	A2, A3, Q2, M1, M2, F
04	Illustrate use of stack during a parametrized function/procedure call that uses local variables.	Cognitive	5	03	Q3, A3, M2, F
05	Justify need to use assembly code along with a high-level language code	Cognitive	5	03	Q3,A3, M2, F

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

B. Program Learning Outcomes

1. Computing Knowledge	Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of complex computing problems.	
2. Problem Analysis	Identify, formulate, research literature, and analyze complex computing problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing sciences.	✓
3. Design/ Develop Solutions	Design solutions for complex computing problems and design systems, components, and processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.	✓
4. Investigation & Experimentation	Conduct investigation of complex computing problems using research-based knowledge and research-based methods.	
5. Modern Tool Usage	Create, select, and apply appropriate techniques, resources and modern computing tools, including prediction and modeling for complex computing problems.	
6. Society Responsibility	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues relevant to context of complex computing problems.	
7. Environment and Sustainability	Understand and evaluate sustainability and impact of professional computing work in the solution of complex computing problems.	

8. Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of computing practice.	
9. Individual and Teamwork	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.	
10. Communication	Communicate effectively on complex computing activities with the computing community and with society at large.	
11. Project Management and Finance	Demonstrate knowledge and understanding of management principles and economic decision making and apply these to one's own work as a member or a team.	
12. Lifelong Learning	Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological changes.	

C. Mapping of CLOs on PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

		PLOs											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CLOs	1					✓							
	2		✓	✓									
	3					✓							

	Topics to be covered				
	List of Topics	**Week**	**No. of Weeks**	**Contact Hours**	**CLO(s)**
Topics covered in the course with number of lectures on each topic (Assume 15 weeks of instruction and 1 hour lecture duration)	**Introduction**: Introduction to Computer Architecture & Organization & Assembly Language ***(1 Lecture)*** --- Applications of Assembly Language, Assemble-Link-Execute Cycle ***(1 Lecture)*** --- Assembly Relativity, Portability, Virtual Machine Concept and Machine Levels ***(1 Lecture)***	**1**	**1**	**3**	**1**
	Microcomputer Concepts, Components of Microcomputer (***1 Lecture)*** --- Intel 80x86 Processor Architecture, Mode of Operations ***(1 Lecture)*** --- Basic Execution Environment ***(1 Lecture)***	**2**	**1**	**3**	**1**
	Assembly Language Fundamentals: *Integer, Character & String Literals, Identifier, Directive Vs Instruction* ***(1 Lecture)*** --- *Instruction, Defining Data* ***(1 Lecture)*** --- Symbolic Constants ***(1 Lecture)*** **Assignment no 1 Release (Start of Week 3)**	**3**	**1**	**3**	**2**
	Data Transfer **(1 Lecture)** --- Addressing **(1 Lecture)** --- Arithmetic Operations **(1 Lecture)** **Assignment no 1 Submission**	**4**	**1**	**3**	**2**

	(End of Week 4)				
	Operators and Directive **(1 Lecture)** --- Instruction to control transfer Instructions **(1 Lecture)** --- Arrays and Loops **(1 Lecture)**	**5**	**1**	**3**	**2**
	WEEK 6	***MID -1 Exam***			
	Procedures and Stack Operations **(1 Lecture)** --- Runtime Stack **(1 Lecture)** --- PUSH and POP Instructions **(1 Lecture)** **Assignment no 2 Release (Start of Week 7)**	**7**	**1**	**3**	**4**
	Conditional Processing: Boolean and comparison instruction, conditional jumps ***(3 Lectures)***	**8**	**1**	**3**	**2**
	conditional loop structures, high-level language constructs ***(3 Lectures)*** **Assignment no 2 Submission (End of Week 9)**	**9**	**1**	**3**	**2**
	Shift & Rotate *Instructions* ***(1 Lectures)*** --- Multiplication & Division instructions ***(1 Lecture)*** --- Extended Addition & Subtraction ***(1 Lecture)***	**10**	**1**	**3**	**2**

	Week 11	***MID -2 Exam***			
	Advanced Procedures – Introduction and Examples: Stack Frames --- *Recursion* **(1 Lecture)** --- *INVOKE, ADDR, PROC, PROTO Directives* **(1 Lecture)** **Assignment no 3 Release (Start of Week 12)**	**12**	**1**	**3**	**1,2,4**
	String and Arrays String primitive Instructions ***(3 Lectures)*** --- *Two dimensional array* **(1 Lecture)** **Assignment no 3 Submission (End of Week 13)**	**13**	**1**	**3**	**2**
	Machine Language Translation Instruction Formats, encoding an Instruction Set and Modes of Addressing, Translation and Working of an Assembler, Map File and Memory Map ***(3 Lectures)***	**14**	**1**	**3**	**3**
	CISC vs RISC, Introduction to MIPS Assembly ***(3 Lectures)***	**15**	**1**	**3**	
	Week 16	***Final Exam***			
	Review		**1**	**3**	
	Total		**16**	**48**	

Laboratory Projects/Experiments Done in the Course	**Mentioned in Lab Course Description**			
Programming Assignments Done in the Course	3 Assignments are given which are attached in the assignments section			
Class Time Spent (in percentage)	**Theory (%)**	**Problem Analysis (%)**	**Solution Design (%)**	**Social and Ethical Issues (%)**

	50	25	20	5
Oral and Written Communications	Every student is required to submit at least 1 written report of typically 10 pages in IEEE research report format. Students will also be called for viva/presentation of the project and any assignment where necessary in Lab Section			

Instructor Name: Muhammad Junaid Rabbani

Instructor Signature: M. Junaid Rabbani

Date: 15th-February-2023

National Computing Education Accreditation Council

INSTITUTION FAST School of Computing, National University of Computer and Emerging Sciences, Karachi

PROGRAM TO BE EVALUATED BS-School of Computing– Spring 2023

Course Description

Course Code	EL2003
Course Title	Computer Organization & Assembly Language Lab
Credit Hours	1
Prerequisites by Course(s) and Topics	PF, DLD
Grading Policy	Absolute grading
Policy about missed assessment items in the course	Retake of missed assessment items (other than midterm/ final exam) will not be held. For a missed midterm/ final exam, an exam re-take/ pre-take application along with necessary evidence are required to be submitted to the department secretary. The examination assessment and retake committee will decide the exam re-take/ pre-take cases.
Course Plagiarism Policy	Plagiarism in project or midterm/ final exam may result in F grade in the course. Plagiarism in an Lab will result in zero marks in the **whole Lab marks** category.
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	Assessment Items

Assessment Item	Number	Weight (%)
Lab Activity	12	20%
Project	1	10%
Midterm Exam	1	20%
Final Exam	1	50%

Course Instructors	
Lab Instructors	
Course Coordinator	Dr. Muhammad Nouman Durrani
URL (if any)	
Current Catalog Description	- Programming Methodology of low-level languages - How to access computer hardware directly - Overview of a user-visible architecture (of Intel 80x86 processors) - Intel 80x86 instruction set, assembler directives, macro, etc.

	- How programs interact with the operating system for various services including memory management and input/output services - How is it possible to interface high-level language and low-level language modules
Textbook (or **Laboratory Manual** for Laboratory Courses)	Assembly Language for Intel Based Computers K.Irvine 7th Edition MIPS Assembly Language Programming by Ed Jorgensen, Version 1.1.35 April 2018
Reference Material	Computer organization and design: the hardware/software interface by David A. Patterson and John L. Hennessy Computer Organization & Embedded Systems Hamacher et al. 6th Ed.

B. Program Learning Outcomes

1. Computing Knowledge	Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of complex computing problems.	
2. Problem Analysis	Identify, formulate, research literature, and analyze complex computing problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing sciences.	✓
3. Design/ Develop Solutions	Design solutions for complex computing problems and design systems, components, and processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.	✓
4. Investigation & Experimentation	Conduct investigation of complex computing problems using research-based knowledge and research-based methods.	
5. Modern Tool Usage	Create, select, and apply appropriate techniques, resources and modern computing tools, including prediction and modeling for complex computing problems.	✓
6. Society Responsibility	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues relevant to context of complex computing problems.	
7. Environment and Sustainability	Understand and evaluate sustainability and impact of professional computing work in the solution of complex computing problems.	
8. Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of computing practice.	
9. Individual and Teamwork	Function effectively as an individual, and as a member or leader in diverse teams and in multi- disciplinary settings.	

10. Communication on activities	Communicate effectively on complex computing with the computing community and with society at large.	
11. Project Management and Finance	Demonstrate knowledge and understanding of management principles and economic decision making and apply these to one's own work as a member or a team.	
12. Lifelong Learning	Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological changes.	

C. Mapping of LLOs on PLOs
(LLO: Lab Learning Outcome, PLOs: Program Learning Outcomes)

		PLOs											
		1	2	3	4	5	6	7	8	9	10	11	12
LLOs	1					✓							
	2		✓										
	3			✓		✓							

Course Learning Outcomes	A. Lab Learning Outcomes (LLOs)

LLO	Lab Learning Outcome (LLO)	Domain	Taxonomy Level	PLO	Tools
01	Use of an Integrated Development Environment (IDE) to compile, debug, run, and refactor x86 Assembly code	Cognitive	3	05	L, M, F, P
02	Identify the use of addressing modes for solving problems related to conditional processing, shift operations, stack operations and string handling.	Cognitive	4	02	L,M,F
03	Design a coding project in x86 or RISC Assembly.	Cognitive	5	03, 05	F,P
Tool: L = Labs, M = Midterm, F=Final, P=Project					

Topics covered in the course with number of lectures on each topic	**Topics to be covered**				
	List of Topics	**Week**	**No. of Weeks**	**Contact Hours**	**CLO(s)**
	1. Introduction to Assembly and Configuration of Visual Studio	**1**	**1**	**3**	**1**
	2. Debugging, Basic elements of Assembly Language, Defining Data, Intrinsic Data types, Data Definition statements	**2**	**1**	**3**	**1**
	3. Data Initialization, Multiple Initialization, String Initialization	**3**	**1**	**3**	**2**
	4. Data transfer Instruction, Instructions and Flags	**4**	**1**	**3**	**2**
	5. Working with data related operators and directives, Indirect Addressing	**5**	**1**	**3**	**2**
	Theory Mid I				
	6. Working with arrays and loops, and built-in procedures	**7**	**1**	**3**	**2**
	Lab Mid				
	7. Stack operations, procedures & Boolean conditional jumps, Working with Conditional processing	**9**	**1**	**3**	**2**
	8. Shift & Rotate, Multiplication & Division instructions, Extended Addition & Subtraction	**10**	**1**	**3**	**2**
	Theory Mid II				
	9. Stack Frames, Recursion, INVOKE, ADDR, PROC, PROTO Directives	**12**	**1**	**3**	**2**
	10. String and Arrays: String Handling Instructions, Two dimensional array	**13**	**1**	**3**	**2**

	11. High-Level Language Interface, Inline Assembly	**14**	**1**	**3**	**2**
	12. Project evaluations	**15**	**1**	**3**	**3**
	Final Exam	**16**	**1**	**3**	**3**
	Total		**16**	**48**	

Laboratory Projects/Experiments Done in the Course	**Mentioned in Lab Manuals**			
Class Time Spent (in percentage)	**Theory (%)**	**Problem Analysis (%)**	**Solution Design (%)**	**Social and Ethical Issues (%)**
	10	50	35	5
Oral and Written Communications	Every student is required to submit at least 1 written report of typically 10 pages in IEEE research report format. Students will also be called for viva/presentation of the project and any assignment where necessary in Lab Section			

COURSE DESCRIPTION FORM

INSTITUTION National University of Computer and Emerging Sciences

PROGRAM (S) TO BE EVALUATED Computer Science

A. Course Description

(Fill out the following table for each course in your computer science curriculum. A filled out form should not be more than 2-3 pages.)

Course Code	SS-2005
Course Title	Sociology
Credit Hours	3
Prerequisites by Course(s) and Topics	No prerequisites but it is appreciable if the students stay abreast with problems, trends and development of society in the context of modernity, global development and morals and ethics.
Assessment Instruments with Weights (assignments, quizzes, midterms, final)	Assessment with the weight.

Assessment Type	**Weight**
Assignments / Quizzes/Class participation	10
Project	10
Mid-Terms	30 (15 each)
Final	50

Course Coordinator	Ms. Aqsa Fayyaz
URL (if any)	
Current Catalog Description	This course will introduce you to the discipline of sociology. Sociology, and in turn this class, examines questions such as: What is the nature of society? And what is the relationship between society and the individual? This course focuses on how society functions and is organized, and how society impacts and influences individual motivation, understanding, action, and well-being. Basic sociological ideas regarding social relations, social interaction, social structure, and social change are examined. Students are introduced to key issues addressed by contemporary sociologists including class, race, gender, religion, globalization, education, health care, crime, the media, and the environment. Sociology is a social science, and thus ideas, discussions, and determinations within this field are based upon empirical research, and thus we will also discuss methods used within the discipline of sociology. The knowledge gained in this course will aid you in future studies within a variety of fields and careers, and it will encourage the development of critical thinking about important and timely issues.
Textbooks	Sociology by Robert Van Krieten and Daphne Habibis and Philip Smith and Bret Hutchinns and Greg Martin and Kart Maton. 5th Edition

Reference Books/ Material	1. Sociology a Down to Earth approach by James M Hensilin Thirteenth Edition
Course Goals	**A. Course Learning Outcomes (CLOs)** Upon successful completion of this course students will be able to: 1. Understand the basic concepts, theories, and perspectives of sociology. 2. Analyze social issues and phenomena from a sociological perspective 3. Understand the relationship between individuals and society: Students should develop an understanding of how individuals are shaped by social forces and how they, in turn, shape society.

B. Program Learning Outcomes

For each attribute below, indicate whether this attribute is covered in this course or not. Leave the cell blank if the enablement is little or non-existent.

1. Academic Education:	To prepare graduates as computing professionals	
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.	
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.	
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.	
5. Modern Tool Usage:	Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.	
6. Individual and Team Work:	Function effectively as an individual and as a member or leader in diverse teams and in multi-disciplinary settings.	
7.Communication:	Communicate effectively with the computing community and with society at large about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.	
8. Computing Professionalism and Society:	Understand and assess societal, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional	

	computing practice.
9. Ethics:	Understand and commit to professional ethics, responsibilities, and norms of professional computing practice.
10. Life-long Learning:	Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.

C. Relation between CLOs and PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

		PLOs									
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
CLOs	1						A				
	2						A	A			
	3									A	A
	4									A	A
	5										
	6										
	7										

Topics Covered in the Course, with Number of Lectures on Each Topic

1. Topics to be covered:

List of Topics	No. of Weeks	Contact Hours	CLO
Introduction and origin and development of sociology	1	3	1
Theoretical perspectives of sociology	1	3	2
Social interaction and social structure	1	3	3
Socialization and personality development	1	3	1
Statuses, Social roles, Social groups, Social institutions, and Inequality	1	3	1
Culture. Basic Components such as language, values, norms, mores, taboos and laws	1	3	2
Social Inequality	1	3	2
Global stratification: class, gender, racial and ethnic, and religious inequalities	1	3	1
Social Mobility	1	3	2
Social Institutions	1	3	3
Family and Marriage	1	3	1
Deviance, Crime and Social Control	1	3	1
Formal and Informal Social control	1	3	3
Social Change	1	3	1
Methods of Social research	1	3	2
Total	**15**	**45**	

Laboratory Projects/Experiments Done in the Course	No lab work
Programming Assignments Done in the Course	Project is the integral part of the course with a special focus on review based studies.

Class Time Spent on (in credit hours)	**Theory**	**Problem Analysis**	**Solution Design**	**Social and Ethical Issues**
	20	20	5	5
Oral and Written Communications	Every student should participate in the class participation activities.			

Instructor Name: Miss Aqsa Fayyaz
Date 20/6/2023
Spring 2023

COURSE DESCRIPTION FORM

INSTITUTION **FAST-NU, Main Campus, Shah Latif Town, Karachi**

BSCS

PROGRAM (S) TO BE EVALUATED

A. Course Description

(Fill out the following table for each course in your computer science curriculum. A filled out form should not be more than 2-3 pages.)

Course Code	MT 2005
Course Title	Probability & Statistics
Credit Hours	3
Prerequisites by Course(s) and Topics	Calculus & Analytical Geometry
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	Sessional – I (15%), Sessional – II (15%), Final Exam (50%), Assignments & quizzes & Class participation (20%)
Course Coordinator	M Abdul Basit Khan
URL (if any)	Nil
Current Catalog Description	This course gives an introduction to probability and data analysis from a computer science perspective, including many of the fundamental concepts and techniques that are most relevant to current research areas.
Textbook (or **Laboratory Manual** for Laboratory Courses)	Mann, Prem S. *Introductory statistics*. John Wiley & Sons, 2007. Walpole, Myers, Myers YE, "Probability & Statistics for Engineers & Scientists", 9th Edition
Reference Material	Introductory statistics , Neil A. Weiss , 9rd Edition
Course Goals	The course is designed to develop the understanding of probability, random variables and random processes, to be proficient at manipulating data to draw insights, probe research questions and Enhance the capabilities of data interpretation.

Topics Covered in the Course, with Number of Lectures on Each Topic (assume 15-week instruction and one-hour lectures)	**Week 01:** Statistics and its types, Basic terms, summation notation, Organizing and graphing qualitative data **Week 02:** Organizing and graphing quantitative data, Stem-and-Leaf display, Measures of the center of ungrouped data. **Week 03:** Measure of Dispersion of ungrouped data, Mean, Variance and standard deviation for grouped data. Use of standard deviation. (Chebyshev's theorem, Empirical Rule), Measure of position. Box-and-Whisker plot. **Week 04:** Experiment, Outcome, Sample space Calculating Probability, Marginal Probability, Conditional Probability and related concepts, Intersection of events and Multiplicative rule. **Week 05:** Union of events and addition rule, Counting rule, factorial, combination, and permutation. Week 06: Sessional – I **Week 07:** Bayes's Formula and Total probability Random Variable, probability distribution of discrete random variable, *cumulative distribution function*, mean and standard deviation. **Week 08:** Binomial probability distribution and their mean, std Hypergeometric probability distribution Poisson Probability distribution and their mean, std **Week 09:** Joint Probability Distribution, marginal distribution Mathematical Expectations: Mean & Variance of a Random Variable, Covariance, and Correlation. **Week 10:** Normal probability distribution Standardizing a Normal Distribution Application of the Normal Distribution Determining the z and x Values When an Area Under the Normal Distribution Curve Is Known. **Week 11: Estimation & Hypothesis Testing:** Introduction, confidence interval estimation using z & t distributions for single mean and difference between two means. Testing of hypothesis for single mean and difference between two means using z-test (CLO-3), p-value method **Week 12:** Sessional – II **Week 13:** Independent & Dependent sample tests: **Week 14:** Regression & Correlation: **Week 15:** Multiple linear Regression: **Week 16:** Analysis of variance: **Week 17:** Final Examination
Laboratory Projects/Experiments Done in the Course	Nil
Programming Assignments Done in the Course	Nil

Class Time Spent on (in credit hours)	**Theory**	**Problem Analysis**	**Solution Design**	**Social and Ethical Issues**
	150 min	50 min	25 min	15 min
Oral and Written Communications	Every student is required to submit at least __Nil___ written reports of typically _Nil____ pages and to make __Nil___ oral presentations of typically __Nil___ minutes' duration. Include only material that is graded for grammar, spelling, style, and so forth, as well as for technical content, completeness, and accuracy.			

Instructor Name __Muhammad Abdul Basit Khan

Instructor Signature __Muhammad Abdul Basit Khan

Date: 15 June 2023

COURSE DESCRIPTION FORM

INSTITUTION National University of Computer and Emerging Sciences (NUCES-FAST)

PROGRAM (S) TO BE EVALUATED BS(CS)

A. Course Description

(Fill out the following table for each course in your computer science curriculum. A filled out form should not be more than 2-3 pages.)

Course Code	CS-2008
Course Title	Numerical Computing
Credit Hours	3+0
Prerequisites by Course(s) and Topics	Not Applicable
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	Mid-I: 15 Mid-II: 15 Assignments: 20 Final: 50
Course Coordinator	Muhammad Amjad
URL (if any)	
Current Catalog Description	The Numerical computing includes: Error concept and analysis , Roots of nonlinear algebraic equations of one variable ,Direct and iterative method for system of linear equations, Linear interpolation with 2nd and 3rd dimensional , Interpolating polynomials , Differences , Operators and their relation , Numerical differentiation and integration , Numerical solution of differential equation .Iteration for non linear system of equation
Textbook (or **Laboratory Manual** for Laboratory Courses)	Numerical Analysis , 9thEdition , Burden and Faires
Reference Material	1) Numerical Methods using MATLAB , 3rd Edition ,John H.Mathews 2) Applied Numerical Methods with Matlab for Engineers and Scientist, 3rdEdition Steven C,Chapra ,MC Graw Hill

Course Goals

To introduce the students to the mostly used computing methods in the different fields of engineering and sciences.
The emphasis will be on understanding the algorithm of the various methods for computing and on applying these to obtain the approximate solutions for various mathematical problems.
MATLAB & Excel will be used as tool for implementation and application of these computing methods.

A. Course Learning Outcomes (CLOs)

CLO	Course Learning Outcome (CLO) Statements	Domain	Taxonomy Level	PLO	Tools
01	Analyze Error and difference operators of numerical methods and compute the roots of algebraic and transcendental function of nonlinear equations of single variable.	Cognitive	04	02	A1,Q1, M1,F
02	Apply numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations.	Cognitive	03	03	A1,Q2 M2,F
03	Demonstrate the capability of using numerical analysis library or software for solving related problems of interpolation, differentiation, integration, the solution of linear and nonlinear equations related to the program domain	Cognitive	01	05	A1,A2,A3

Tools: A = Assignment(A1,A2), M = Midterm (M1,M2), F=Final, A3=Presentation (software)

A. Course Learning Outcomes (CLOs)

1. Analyze Error and difference operators of numerical methods and compute the roots of algebraic and transcendental function of nonlinear equations of single variable.
2. Apply numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations.

3. Demonstrate the capability of using numerical analysis library or software for solving related problems of interpolation, differentiation, integration, the solution of linear and nonlinear equations related to the program domain

(Approved in 23rd Academic Council; 30th December 2019)

B. Program Learning Outcomes

PLO 1	Computing Knowledge	Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of complex computing problems.	
PLO 2	Problem Analysis	Identify, formulate, research literature, and analyse complex computing problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing sciences.	✔
PLO 3	Design/Develop Solutions	Design solutions for complex computing problems and design systems, components, and processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.	✔
PLO 4	Investigation & Experimentation	Conduct investigation of complex computing problems using research based knowledge and research based methods	

PLO 5	Modern Tool Usage	Create, select, and apply appropriate techniques, resources and modern computing tools, including prediction and modelling for complex computing problems.	✔
PLO 6	Society Responsibility	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues relevant to context of complex computing problems.	
PLO 7	Environment and Sustainability	Understand and evaluate sustainability and impact of professional computing work in the solution of complex computing problems	
PLO 8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of computing practice.	
PLO 9	Individual and Team Work	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.	
PLO 10	Communication	Communicate effectively on complex computing activities with the computing community and with society at large.	
PLO 11	Project Mgmt. and Finance	Demonstrate knowledge and understanding of management principles and economic decision making and apply these to one's own work as a member or a team.	

PLO 12	Life Long Learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological	

C. Relation between CLOs and PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

		PLOs									
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
CLOs	1		✔									
	2			✔								
	3					✔						
	4											
	5											
	6											
	7											
	8											
	9											
	10											
	11											
	12											

Topics Covered in the Course, with Number of Lectures on Each Topic (assume 15-week instruction and one-hour lectures)

1. Topics to be covered:

List of Topics	No. of Weeks	Contact Hours	CLO
Chapter 1 **Error analysis:** Introduction of Numerical Computing, ChoppingRoundoff and truncation error, Absolute, relative and percentage error, Taylor polynomial, Significant figures,	**2**	**6**	**1**

Nested arithemetic, loss of significance. **Chapter 2** **Solution(Root) of equations in one variable:** The Bisection or Binary-search method. Fixed Point iteration. (x=g(x))				
Chapter 2 Newton's Raphson and Secant and Method of False position (Regula falsi).	**1**	**3**	**1**	
Chapter 3 **Interpolation and Polynomial approximation:** Lagrange interpolation polynomial of degree one, two and three with error term. Divided differences and Newton's Divided difference formula for interpolating polynomial	**2**	**6**	**2**	
========== MID 1 ==========				
Chapter 3 Simple difference table Newton Forward and Backward difference formula. Use Gauss, Newton centered difference (sterling) and Bessel's formula for interpolation.	**2**	**6**	**2**	
Chapter 4 **Numerical differentiation:** Differentiation using Forward and Backward differences 3-point Endpoint formula & error bound 5-point Endpoint formula & error bound Differentiation based on Stirlling , Bessel's and Lagrange's formula	**1**	**3**	**2**	
Chapter 4 **Numerical Integration:** Richardson's extrapolation	**1**	**3**	**2**	

	Trapezoidal and Simpson's rule with error term. Closed & open Newton-Cotes formulas with error term			
	========== MID 2 ==========			
	Chapter 4 Composite Trapezoidal , Simpson's and Midpoint formula with bound error	**1**	**3**	**3**
	Chapter 5 **Differential Equations:** Mid-Point, Modify Euler, 4-RK method **Chapter 6** **Direct Method for solving linear system:** LU decomposition, LDL^t Factorization	**1**	**3**	**3**
	Chapter 7 **Iterative Techniques:** Iterative methods for solving linear system Gauss-Siedel and Jacobi's methods.	**1**	**3**	**3**
	Chapter 10 **Numerical solution for solving Nonlinear system:** Fixed point and Newton's method	**1**	**3**	**3**
	Approximating Eigenvalues: The Power method **One-Dimensional Optimization**: Golden-Section Search and Parabolic Interpolation	**1**	**3**	**3**
	Total	**16**	**45**	

Laboratory Projects/Experiments Done in the Course				
Programming Assignments Done in the Course				
Class Time Spent on (in credit hours)	**Theory**	**Problem Analysis**	**Solution Design**	**Social and Ethical Issues**
	15	20	10	0

Oral and Written Communications	Every student is required to submit at least ___Nil_ written report of typically __nil_ pages and to make _nil_ oral presentations of typically _nil___ minute's duration. Include only material that is graded for grammar, spelling, style, and so forth, as well as for technical content, completeness, and accuracy.

Instructor Name: Muhammad Amjad

Instructor Signature _____

Date: 18: 08 : 2023

COURSE DESCRIPTION FORM

FAST-NUCES

INSTITUTION _____

PROGRAM (S) TO BE EVALUATED BSCS

A. Course Description

(Fill out the following table for each course in your computer science curriculum. A filled out form should not be more than 2-3 pages.)

Course Code	CS2006
Course Title	Operating Systems
Credit Hours	3+1
Prerequisites by Course(s) and Topics	PF & Data Structures
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	Project + Presentation 10% Assignments 10% Midterms 30% Final 50%
Course Coordinator	Abdul Rahman
URL (if any)	http://slate.nu.edu.pk/portal/site/0f61819d-6f32-497a-a353-a0e126597e8f
Current Catalog Description	The objective of this course is to give students knowledge of construction and working of Operating systems, to enable them to understand management and sharing of computer resources, Operating systems basics, system calls, process concept and scheduling, inter-process communication, communication and concurrency and develop effective and efficient applications and to appreciate the problems and issues regarding multi-user, multitasking, and distributed systems, multithreaded programming, multithreading models, threading issues, process scheduling algorithms, thread scheduling, multiple-processor scheduling, synchronization, critical section, synchronization hardware, synchronization problems, deadlocks, detecting and recovering from deadlocks, memory management, swapping, contiguous memory allocation, segmentation & paging, virtual memory management, paging, file concept, directory and disk structure, directory implementation, free space management, disk structure, system protection, virtual machines, operating system security.
Textbook (or **Laboratory Manual** for Laboratory Courses)	• Operating system Concepts by Silberchatz, 10th Edition • OPERATING SYSTEMS INTERNALS, 9th Ed. by Dr. William Stallings • Modern Operating System by Abdrew S. Tannenbaum 5th Edition. • The Definitive Guide To Suse Linux Enterprise Server 12
Reference Material	• Linux: The Complete Reference, Sixth Edition • Linux Shell Scripting Cookbook, Second Edition • LINUX, System Programming by Robert Love • LINUX KERNEL IN A NUTSHELL by Greg Kroah-Hartman • Linux Bible Ninth Edition by Christopher Negus

Course Goals

A. Course Learning Outcomes (CLOs)

CLO	Name	Domain	Taxonomy Level	Tools
01	**Understand** / Comprehend the core functions (i.e. process management, scheduling, memory management, file management, disk management) and structure of operating system. **Compare** the functionality of different computing hardware structures and Operating Systems Structures.	Cognitive	2	A,M,F
02	**Analyze** and evaluate the algorithms of the core functions of the Operating Systems and explain the major performance issues about the core functions. **Analyze** concurrency problems in multi-processing/multi-thread operating systems and Evaluate different process co-coordinating solutions.	Cognitive	3	A,M,F
03	**Design** and Implement solutions for POSIX compliant Enterprise Operating systems (SUSE Enterprise Linux / iOS) OR refine existing solutions to reflect implementation details	Cognitive	3,4	A,M,F,P
04	**Apply** and use Opensource toolchain to develop & design of operating system software.	Cognitive	3,4,5	A,M,F,P

Tool: A = Assignment, M = Midterm, F=Final, P = Project

B. Program Learning Outcomes

For each attribute below, indicate whether this attribute is covered in this course or not. Leave the cell blank if the enablement is little or non-existent.

PLO 1	Computing Knowledge	Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of complex computing problems.	✔
PLO 2	Problem Analysis	Identify, formulate, research literature, and analyze complex computing problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing sciences.	✔
PLO 3	Design/Develop Solutions	Design solutions for complex computing problems and design systems, components, and processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.	✔
PLO 4	Investigation & Experimentation	Conduct investigation of complex computing problems using research-based knowledge and research-based methods	

PLO 5	Modern Tool Usage	Create, select, and apply appropriate techniques, resources and modern computing tools, including prediction and modelling for complex computing problems.	✔
PLO 6	Society Responsibility	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues relevant to context of complex computing problems.	
PLO 7	Environment and Sustainability	Understand and evaluate sustainability and impact of professional computing work in the solution of complex computing problems	
PLO 8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of computing practice.	✔
PLO 9	Individual and Team Work	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.	✔
PLO 10	Communication	Communicate effectively on complex computing activities with the computing community and with society at large.	✔
PLO 11	Project Mgmnt and Finance	Demonstrate knowledge and understanding of management principles and economic decision making and apply these to one's own work as a member or a team.	
PLO 12	Life Long Learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological changes.	

C. Relation between CLOs and PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

		PLOs											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CLOs	1	✔											
	2		✔										
	3			✔									
	4					✔							

Topics Covered in the Course, with Number of Lectures on Each Topic (assume 15-week instruction and one-hour lectures)

1. Topics to be covered:

Weeks	List of Topics	No. of Weeks	Contact Hours	CLO	
1	History of Operating systems & Open-source movement, POSIX, GNU / GLP, The Cathedral and the Bazaar, Windows Refund Day, Homebrew Computer Club	0.5	1.5	1	
2	Introduction to Operating system,	1.5	4.5	1	
3	Operating system structure	1	3	1,3	Assignment 1
4	Process Concept (Process	1	3	1,2,3	

		scheduling, interposes communication)				
	5	Process scheduling Algorithm (Algorithms for process scheduling, real time scheduling)	1	3	1,2,3	
	6	Mid Term 1				
	7	Multi-threaded Programming(threads models , threads issues)	1	3	2,3	Assignment 2
	8	Process Synchronization	1	3	2,3	
	9	Process Synchronization continued	1	3	2,3	
	10	Memory management strategies	1	3	1,2	Assignment 3
	11	Memory management strategies continued	1	3	2,3	
	12	Mid Term 2				
	13	Virtual Memory	1	3	1,2	Assignment 4
	14	Virtual Memory continued	1	3	2,3	
	15	Dead Lock	1	3	1,2	
	16	Embedded Linux	1	3	2,3,4	
	17	Protection and Security	1	3	2,3,4	
		Total	**15**	**45**		

Laboratory Projects/Experiments Done in the Course	Lab 1: Introduction & Basic Linux Commands
	Lab 2: Shell Scripting & vi, Aliases, Environment Variables and Subshells
	Lab 3: Working with SAMBA & network services
	Lab 4: Linux multifunction Server Management (LAMP stack) Postfix Thunderbird.
	Lab 5: System Call related to Process Management, argument arrays
	Lab 6: Inter- Process Communication
	Lab 7: System Configuration. Boot loader, Managing Services, System Startup Files (rc.d, rc.sysinit rc.local init.d), make, configure install, Integrity Checks
	Lab 8: Mid Exam
	Lab 9: Multithread Programming in Pthreads
	Lab 10: Multithread Programming in OpenMP (shared memory)
	Lab 11: Semaphores in Linux
	Lab 12: Working with Embedded Linux
	Lab 13: Linux hardening & security
	Lab 14: Final Lab Exam

Programming Assignments Done in the Course	4			
Class Time Spent on (in credit hours)	**Theory**	**Problem Analysis**	**Solution Design**	**Social and Ethical Issues**
	20	15	6	1
Oral and Written Communications	Every student is required to submit at least __1__ written report of typically _2__ pages and to make _1__ oral presentations of typically __10__ minute's duration. Include only material that is graded for grammar, spelling, style, and so forth, as well as for technical content, completeness, and accuracy.			

Instructor Name ___**Engr. Abdul Rahman Mahmood**_ __

Instructor Signature _____

Date _**12-01-2023**_____

COURSE DESCRIPTION FORM

INSTITUTION National University of Computer and Emerging Sciences (NUCES-FAST)
PROGRAM (S) TO BE EVALUATED BS (CS

A. Course Description

Course Code	SS-2003
Course Title	Psychology
Credit Hours	3
Prerequisites by Course(s) and Topics	No
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	Mid-I: 15 Mid-II: 15 Assignments/Quizzes: 10 Project: 10 Final: 50
Course Coordinator	**Ms. Aqsa Fayyaz**
URL (if any)	
Current Catalog Description	Psychology is the scientific study of Human mind and behavior. This course provides an overview of the study of psychology, focusing on historical background, current psychological issues, theories that explain them and give insight about the ways to solve such difficulties in a healthier manner. The aim of this course is to enhance student's understanding of their own and others' thinking, feelings and behavior patterns. This course will facilitate students to self-regulate in an effective manner. It will also enable them to groom their personalities personally and professionally, by developing basic understanding of application of psychological theories in the real world. In addition, awareness regarding drug abuse and chemical addiction will also be discussed. Goals: Students will facilitate learning by designing presentations, interactive exercises, self-assessment to actively discover, analyze and acquire the concepts offered in the course.
Textbook (or **Laboratory Manual** for Laboratory Courses)	**Atkinson & Hilgard's Introduction to Psychology, 15th Edition**
Reference Material	**Atkinson & Hilgard's Introduction to Psychology, 15th Edition**

Course Goals

A. Course Learning Outcomes (CLOs)

No.	Course Learning Outcome (CLO) Statements	Domain	Taxonomy level	PLO
01	Have a grasp over basic concepts and theoretical perspectives explaining human behavior. The students will be able to appreciate the complexity of human behavior and relationships.	Cognitive	1	6,7
02	They will be able to understand Psychology as a science and empirical methods used for understanding different aspects of human behavior in their daily routine.	Affective	3	7
03	The students will be groomed on personal and professional level.	, Behavioral	1	10

B. Program Learning Outcomes

For each attribute below, indicate whether this attribute is covered in this course or not. Leave the cell blank if the enablement is little or non-existent.

1. Academic Education:	To prepare graduates as computing professionals	
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.	
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.	
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.	
5. Modern Tool Usage:	Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the	

	limitations.
6. Individual and Team Work:	Function effectively as an individual and as a member or leader in diverse teams and in multi-disciplinary settings.
7. Communication:	Communicate effectively with the computing community and with society at large about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.
8. Computing Professionalism and Society:	Understand and assess societal, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practice.
9. Ethics:	Understand and commit to professional ethics, responsibilities, and norms of professional computing practice.
10. Life-long Learning:	Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.

C. Relation between CLOs and PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

		PLOs									
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
CLOs	1										
	2										
	3										

Weeks	Contents/Topics	CLO	Assessment
1	**Introduction to Psychology** Definition and introduction. Psychology as a science. Scope and goals of psychology The key debates of psychology Brief history of psychology	1	M1,F,P
2	**Learning** Behavioral approaches/ theories of learning Classical conditioning Operant conditioning Cognitive approaches / theories of learning Social learning theories **Forgetting** Causes of memory failure Forgetfulness How to improve memory	1	M1,F, P
3	**Cognition** Understanding of internal mental processes Theories of cognitive development Decision making skills	1	M1,F, P
4	**Memory** Definition of memory Process of memory Stages of memory	1	M1,F, P
5	**Motivation** Understanding Motivation Motivational process Intrinsic and extrinsic motivation	1+2+3	M1,F, P
6	**Mid 1**		
7	**Personality** Theories of Personalities Understanding personality in regards to ego defense mechanisms. (Sigmund Freud) Rogers Humanistic Theory Trait Theorists	1+3	M2,F, P
8	**Emotional Intelligence**	1+2+3	M2,F, P
9	**Counseling skills**	1+2+3	M2,F, P
10	**Communication & Social skills**	1+2+3	M2.F, P
11	**Mid 2**		
12	**Understanding Chemical and Non-chemical Addictions**	2	F, P
13	**Anger and Stress Management**	1+2+3	F,P
14	**Abnormal Psychology** Concept of Abnormality Normality and Abnormality Defining Psychological abnormality 4D's (Deviance, Distress, Dysfunction, Danger) Paradigm shift of mental health	1+2+3	F,P

	16	**Revision**		


NATIONAL UNIVERSITY OF COMPUTER AND EMERGING SCIENCES
KARACHI CAMPUS

Topics Covered in the Course, with Number of Lectures on Each Topic (assume 15-week instruction and one-hour lectures)				
Laboratory Projects/Experiments Done in the Course				
Programming Assignments Done in the Course				
Class Time Spent on (in credit hours)	**Theory**	**Problem Analysis**	**Solution Design**	**Social and Ethical Issues**
	15	10	10	10
Oral and Written Communications	Every student is required to submit at least _ 1_ assignment of typically _1_ page and to make _1__ oral presentation of typically __10-15__ minute's duration. Two quizzes will be taken. Take part in class activities and discussions. Demonstrate psychological knowledge about human development, social/cultural Phenomena, life			

Lecturer name: Ms. Aqsa Fayyaz

Spring'2023

COURSE DESCRIPTION FORM

INSTITUTION FAST - National University of Computers and Emerging Sciences

PROGRAM (S) TO BE EVALUATED BS - Computer Science

A. Course Description

(Fill out the following table for each course in your computer science curriculum. A filled-out form should not be more than 2-3 pages.)

Course Title	Theory of Computation / Automata		
Course Code	CS3005	**Credit Hours**	3 + 0
Prerequisites by Course(s)	Discrete Structures	**Semester**	Spring 2022
Assessment Instruments (With tentative weights)	**Semester Work 20%** (at least 3 assignments and 3 quizzes) **Midterm 30%** (2 Mid semester exam – Week 6 and Week 11) **Final 50%** (Comprehensive end of semester exam)		
Course Coordinator	Muhammad Shahzad		
Office Hours	Details displayed outside my Basement (Old library- CS Block).		
Current Catalog Description	Finite State Models: Language definitions preliminaries, Regular expressions/Regular languages, Finite automata (FAs), Transition graphs (TGs), NFAs, Kleene's theorem, Transducers (automata with output), Pumping lemma and non-regular language Grammars and PDA: CFGs, Derivations, derivation trees and ambiguity, Simplifying CFLs, Normal form grammars and parsing, Decidability, Context sensitive languages, grammars and linear bounded automata (LBA), Chomsky's hierarchy of grammars Turing Machines Theory: Turing machines, Post machine, Variations on TM, TM encoding, Universal Turing Machine, Defining Computers by TMs		
Textbook (or **Laboratory Manual** for Laboratory Courses)	1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Introduction to Automata Theory, Languages, and Computation 2. P. Linz. Introduction to Formal Languages and Automata, 6th edition, 2017 (or 5th or 4th edition), Jones and Barlett 3. Daniel I. A. Cohen, Introduction to Computer Theory		
Reference Material	1. John Martin, Introduction to Languages and the Theory of Computation, Third Edition 2. Michael Sipser, Introduction to Theory of Computation 3. Instructor Notes		
Course Goals	**A. Course Learning Outcomes (CLOs)**		

CLO No.	Course Learning Outcomes	Bloom Taxonomy	Tools
CLO-1	Explain and manipulate the different concepts in automata theory and formal languages such as formal proofs, automata, regular expressions, Turing machines etc	C2 (Understand)	A1, Q1
CLO-2	Prove properties of languages, grammars and automata with rigorously formal mathematical methods	C2 (Understand)	A2, Q2
CLO-3	Design of automata, RE and CFG	C3 (Apply)	Q3, M1, F1
CLO-4	Transform between equivalent NFAs, DFAs and Res	C3 (Apply)	M1, F1
CLO-5	Define Turing machines, PDA machines performing simple tasks	C2 (Understand)	A3, M2, F1 Q3

Tool: A = Assignment, Q = Quiz, M = Midterm, F=Final, CEP = Complex Engineering Problem.

B. Program Learning Outcomes

PLO 1	Computing Knowledge	Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of complex computing problems.
PLO 2	Problem Analysis	Identify, formulate, research literature, and analyze complex computing problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing sciences.
PLO 3	Design/Develop Solutions	Design solutions for complex computing problems and design systems, components, and processes that meet appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
PLO 4	Investigation & Experimentation	Conduct investigation of complex computing problems using research-based knowledge and research-based methods
PLO 5	Modern Tool Usage	Create, select, and apply appropriate techniques, resources and modern computing tools, including prediction and modeling for complex computing problems.
PLO 6	Society Responsibility	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues relevant to context of complex computing problems.
PLO 7	Environment and Sustainability	Understand and evaluate sustainability and impact of professional computing work in the solution of complex computing problems
PLO 8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of computing practice.
PLO 9	Individual and Team Work	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
PLO 10	Communication	Communicate effectively on complex computing activities with the computing community and with society at large.
PLO 11	Project Mgmnt and Finance	Demonstrate knowledge and understanding of management principles and economic decision making own work as a member or a team.
PLO 12	Life Long Learning	Recognize the need for, and have the preparation and

		ability to engage in independent and life-long learning in the broadest context of technological changes.

C. Relation between CLOs and PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

		PLOs									
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
CLOs	1	✔									
	2		✔								
	3			✔							
	4			✔							
	5			✔							

Topics Covered in the Course (Tentative plan)

Please note:

1. Students are expected to go through the suggested reading topics from at least one reference book and internet, before & after each class.
2. Representative topic of suggested chapters is given week-wise (on right) as Chapter **[Ullman] / [Cohen]**. Please read the full chapter(s).
3. Apart from graded assignments, students are expected to discuss and solve exercises at the end of

Week	Lecture	Topics	CLO	Chapters	Assessments
1.	**1.**	Discussion on Course Outline, Introduction to Finite Automata	CLO-1	[HMU]:1.1 [Linz]: 1	
	2.	What does automata mean? Introduction to Languages, Alphabets, Strings	CLO-1	[HMU]: 1.5 [DC]: 1	
	3.	Kleene Star Closure, Regular Expression (RE)	CLO-3	[DC]: 4 [HMU]: 3 [JM]: 3 [Linz]: 3	
2.	**1.**	Equivalent RE, Finite Automaton (FAs), Equivalent FAs	CLO-3	[HMU]: 2 [JM]: 2 [MS]: 1	
	2.	FA corresponding to finite languages, Transition Graph	CLO-3	[Linz]: 2.1 [DC]: 6	
	3.	Continued			
3.	**1.**	Examples of TGs: accepting all strings, accepting none, starting with b, not ending in b, containing aa, containing aa or bb.	CLO-4	[Linz]: 2 [DC]: 6	***Assignment 1 Friday Release Week 3***
	2.	Generalized Transition Graph	CLO-4	[DC]: 6	

each chapter.		3.	Language accepted by NFA, Recursive definition of NFA	CLO-4	[Linz]: 2.2 [HMU]:2.3	
	4.	1.	Basis Clause and Inductive Clause of NFA	CLO-4, 2	[Instructor Notes]	***Quiz no 1***
		2.	NFA with Λ Transitions, Language accepted by NFA- Λ, Definition of Λ-Closure, Basis Clause and Inductive Clause of NFA- Λ	CLO-4	[Instructor Notes]	
		3.	Conversion of NFA- Λ to equivalent NFA	CLO-4	[Instructor Notes]	
	5.	1.	Conversion of NFA to equivalent DFA	CLO-4	[Instructor Notes]	***Assignment 1 submission Monday Week 5***
		2.	Equivalence of DFAs, NFAs and NFA-Λ	CLO-4	[Instructor Notes]	
		3.	Kleene's Theorem Part-1 & Part-2	CLO-4	[JM]: 3.4, 3.5 [DC]: 7	
	6.	1.				
		2.	**Mid-I Examination**			
		3.				
	7.	1.	Complement of Regular Language and Complement of DFA, Intersection of Regular Languages	CLO-3	[Instructor Notes]	
		2.	Properties of RLs	CLO-2,3	[Linz]: 4 [HMU]: 4	
		3.	Pumping Lemma	CLO-3	[HMU]: 4.1 [JM]: 2.4	
	8.	1.	Minimization of DFA	CLO-4	[Instructor Notes] [HMU]: 4.4	***Quiz no 2 Assignment 2 Friday Release Week 8***
		2.	Mealy & Moore Machines	CLO-4	[DC]: 9	
		3.	Conversion between Mealy & Moore Machines	CLO-4	[Instructor Notes]	
	9.	1.	Regular Grammars, Linear Grammar, Context-free Languages (CFL), Context-free grammars (CFG).	CLO-2,3	[DC]: 13 [MS]: 2	
		2.	Parse Trees, Derivations and ambiguity and Chomsky-normal-form grammars (CNF), Null Production	CLO-3	[DC]: 20 [Linz]: 6.2	
		3.	Trees, Polish Notations, Total Language Tree	CLO-3	[JM]: 4.4	

	10.	**1.**	Push down automata (PDA)	CLO-5	[JM]: 5 [DC]: 17 [MS]: 2.2	***Assignment 2 submission Monday Week 10***
		2.	Deterministic PDA, Pumping Lemma for CFG	CLO-5		
		3.	NPDA and CFG Equivalence	CLO-5		
	11.	**1.**				
		2.	**Mid-II Examination**			
		3.				
	12.	**1.**	Turing Machines (TM) Intro & Formalities	CLO-5	[MS]: 3.1 [Linz]: 9	
		2.	Designing TM as Acceptors/Transducers	CLO-5	[Linz]: 9	
		3.	Turing's Thesis, Turing Machine Variations	CLO-5	[MS]: 3.2 [DC]: 27	
	13.	**1.**	Universal Turing Machine Decidability	CLO-5	[JM]: 7.8 [DC]: 27	***Assignment 3 Friday Release Week 13***
		2.	Recursive vs. recursively enumerable	CLO-5	[JM]: 8 [DC]: 28	
		3.	Continued			
	14.	**1.**	Decidable Problem and Undecidable Problem,	CLO-4	[JM]: 9 [HMU]: 9 [MS]: 4	***Quiz no 3***
		2.	Continued			
		3.	Continued			
	15.	**1.**	Reducibility, Reduction problems	CLO-5	[MS]: 5.1	***Assignment 3 submission Monday Week 15***
		2.	The Chomsky Hierarchy	CLO-1,2,3	[JM]: 8.3	
		3.	Continued			
	16.	**1.**	**Revision**			

Class Time Spent on (in credit hours)	**Theory**	**Problem Analysis**	**Solution Design**	**Social and Ethical Issues**
	5	15	28	0
Oral and Written Communications	Every student is required to submit at least 3 assignments and 3 quizzes with no oral presentations.			

Instructor Name ____Muhammad Shahzad_____
Instructor Signature _____
Date ____16-01-2023_____

COURSE DESCRIPTION FORM

INSTITUTION National University of Computer and Emerging Sciences (NUCES-FAST)

PROGRAM (S) TO BE EVALUATED BS(CS)

A. Course Description

(Fill out the following table for each course in your computer science curriculum. A filled out form should not be more than 2-3 pages.)

Course Code	CS-2005
Course Title	Database Systems
Credit Hours	3+1
Prerequisites by Course(s) and Topics	CS-2001 (Data Structures)
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	Mid-I: 15 Mid-II: 15 Assignments/Quizzes: 10 Project: 10 Final: 50
Course Coordinator	Dr. Zulfiqar Ali Memon
URL (if any)	
Current Catalog Description	Basic database concepts, Conceptual modelling, Relational data model, Relational theory and languages, Database design, SQL, Introduction to query processing and optimization, Introduction to concurrency and recovery with advance topics. This course provides students with the essential concepts, principles, and techniques of modern database systems from a user perspective. This means that the lecture focuses on the functionalities that are offered by database systems and not on the methods to implement them. Specifically, the course teaches students the ability to develop a solution for a real-world data management problem that requires the application of the theories and practices developed in class. From a theoretical point of view, this course covers the essential principles for the design, analysis, and use of computerized database systems. The design and techniques of conceptual modeling, database modeling, database system architecture, and user/program interfaces are presented in a unified way.
Textbook (or **Laboratory Manual**	Ramez Elmasri & Shamkant B. Navathe, *Database Systems, Models, Languages, Design and Application Programming,* 7th Edition, 2016.

for Laboratory Courses)	
Reference Material	1) Thomas Connolly, Carolyn Begg, *Database Systems: A practical approach to design, implementation and Management*, 6th Edition, 2015. 2) C.J. Date, *An Introduction to Database Systems*, 8th Edition, 2004
Course Goals	**A. Course Learning Outcomes (CLOs)** 1. Explain fundamental database concepts. 2. Analyze an information storage problem and derive an information model expressed in the form of an entity relation diagram and other optional analysis forms, such as a data dictionary. 3. Demonstrate an understanding of normalization theory to normalize the database and formulate, using SQL & relational algebra, solutions to a broad range of query & data problems in a team work.

B. Program Learning Outcomes

For each attribute below, indicate whether this attribute is covered in this course or not. Leave the cell blank if the enablement is little or non-existent.

1. Academic Education:	To prepare graduates as computing professionals	
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.	
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.	✔
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.	✔
5. Modern Tool Usage:	Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an	✔

	understanding of the limitations.	
6. Individual and Team Work:	Function effectively as an individual and as a member or leader in diverse teams and in multi-disciplinary settings.	
7. Communication:	Communicate effectively with the computing community and with society at large about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.	
8. Computing Professionalism and Society:	Understand and assess societal, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practice.	
9. Ethics:	Understand and commit to professional ethics, responsibilities, and norms of professional computing practice.	
10. Life-long Learning:	Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.	

C. Relation between CLOs and PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

		PLOs									
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
CLOs	1			✔							
	2				✔						
	3					✔					

Topics Covered in the Course, with Number of Lectures on Each Topic (assume 15-week instruction and one-hour lectures)

1. Topics to be covered:

List of Topics	No. of Weeks	Contact Hours	CLO
Chapter 1 Introduction, Characteristics of Database Approach, Files Vs. Databases, Characteristics of Database approach, Advantages of	**2**	**6**	**1**

	using DBMS, When not to use DBMS, Chapter 2 Data Model, Schema and Instance, three schema architecture and data independence, classification of DBMS, database languages & Interfaces, Database systems environment. Chapter 5 Relational Model Concepts, Relational Model Constraints			
	Chapter 5 Relational Database Schemas, Update Operations, Transactions, and Dealing with Constraint Violations Chapter 6 SQL Data Definition and Data Types, Specifying Constraints in SQL, Basic Retrieval Queries in SQL, INSERT, DELETE, and UPDATE Statements in SQL, Additional Features of SQL	**2**	**6**	**1,2**
	Chapter 7 More Complex SQL Retrieval Queries, Views (Virtual Tables) in SQL, Schema Change Statements in SQL	**1**	**3**	**1,2**
	========== *MID 1* ==========			
	Chapter 3 Using High-Level Conceptual Data Models for Database Design, A Sample Database Application. Entity Types, Entity Sets, Attributes, and Keys, Relationship Types, Relationship Sets, Roles, and Structural Constraints, Weak Entity Types, Refining the ER Design for the COMPANY Database, ER Diagrams, Naming Conventions, and Design Issues, Relationship Types of Degree Higher than Two	**1.5**	**4.5**	**2**
	Chapter 8 Unary Relational Operations: SELECT and PROJECT Relational Algebra Operations from Set Theory	**1**	**3**	**2**

	Binary Relational Operations: JOIN and DIVISION Examples of Queries in Relational Algebra			
	Chapter 14 Informal Design Guidelines for Relation Schemas Functional Dependencies/Normal Forms Based on Primary Keys General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form Multivalued Dependency and Fourth Normal Form Join Dependencies and Fifth Normal Form	**2.5**	**7.5**	**3**
	========== *MID 2* ==========			
	Chapter 20 Introduction to Transaction Processing Transaction and System Concepts Desirable Properties of Transactions Characterizing Schedules Based on Recoverability Characterizing Schedules Based on Serializability Transaction Support in SQL, Chapter 21 Two-Phase Locking Techniques for Concurrency Control Concurrency Control Based on Timestamp Ordering Multiversion Concurrency Control Techniques Validation (Optimistic) Concurrency Control Techniques Granularity of Data Items and Multiple Granularity Locking	**2**	**6**	**1,2**
	Chapter 22 Recovery Concepts NO-UNDO/REDO Recovery Based on Deferred Update Recovery Techniques Based on Immediate Update Chapter 24 Introduction to NOSQL Systems Document-Based NOSQL Systems and MongoDB	**1.5**	**4.5**	**1,2**

	NOSQL Key-Value Stores Column-Based or Wide Column NOSQL Systems			
	Review	**0.5**	**1.5**	**1,2,3**
	Project Presentations	**1**	**3**	**1**
	Total	**15**	**45**	

Laboratory Projects/Experiments Done in the Course				
Programming Assignments Done in the Course				
Class Time Spent on (in credit hours)	**Theory**	**Problem Analysis**	**Solution Design**	**Social and Ethical Issues**
	30	10	5	0
Oral and Written Communications	Every student is required to submit at least __1__ written report of typically _2__ pages and to make _1__ oral presentations of typically __10__ minute's duration. Include only material that is graded for grammar, spelling, style, and so forth, as well as for technical content, completeness, and accuracy.			

Instructor Name __Dr. Zulfiqar Ali Memon

Instructor Signature _____

Date __September 12th, 2023

COURSE DESCRIPTION FORM

INSTITUTION National University of Computer and Emerging Sciences (NUCES-FAST)
PROGRAM (S) TO BE EVALUATED BS (CS)

A. Course Description

(Fill out the following table for each course in your computer science curriculum. A filled out form should not be more than 2-3 pages.)

Course Code	CL-2005
Course Title	Database Systems Lab
Credit Hours	3+1
Prerequisites by Course(s) and Topics	CL-2001 (Data Structures)
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	Lab Work: 20 Project:5 Mid :25 Final: 50
Course Coordinator	Dr Zulfiqar Ali Memon
URL (if any)	
Current Catalog Description	Basic database concepts, Conceptual modelling, Relational data model, Relational theory and languages, Database design, SQL, Introduction to query processing and optimization, Introduction to concurrency and recovery with advance topics. This course provides Students with the essential concepts, principles, and techniques of modern database systems from a user perspective. This means that the lecture focuses on the functionalities that are offered by database systems and not on the methods to implement them. Specifically, the course teaches students the ability to develop a solution for a real- world data management problem that requires the application of the theories and Practices developed in class. From a theoretical point of view, this course covers the essential principles for the design, analysis, and use of computerized database systems. The design and techniques of conceptual modeling, database modeling, database system Architecture, and user/program interfaces are presented in a unified way.

~~**Textbook** (or **Laboratory Manual**~~	~~Ramez Elmasri & Shamkant B. Navathe, *Database Systems, Models, Languages, Design and Application Programming,* 7th Edition, 2016.~~
for Laboratory Courses)	
Reference Material	1) Thomas Connolly, Carolyn Begg, *Database Systems: A practical approach to design, implementation and Management*, 6th Edition, 2015. 2) C.J. Date, *An Introduction to Database Systems*, 8th Edition, 2004

Course Goals

A. Course Learning Outcomes (CLOs)

1. Differentiate database systems from file systems by enumerating the features provided by database systems and describe each in both function and benefit.
2. Define the terminology, features, classifications, and characteristics embodied in database systems.
3. Analyze an information storage problem and derive an information model expressed in the form of an entity relation diagram and other optional analysis forms, such as a data dictionary.
4. Transform an information model into a relational database schema and to use a data definition language and/or utility to implement the schema using a DBMS.
5. Formulate, using relational algebra, solutions to a broad range of query problems.
6. Formulate, using SQL, solutions to a broad range of query and data update problems.
7. Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.
8. Demonstrate a rudimentary understanding of programmatic interfaces to a database and be able to use the basic functions of one such interface.

B. Program Learning Outcomes

1. Academic Education:	To prepare graduates as computing professionals	✓
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.	✓
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.	✓
4. Design/ Development of	Design and evaluate solutions for complex computing problems, and design and evaluate	✓

Solutions:	systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.	
5. Modern Tool Usage:	Create, select, adapt and apply appropriate Usage techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.	✓
6. Individual and Team Work:	Function effectively as an individual and as a member or leader in diverse teams and in multi-disciplinary settings.	

C. Relation between CLOs and PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

		PLOs									
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
CLOs	1	✓	✓	✓							
	2										
	3				✓	✓					
	4						✓	✓	✓	✓	✓
	5									✓	✓

Topics Covered in the Course, with Number of Lectures on Each Topic (assume 15-week instruction and one-hour lectures)

1. Topics to be covered:

List of Topics	No. of Weeks	Contact Hours
Lab-01: Introduction & History of Database Systems, Introduction of SQL	01	03
Lab-02: Basic SQL Schema and Statements, Arithmetic operators, Column Alias, Concatenation Operator, Where Clause, Comparison Operators & Conditions, Logical Conditions (AND, OR, NOT), Functions (count, max, min, Dates),Operators (Like, Rownum, In, Between), Order by clause	01	03
Lab-03: DDL(create, alter, drop, truncate, rename), Defining constraints on table, types of constraints, deferred constraint checking(chicken egg problem) and DML (Create, insert, update, delete)	01	03
Lab-04: Sub queries (Single Row, Multiple Rows and correlated),Groups of Data(Group by ,Having)	01	03
Lab-05: Joins, Types of Joins (Equality Joins, Non Equality Joins, Outer Joins and Self Joins), Set Operators (union, union all, intersection, minus).	01	03
Lab-06: Relational Modeling	01	03
Lab-07: PL/SQL: Block Structure, Variable & types, Conditional Logic, Cursors, Views, Procedures &Functions)	01	03
========== *MID Exam* ==========		

	Lab-08: Triggers	01	03
	Lab-09: Connectivity: PHP with MYSQL, JAVA with MYSQL, C# with SQL Server	01	03
	Lab-10: Transaction	01	03
	Lab-11: Mongo DB (Installation & Basics, Projections & Functions)	01	03
	========== *Revision* =========		
	========== *Project Evaluation* =========		
	========== *Final Exam* ==========		

Laboratory Projects/Experiments Done in the Course				
Programming Assignments Done in the Course	Assignments and Lab activities related to Normalization, Joins, and sub Queries.			
Class Time Spent on (in credit hours	**Theory**	**Problem Analysis**	**Solution Design**	**Social and Ethical Issues**
	30	10	5	0
Oral and Written Communications	Every student is required to submit at least__ 1__ written reports of typically _2__ pages and to make _1__oral presentations of typically__10__ minute's duration. Include only material that is graded for grammar, spelling, style, and so forth, as well as for technical content, completeness, and accuracy.			

Instructor Name: Mafaza Mohi

Instructor Signature: *mafaza mohi*

Date 16th January, 2023

NATIONAL UNIVERSITY OF COMPUTER & EMERGING SCIENCES KARACHI CAMPUS

National University of Computer & Emerging Science

Department	Department of Computer Science	**Dept. Code**	CS
Course Title	Design and Analysis of Algorithms	**Course Code**	CS2009
Pre-requisite(s)	CS2001	**Credit Hrs.**	3

Course Objective:	Main objective of course is to understand required skills and knowledge to design and analyze algorithms. Students will learn several algorithm design techniques and use of mathematical tools for empirical analysis of algorithms. Additionally students will be able to learn effective problem solving skills in computing through this course.

PLO	Program Learning Outcome (PLO) Statement
1	**Computing Knowledge:** Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of complex computing problems.
2	**Problem Analysis:** Identify, formulate, research literature, and analyze complex computing problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing sciences.
5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources and modern computing tools, including prediction and modelling for complex computing problems.
9	**Individual & Team Work** Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.

CLO	Course Learning Outcome (CLO)	Domain	Taxonomy Level	PLO	Tools
01	To apply acquired knowledge to solve computing problems complexities and proofs	Cognitive	C3	01	A1, A2, A3, A4, A5, M1, M2, F
02	To analyze complexities of different algorithms using asymptotic notations, complexity classes and standard complexity function	Cognitive	C4	02	A1, A2, A3, A4, A5, M1, M2, F
03	To evaluate generic algorithmic solutions such as sorting, searching and graphs applied to real-world problems	Cognitive	C5	05	A3, A4, A5, M1, M2, F
04	To construct and analyse real world problems solutions using different algorithms design techniques i.e. Brute Force, Divide and	Psychomotor	C6	09	Project

	Conquer, Dynamic Programming, Greedy Algorithms.				
Tool: A = Assignment, Q = Quiz, M = Midterm, F=Final, CEP = Complex Engineering Problem.					

Text Book(s)	**Title**	Introduction to Algorithms" 4th Edition
	Author	Thomas H. Cormen et al.
	Publisher	MIT Press
Ref. Book(s)	**Title**	Introduction to the design and analysis of algorithms 3rd Edition.
	Author	Anany Levitin
	Publisher	Pearson

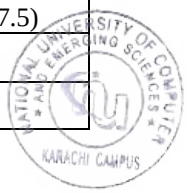
1. Topics to be covered:

List of Topics	No. of Weeks	Contact Hours	CLO
Basics of Algorithms, Mathematical Foundation, Growth of Function, Asymptotic Notations. (Assignment 1 will be given at the start of week-2 and Project will be announced)	**2**	**6**	**1**
Divide and Conquer, Substitution Method, Recurrence-Tree Method, Master's Method.	**2**	**6**	**2**
Data Structures Review (Stack, Queue, Linked List, Hash Table, Binary Tree). Sorting (Merge, Insertion, Quick, Heap, Counting, Radix, Bucket) (Assignment 2 will be given)	**1**	**3**	**3**
Midterm1	**0.5**	**1**	**1,2,3**
Geometric Algorithms (Introduction, Graham Scan, Close Points). String Matching	**2**	**6**	**2,3**
Dynamic Programming (Assignment 3 will	**2**	**6**	**3**

be given)			
Midterm2	**0.5**	**2**	**1,2,3,4**
Greedy Algorithms, Graph Theory (Graph Categorization, Graph Terminology, Representation of Graphs, BFS & DFS, Strongly Connected Components, Greedy Algorithms: Kruskal's Algorithm, Prim's Algorithms, Bellman-Ford Algorithms, Dijkstra's Algorithm) (Assignment 4 will be given)	**3**	**9**	**3**
NP Complete Problems and Solutions using Approximation Algorithm, Amortized algorithms (Assignment 5 will be given)	**2**	**6**	**1**
Project Presentations	**1**	**3**	**4**
Final	**1**	**3**	**1,2,3,4**
Total	**17**	**51 (Including 3 hours final exam)**	

Assessment Plan:

Assessment	Weightage
Quiz/Assignment (Best 4 out of 5)	10
Midterm Exams	30 (Midterm1:12.5, Midterm2: 17.5)
Project	10
Final	50



National University

Of Computer & Emerging Sciences Karachi

Course Outlines of BS (CS) Degree Program

Course Instructor	Dr. Nazish Kanwal, Mr. Abdul Basit & Mr. Usama Antuley	**Semester**	Fall
Batch/Section(s)	2021/BS-CS	**Year**	2023
Course Title	Graph Theory (MT3001)	**Credit Hours**	3
Prerequisite(s)	Nil	**Course TA**	

Textbooks:	1. Saoub, Karin R. *Graph Theory: An Introduction to Proofs, Algorithms, and Applications*. CRC Press, 2021. 2. Graph theory: undergraduate mathematics / by Khee Meng Koh, Fengming Dong, Kah Loon Ng, Eng Guan Tay. Bondy, John Adrian, and Uppaluri Siva Ramachandra Murty
Ref. Books:	1. Bondy, John Adrian, and Uppaluri Siva Ramachandra Murty. *Graph theory with applications*. Vol. 290. London: Macmillan, 1976. 2. West, Douglas Brent. *Introduction to graph theory*. Vol. 2. Upper Saddle River: Prentice Hall, 2001.

Course Objective	The Graph Theory includes Fundamental concepts of graphs, Matrix representation and properties of graphs, Isomorphic and special graphs, Graph Routes, Eulerian Circuits, Hamiltonian Cycles, Properties of Trees, Matching and covering, Connectivity and Network Flow, Max-flow Min-cut Theorem, Graph Coloring, Planarity, with applications to computer systems and software engineering.

No.	Assigned Program Learning Outcome (PLO)	Level	Tools
01	Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of complex computing problems.	R	

I = Introduction, R = Reinforcement, E = Evaluation. A = Assignment, Q = Quiz, Pr=Presentation,

P=Project, M = Midterm, F=Final.

No.	Course Learning Outcome (CLO) Statements	Tools
1	To introduce the fundamental concepts of Graphs, Graph routes, and Trees.	Q,1 A,1 M1, F
2	To understand the concepts of connectivity, Flow, and Graph matching with their application of Graph Theory in subsequent courses in the design and analysis of algorithms, computability theory, software engineering, and computer systems.	A2, M1, Q2, M2, F
3	Students will explore Graph coloring, Planarity, and Applications related to Computer Science.	Q3, Pr / P, F

Week	Contents/Topics	Section	Problems	CLO
1	Introduction to Graph Models and Terminology: Digraphs, Weighted Graphs, Complete Graphs, Graph Complements, Bipartite Graphs, Graph Combinations, (Theorem 1.33)	1.2	**EX #: 1.8** Problems: 1.1-1.7, 1.12,1.14, 1.15, 1.16, 1.17, 1.20, 1.22	1
2	Isomorphisms, Matrix Representation, Proof Techniques.	1.3, 1.4,1.5		1
3	Degree Sequence, Havel-Hakimi Theorem, Touring a Graph, Graph routes: Eulerian Graphs, Hamiltonian Cycles, Hamiltonian Closure.	1.6, 2.1.2, 2.1.3, 2.2	**EX, #:2.4** Problems: 2.1-2.9, 2.15, 2.16, 2.27, 2.28.	1
4	Traveling Salesman Problems, Shortest Paths, Dijkstra's Algorithm, Walks Using Matrices, Distance, Diameter, Radius, girth, and circumference of the graph.	2.2.1, 2.3.1, 2.3.2 2.3.3		2
5	Trees; Spanning Trees, Minimum Spanning Trees, Tree Properties, Tree Enumeration, Rooted Trees, and Decision Trees	3.1- 3.3, 3.4.2	**EX #: 3.5** Problems: 3.1-3.8, 3.13-3.17, 3.23	2
MID-1 Exams				
6	Connectivity Measures (k-Connected, k-Edge-Connected).	4.1 4.2	**EX #:4.6** Problems: 4.1-4.6, 4.9, 4.10, 4.13,	3

7	Connectivity and Paths, Menger's Theorem, Network Flow, Max-flow Min-cut Theorem.	4.4	4.14, 4.15,4.17, 4.20.	3
8	Matching in Bipartite Graphs, Augmenting path & Vertex cover, Berge's Theorem, Matching in General Graphs, Edmond's Blossom Algorithm.	5.1 5.2	**EX #: 5.5** Problems: 5.1-5.14, 5.17-5.19, 5.24, 5.25	3
9 & 10	Stable Matching, Gale-Shapley Algorithm, Factors & Factorization of the graph.	5.3, 5.4		3
MID-II Exams				
11	Graph Coloring; Four Color Theorem, Vertex Coloring, Perfect graphs, and Interval graphs.	6.1	**EX #: 6.5** Problems: 6.1-6.9, 6.12, 6.13, 6.14, 6.19.	3
12 & 13	Edge Coloring, Line graphs, Coloring Variations, On-line Coloring, Weighted Coloring, List Coloring	6.2 6.4		3
14	Planarity; Kuratowski's Theorem, Euler's Formula (with proof), Cycle chord method, Edge-Crossing, Thickness of graph.	7.1 7.3	**EX #: 7.4** Problems: 7.1-7.6, 7.17, 7.18	3
Final Exams				

Marks Distribution:

Particulars	**% Marks**
1. Quizzes (at least 2)+Presentation/Project	15
2. Assignments (at least 2)	05
4. First Mid Exam	15
5. Second Mid Exam	15
6. Final Exam	50
Total:-	**100**

Important Instructions to be followed for this Course.

- Be in the classroom on time. Any student who arrives more than 5 min late in the class would be marked LATE. Anybody coming to class more than 15 minutes late will be marked ABSENT.
- Turn off your cell phones or any other electronic devices before entering the class.
- Maintain the decorum of the classroom all the time.
- Avoid a conversation with your classmates while the lecture is in progress.

- Use parliamentary language in the classroom as well as in assignments. Refrain from using impolite, vulgar, or abusive language in the classroom as well as in-class presentations and assignments.
- Submit your assignments on time, no assignment will be accepted after the deadline.
- There would be no re-take of any quiz.

Instructions / Suggestions 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.
- Chapters should be read, and homework should be attempted before class.
- Do not get behind. You are encouraged to work with other students. Plus, I am always available during office hours to help you.
- The homework assigned is a minimum. You may 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 gain knowledge.
- Be creative in thinking, but stick to the topic assigned for discussions, assignments, and presentations.
- Always bring your textbooks with you to the class.

Note: Students are welcome all the time to get help from the Teacher.

Signature: _____ Date:17-08-2023

COURSE DESCRIPTION FORM

INSTITUTION National University of Computer and Emerging Sciences

PROGRAM (S) TO BE EVALUATED Computer Science

A. Course Description

(Fill out the following table for each course in your computer science curriculum. A filled out form should not be more than 2-3 pages.)

Course Code	CS
Course Title	Parallel and Distributed Computing
Credit Hours	3+0
Prerequisites by Course(s) and Topics	Operating Systems
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	Midterms 30% Assignments (Quiz optional) 10% Projects 10% Final Exam 50%
Course Coordinator	Dr. Nadeem Kafi
URL (if any)	-
Current Catalog Description	Asynchronous/synchronous computation/communication, concurrency control, fault tolerance, GPU architecture and programming, heterogeneity, interconnection topologies, load balancing, memory consistency model, memory hierarchies, Message passing interface (MPI), MIMD/SIMD, multithreaded programming, parallel algorithms & architectures, parallel I/O, performance analysis and tuning, power, programming models (data parallel, task parallel, process-centric, shared/distributed memory), scalability and performance studies, scheduling, storage systems, synchronization, and tools (Cuda, Swift, Globus, Condor, Amazon AWS, OpenStack, Cilk, gdb, threads, MPICH, OpenMP, Hadoop, FUSE).

Textbook (or **Laboratory Manual** for Laboratory Courses)	**Book#1:Introduction to Parallel Computing, Second Edition** Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar **Book#2: Programming Massively Parallel Processors** By David B. Kirk
Reference Material	**Book#3: Big Data Systems: A 360 degree Approach** By Jawwad Shamsi

Course Goals

A. Course Learning Outcomes (CLOs)

1. Learn about parallel and distributed computers.
2. Write portable programs for parallel or distributed architectures using Message-Passing Interface (MPI) library.
3. Analyze complex problems with shared memory programming with openMP.

B. Program Learning Outcomes

For each attribute below, indicate whether this attribute is covered in this course or not. Leave the cell blank if the enablement is little or non-existent.

1. Academic Education:	To prepare graduates as computing professionals	✔
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.	✔
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.	✔
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.	✔
5. Modern Tool Usage:	Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.	✔
6. Individual and Team Work:	Function effectively as an individual and as a member or leader in diverse teams and in multi-disciplinary settings.	✔
7. Communication:	Communicate effectively with the computing community and with society at large about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.	✔

8. Computing Professionalism and Society:	Understand and assess societal, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practice.	✔
9. Ethics:	Understand and commit to professional ethics, responsibilities, and norms of professional computing practice.	✔
10. Life-long Learning:	Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.	✔

C. Relation between CLOs and PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

		PLOs									
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
CLOs	1	✔	✔	✔							
	2	✔	✔	✔							
	3	✔	✔	✔							
	4										
	5										
	6										
	7										

Topics Covered in the Course, with Number of Lectures on Each Topic (assume 15-week instruction and one-hour lectures)

1. Topics to be covered:

List of Topics	No. of Weeks	Contact Hours	CLO
Introduction: Flynn's Taxonomy, Granularity: fine and coarse grained, some general terms parallel execution, parallel overhead, scalability, Shared Memory paradigm, Distributed memory paradigm, Hybrid – shared and distributed memory.	**1**	**3**	**1**

	(Ref Book: Book#3)			
	Parallel Programming Platforms: Scope of Parallelism, Implicit Parallelism: Trends in Microprocessor Architectures, Pipelining and Superscalar Execution, Superscalar Execution: Issue Mechanisms , Superscalar Execution: Efficiency Considerations, Very Long Instruction Word (VLIW) Processors, Limitations of Memory System Performance, Memory System Performance: Bandwidth and Latency, Improving Effective Memory Latency Using Caches, Impact of Caches , impact of bandwidth, Alternate Approaches for Hiding Memory Latency, Multithreading and prefetching, Interconnection Networks for Parallel Computers, static and dynamic network, Network Topologies: Buses and Crossbar. **(Book : Book#1)**	**1**	**3**	**1**
	Principles of Parallel Algorithm Design: Preliminaries: Decomposition, Tasks, and Dependency Graphs, Multiplying a Dense Matrix with a Vector, Database Query Processing, Granularity of Task Decompositions, Degree of Concurrency, Critical Path Length, Limits on Parallel Performance, Task Interaction Graphs, sparse matrix example, Processes and Mapping, Decomposition Techniques: recursive decomposition, Array example, data decomposition, matrix example, itemset	**1**	**3**	**1,2,3**

	frequencies, exploratory decomposition, 15-puzzle example,speculative decomposition, simulation of network nodes. Parallel Algorithm Models: Data Parallel Model, Task Graph Model, Master-Slave Model, Pipeline / Producer-Comsumer Model, Hybrid Models. **(Book : Book#1)**				
	Programming Shared Address Space (OpenMP): OpenMP programming model, parallel directive, reduction clause, for loop, nowait clause, scheduling clause: static, dynamic, guided, Data sharing attribute clauses: shared, private, default, reduction, Synchronization clauses: critical, atomic, barrier, ordered. Parallel For Loops, sections directive, OpenMP Library Functions: int omp_get_num_threads ( ); int omp_get_max_threads ( ); int omp_get_thread_num ( ), **(Book : Book#1))**	**2**	**6**	**1,3**	
	Mid 1 Exams				
	Programming Using the Message Passing Paradigm: Principles of MPI, The Building Blocks: Send and Receive Operations, Buffered and non bufferedMP, MPI interface, Starting and Terminating the MPI Library, Communicators, Querying Information, Sending and Receiving Messages, overlapping communication with computation, collective communication and computation opertaions: barrier, broadcast, reduction, prefix, scatter, gather.	**2**	**6**	**1,2**	

	(Book : Book#1)			
	Distributed File System (HDFS): Client-server file systems, What is a parallel file system, Google File System (GFS), Design Assumptions and design principles. File System Interface, GFS Master & Chunkservers, files, chunks , Master, Client Interaction Model, Reading and writing to files, namespace, Core Part of Google Cluster Environment, HDFS design goals, architecture, namenode, datanode, rackawareness. Hadoop: Distributed file system. **(Ref Book: Book#3)** **(Paper: Shvachko, Konstantin, Hairong Kuang, Sanjay Radia, and Robert Chansler. "The hadoop distributed file system." In *2010 IEEE 26th symposium on mass storage systems and technologies (MSST)*, pp. 1-10. Ieee, 2010.)**	**1**	**3**	**1**
	Map Reduce Framework: Map, Partition, shuffle, sort, reduce. Example: word count, URL access count, reverse web link graph, inverted index, stock summary. **(Ref Book:Book#3)**	**2**	**6**	**1**
	Mid 1I Exams			
	Introduction to Data Parallelism and CUDA C: Data Parallelism, CUDA program structure, Vector Addition kernel, Device global memory and data transfer, kernel functions and threading. **CUDA Memories:** Importance of Memory Access Efficiency, CUDA Device Memory Types. **(Book:Book#2)**	**1.5**	**3**	**1,2,3**
	Data-Parallel Execution Model: Cuda thread organization,	**1.5**	**6**	**1,2,3**

	mapping threads to multidimensional, synchronization and transparent scalability, assigning resources to blocks, query device properties. **(Book: Book#2)**				
	Total	**15**			

Laboratory Projects/Experiments Done in the Course	Lab 1: Parallel Execution in OpenMP Lab 2: Scheduling in OpenMP Lab 3: Critical in OpenMP Lab 4: Independent Parallel Task using Sections in OpenMP Lab 5: Communication rank and size in MPI Lab 6: MPI_send / MPI_Recv Lab 7: MPI Scatter, Gather, Bcast Lab 8: Map Reduce Lab 9: CPU / GPU transfer in CUDA C
Programming Assignments Done in the Course	**Assignment # 1:** Task : OpenMP Assignment (Lab 1, 2,3,4) **Assignment#2:** Task : MPI Assignment (Lab 5,6,7) **Assignment #3:** Task 1: Hadoop installation on a single node (screen shot submission of jps) on VM Task 2: Map Reduce Assignment (Lab 8) **Assignment#4: (Note: Student list need to be given to IT to make account on GPU server so they can ssh remotely through MobaXterm)** Task: CUDA C Assignment (Lab 9)

Class Time Spent on (in credit hours)	**Theory**	**Problem Analysis**	**Solution Design**	**Social and Ethical Issues**
	20	30	40	10
Oral and Written Communications	Every student is required to submit a project along with its report of not more than 8 pages.			

Instructor Name: Dr. Nadeem Kafi

Instructor Signature

Date 07 February, 2023

COURSE DESCRIPTION FORM

FAST-NUCES

INSTITUTION _____

PROGRAM (S) TO BE EVALUATED BSCS

A. Course Description

(Fill out the following table for each course in your computer science curriculum. A filled out form should not be more than 2-3 pages.)

Course Code	CS-3004
Course Title	Software Design and Analysis
Credit Hours	3+0
Prerequisites by Course(s) and Topics	CS-2001 Data Structures, OOP
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	Project + Presentation 8% Quizzes 06% Assignments 8% Midterms 28% Final 50%
Course Coordinator	
URL (if any)	
Current Catalog Description	Object Oriented approach, at present, is the method of choice for the industry to develop different software. It is a marked shift, in the way a software solution is conceived and implemented, from the structured/procedural design paradigm. Instead of viewing the problem domain as a sequence or set of procedures, the emphasis in OOA/D is on entities that interact with one another while making a design closer to the problem domain and the way human beings think and understand the real world.
Textbook (or **Laboratory Manual** for Laboratory Courses)	• UML 2 Toolkit by Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado • UML and the Unified Process, Practical object-oriented analysis and design by Jim Arlow, Ila Neustadt
Reference Material	• Applying UML and Patterns 3rd Edition by Craig Larman • The Unified Modeling Language Reference Manual, 2nd edition by James Rumbaugh, Ivar Jacobson and Grady Booch • UML Distilled, 3rd Edition by Martin Flower • Internet

Course Goals

A. Course Learning Outcomes (CLOs)

CLO	Name	Domain	Taxonomy Level	Tools
01	Understand the role of design and its major activities within the software development process, with focus on the Unified process.	Cognitive	1,2	A,M,F
02	Comprehend the advantages of consistent and reliable software design.	Cognitive	1,2	A,M,F
03	Design and Implement OOD models and refine them to reflect implementation details	Cognitive	3,4	A,M,F,P
04	Apply and use UML to visualize and document the design of software systems.	Cognitive	3,4,5	A,M,F,P

Tool: A = Assignment, M = Midterm, F=Final, P = Project

B. Program Learning Outcomes

For each attribute below, indicate whether this attribute is covered in this course or not. Leave the cell blank if the enablement is little or non-existent.

PLO 1	Computing Knowledge	Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of complex computing problems.	✔
PLO 2	Problem Analysis	Identify, formulate, research literature, and analyze complex computing problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing sciences.	✔
PLO 3	Design/Develop Solutions	Design solutions for complex computing problems and design systems, components, and processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.	✔
PLO 4	Investigation & Experimentation	Conduct investigation of complex computing problems using research-based knowledge and research-based methods	
PLO 5	Modern Tool Usage	Create, select, and apply appropriate techniques, resources and modern computing tools, including prediction and modelling for complex computing problems.	✔
PLO 6	Society Responsibility	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues relevant to context of complex computing problems.	
PLO 7	Environment and Sustainability	Understand and evaluate sustainability and impact of professional computing work in the solution of complex computing problems.	
PLO 8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of computing practice.	✔

PLO 9	Individual and Team Work	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.	✔
PLO 10	Communication	Communicate effectively on complex computing activities with the computing community and with society at large.	✔
PLO 11	Project Mgmnt and Finance	Demonstrate knowledge and understanding of management principles and economic decision making and apply these to one's own work as a member or a team.	
PLO 12	Life Long Learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological changes.	

C. Relation between CLOs and PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

		PLOs											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CLOs	1	✔											
	2		✔										
	3			✔									
	4					✔							

Weeks	Topic	hours
1.	OOP Concepts revision and Course Introduction Overview of SAD & OOAD,), SDLC, Software Environments, Flow charts DFDs, Intro to OOP (Java).	3
2.	Software Process Models & UP, Use case Diagrams	3
3.	Use case Diagrams, case studies ,Domain Model, User Stories	3
4.	Class Diagrams, Class Relationships, Interfaces, Parameterized Class, Enumeration, Exceptions	2
5.	Use-Case Realization, Entity, Control and Boundary classes	2
6.	MID-1	1
7.	Activity Diagrams Case Study	3
8.	Advance features of Activity Diagrams, UML for Real-Time Systems, Active Class / Object, Asynchronous / Synchronous Communication, Events / Triggers, Signals (Change / Signal / Call / Time trigger), Messages (Synchronous, Reply, Create, Asynchronous, Lost, Found), Synchronization and Concurrency, Fault Tolerance, Thread Implementation in Java, Model, Views and Diagrams, 4+1 view model, Architectural views	2
9.	Interaction Diagrams, Sequence and Collaboration Diagrams	2
10.	Timing Diagrams	2

	Homogenization of Classes	
11.	Implementation, Component and Deployment Diagrams	2
12.	Mid Term 2	1
13.	State Chart Diagrams and MVC	2
14.	Introductions to Design Patterns, Singleton Pattern, Façade	2
15.	Factory & Adapter Pattern	3
16.	Project Presentation and Discussion	3

Laboratory Projects/Experiments Done in the Course:

Topic	hours
Lab 1: Use Case Diagram	1
Lab 2: Class Diagrams	1
Lab 3: Activity Diagrams	1
Lab 4: Advance Activity Diagram	1
Lab 5: sequence Diagram	1
Lab 6: Collaboration Diagram	1
Lab 7 : State chart diagrams	1
Lab 8: Component & Deployment Diagrams	1
Lab 9: Design patterns	1

Laboratory Projects/Experiments Done in the Course	There will be class activities carried out after covering course topics in the form of case study evaluation and other class activities to help better learn the concepts. Tool will be Papyrus and Java will be the Language for OOP. There will be weekly tasks given to students.			
Programming Assignments Done in the Course	4			
Class Time Spent on (in credit hours)	**Theory**	**Problem Analysis**	**Solution Design**	**Social and Ethical Issues**
	20	15	6	1
Oral and Written Communications	Every student is required to submit at least_1_written report of typically _2__pages and to make _1_ oral presentations of typically__10__ minute's duration. Include only material that is graded for grammar, spelling, style, and so forth, as well as for technical content, completeness, and accuracy.			

COURSE DESCRIPTION FORM: CS4059 Fundamental of Computer Vision

COURSE DESCRIPTION FORM

INSTITUTION FAST School of Computing, National University of Computer and Emerging Sciences, Karachi

PROGRAM TO BE EVALUATED BS-CS– Spring 2023

Course Description

Course Code	CS4059
Course Title	Fundamental of Computer Vision
Credit Hours	3
Prerequisites by Course(s) and Topics	
Grading Policy	
Policy about missed assessment items in the course	Retake of missed assessment items (other than midterm/ final exam) will not be held. For a missed midterm/ final exam, an exam re-take/ pre-take application along with necessary evidence are required to be submitted to the department secretary. The examination assessment and retake committee will decide the exam re-take/ pre-take cases.
Course Plagiarism Policy	Plagiarism in project or midterm/ final exam may result in F grade in the course. Plagiarism in an assignment will result in zero marks in the **whole assignments** category.
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	***75% Theory 25% Practical*** Assessment Items

Assessment Item	Number	Weight (%)
Assignments + Quizzes	3+3	5+5
Midterm Exam	2	10 each
Computer Vision Challenging Task	1	10
Project (Theory)	1	10
Final Exam	1	50

Course Instructors	
Lab Instructors (if any)	
Course Coordinator	Dr. Muhammad Farrukh Shahid
URL (if any)	

Current Catalog Description	Provide the student with knowledge of the theories and applications of image processing and machine vision. Familiarize the student with some important concepts and analytical techniques for linear and non-linear image processing. Give the student some experience in the development of image processing applications and research using Python, OpenCV and other Python libraries for numeric processing Familiarize the student with a broad range of operators and processing techniques for image reconstruction, filtering, enhancement, expansion, motion estimation, optic flow, image classification and video processing
Textbook (or **Laboratory Manual** for Laboratory Courses)	Computer Vision: Algorithms and ApplicationsSecond Edition Richard Szeliski Springer Nature Switzerland AG, 2022
Reference Material	Computer Vision: Principles, Algorithms, Applications, Learning E.R. Davies Academic Press, Elsevier Inc., 2018

Course Learning Outcomes

PLO	Program Learning Outcome (PLO) Statement
PLO3	Design/Develop Solutions Design solutions for complex computing problems and design systems, components, and processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
PLO5	Modern Tool Usage Create, select, and apply appropriate techniques, resources and modern computing tools, including prediction and modelling for complex computing problems.

CLO	Course Learning Outcome (CLO)	Domain	Taxonomy Level	PLO	Tools
01	Understand the theories and methods in image processing and computer vision	Cognitive	3	5	A2, M1, F
02	Formulate, and solve problems in image processing and computer vision	Cognitive	5	5	A1, Q2, M1, M2, F
03	Analyse, evaluate and examine classical computer vision systems	Cognitive	5	3	A3, Q2, M2, F
04	Analyse, evaluate and examine latest computer vision systems	Cognitive	5	3	A4, CCP, F4

Tool: A = Assignment, Q = Quiz, M = Midterm, F=Final, CCP = Complex Engineering Problem.

Topics covered in the course with number of lectures on each topic (Assume 15 weeks of instruction and 1 hour lecture duration)	**Topics to be covered**				
	List of Topics	**Week**	**No. of Weeks**	**Contact Hours**	**CLO(s)**
	Introduction: Introduction to the Course ***(1 Lecture)*** --- The roadmap of the Computer Vision ***(1 Lecture)*** --- *Formal Definition of CV and its application, history, and latest trends in CV* ***(1 Lecture)***	**1**	**1**	**3**	**1**
	Image Formation, Image representation, (***1 Lecture)*** --- Geometric primitives and transformations, Photometric image formation, ***(1 Lecture)*** --- The digital Camera orientation ***(1 Lecture)*** **Assignment no 1 Release (End of Week 2)**	**2**	**1**	**3**	**1,2,3**
	--- RGB/Grayscale, Otsu/K-means thresholding (2 Lecture) --- Histogram equalization, Matte and Compositing (1 Lecture)	**3**	**1**	**3**	**1,2,3**
	Image processing **(1 Lecture)** --- Linear filtering, More neighborhood operators, (1 Lecture) --- Fourier transforms, Pyramids, and wavelets, **(1 Lecture)** **Assignment no 1 Submission (End of Week 4)**	**4**	**1**	**3**	**1,2,3**

	Geometric transformations, Global optimization ***(2 Lectures)*** --- Separable filtering, SVD, PCA ***(1 Lecture)***	**5**	**1**	**3**	
	WEEK 6	***MID -1 Exam***			
	SVD, PCA ***(1 Lecture)*** --- Distance transform, Binary image processing/Morphological Image Processing (***2 Lectures)*** **Assignment no 2 Release (Start of Week 7)**	**7**	**1**	**3**	**2,3**
	Viola-Jones Algorithm, Integral image, Haar features ***(1 Lecture)*** Hough transform, gradient images, ***(2 Lecture)*** ---	**8**	**1**	**3**	**2,3**
	Histogram of Oriented Gradients HoG, ***(1 Lecture)*** SIFT, Blob detection in computer vision. ***(2 Lecture)*** --- **Assignment no 2 Submission (End of Week 9)**	**9**	**1**	**3**	**2,3**
	Introduction to Image Classification ***(1 Lectures)*** --- Image Classification models ***(1 Lecture)*** Simple CNN model for classification ***(1 Lecture)***	**10**	**1**	**3**	

	Week 11	***MID -2 Exam***			
	Modern Classification models Alexnet, GoogleNet ***(3 Lectures)*** **Assignment no 3 Release (Start of Week 12)**	**12**	**1**	**3**	**2,3**
	Image detection Introduction to Single stage and Double Stage detectors ***(3 Lectures)***	**13**	**1**	**3**	**2,3**
	YOLO model, R-CNN model. ***(3 Lectures)*** **Assignment no 3 Submission (Start of Week 14)**	**14**	**1**	**3**	**1,2**
	Revision	**15**	**1**	**3**	
	Week 16	***Final Exam***			
	Review		**1**	**3**	**1,2,3**
	Total		**16**	**48**	

Laboratory Projects/Experiments Done in the Course				
Programming Assignments Done in the Course	All the assignments would be programming based (e.g., C++, Java, Python, Open CV)			
Class Time Spent (in percentage)	**Theory (%)**	**Problem Analysis (%)**	**Solution Design (%)**	**Social and Ethical Issues (%)**
	50	25	20	5
Oral and Written Communications	Every student is required to submit at least 1 written report of typically 10 pages in IEEE research report format. Students will also be called for viva/presentation of the project and any assignment where necessary.			

COURSE DESCRIPTION FORM

FAST-NUCES

INSTITUTION _____

PROGRAM (S) TO BE EVALUATED BS(CS) _____

A. Course Description

Course Code	CS3009
Course Title	Software Engineering
Credit Hours	3+0
Prerequisites by Course(s) and Topics	Software Analysis and Design
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	Midterm examinations 30% Final term examination 50% Assignments(2) 04% Project 10% Quiz(3) 06%
Course Coordinator	Hajra Ahmed
URL (if any)	
Current Catalog Description	Introduction to engineering concepts, software engineering concepts including requirements engineering, software process models, UI design, process improvement, design engineering, software architecture, software project planning, cost estimation, software testing, quality assurance, risk management
Textbook (or **Laboratory Manual** for Laboratory Courses)	Ian Sommerville, Software Engineering 10th Edition Pressman, R S Software Engineering: A Practitioners Approach (7th Edition, European Adaptation), McGraw Hill, 1994
Reference Material	Roger S. Pressman_ Bruce R. Maxin - Software Engineering_ A Practitioner's Approach-McGraw-Hill Education (2014)

Course Goals

A. Course Learning Outcomes (CLOs)

No	CLO	Domain	Taxonomy level
1	Apply suitable process models and activities for medium size software systems	C	3 (Applying)
2	Analyze software requirements and how to produce software design and architecture	C	4 (Analyzing)
3	Apply software quality assurance, verification and validation to medium size software systems	C	4 (Analyzing)
4	Understand key principles and common methods for software project management such as scheduling, size estimation, cost estimation and risk analysis	C	2 (Understanding)

B. Program Learning Outcomes

For each attribute below, indicate whether this attribute is covered in this course or not. Leave the cell blank if the enablement is little or non-existent.

PLO1	Computing Knowledge	Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of complex computing problems.	✔
PLO2	Problem Analysis	Identify, formulate, research literature, and analyse complex computing problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing sciences.	✔
PLO3	Design/Develop Solutions	Design solutions for complex computing problems and design systems, components, and processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.	✔
PLO4	Investigation & Experimentation	Conduct investigation of complex computing problems using research based knowledge and research based methods	
PLO5	Modern Tool Usage	Create, select, and apply appropriate techniques, resources and modern computing tools, including prediction and modelling for complex computing problems.	
PLO6	Society Responsibility	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues relevant to context of complex computing problems..	
PLO7	Environment and Sustainability	Understand and evaluate sustainability and impact of professional computing work in the solution of complex computing problems	
PLO8	Ethics	Apply ethical principles and commit to professional	

		ethics and responsibilities and norms of computing practice.	
PLO9	Individual and Team Work	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.	
PLO10	Communication	Communicate effectively on complex computing activities with the computing community and with society at large.	
PLO11	Project Mgmnt and Finance	Demonstrate knowledge and understanding of management principles and economic decision making and apply these to one's own work as a member or a team.	✔
PLO12	Life Long Learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological changes.	

C. Relation between CLOs and PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

		PLOs											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CLOs	1	✔											
	2		✔										
	3			✔									
	4											✔	

Topics Covered in the Course, with Number of Lectures on Each Topic (assume 15-week instruction and one-hour lectures)

Weeks	Topics	CLO	Tools
1	Introduction, History of Software Engineering, Importance and Need of SE. Software Engineering Ethics, Case Studies	1,4	Prj, M
2	Software Process, Process Activities, Process Models, Waterfall, Incremental, Prototyping, Coping with Change, Software Process Improvement	1	A, Prj, M
3	Agile Methods, Extreme Programming, Scrum, Scaling Agile	1	A, Prj, M
4	Requirement Engineering, Functional and Non-functional	1	P, Prj, M

		Requirements, Requirements Engineering Process, Requirements Elicitation, Specification, Validation, and Change		
	5	WBS, Wideband Delphi estimation method	1,4	M,A, Prj,
	6	Mid Term 1		
	7	Architectural Design, Design Decision, Views, Patterns	2	M
	8	UI Design: Golden rules of design, UI design, analysis and evaluation. WebApp design concepts	2,3	M, Prj
	9	Software Testing: Development, Release and Acceptance testing, types of testing, testing strategies	3	A, Prj, M
	10	Human Resource: Managing people, teamwork	1	Prj
	11	Mid Term 2		
	12	Quality Management: Standards, quality in Agile, Measurements	3	F
	13	Estimation for software projects: Size oriented, Functional Points	4	F
	14	Project Scheduling and Risk management: PERT chart, Gantt chart, Network diagram, Risk mitigation, monitoring and management	4	F
	15	Projects and Reviews		Prj
	16	Final exam		

A = Assignment, Q = Quiz, M = Midterm, F=Final, P=Presentation, W=Written Report, Prj=Project

Laboratory Projects/Experiments Done in the Course	There will be class activities carried out after covering course topics in the form of case study evaluation and other class activities to help better learn the concepts.
Programming Assignments Done in the Course	N/A

Class Time Spent on (in credit hours)	**Theory**	**Problem Analysis**	**Solution Design**	**Social and Ethical Issues**
	1	1	0.8	0.2

Oral and Written Communications	Every student is required to submit at least 2 written reports of typically 5 pages and to make 1oral presentations of typically 20 minute's duration. Include only material that is graded for grammar, spelling, style, and so forth, as well as for technical content, completeness, and accuracy.

Instructor Name: Hajra Ahmed

Instructor Signature _____

Date: 11-Jan- 2023

COURSE DESCRIPTION FORM

INSTITUTION National University of Computer and Emerging Sciences-FAST

PROGRAM (S) TO BE EVALUATED Cyber Security

A. Course Description

(Fill out the following table for each course in your computer science curriculum. A filled out form should not be more than 2-3 pages.)

Course Code	CS3001
Course Title	Computer Networks
Credit Hours	03
Prerequisites by Course(s) and Topics	CS2001-Data Structures
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	Mid1: 12.5% Mid2: 12.5% Final: 50% Project: 10% Assignments: 7.5% Quizzes: 10%
Course Coordinator	Mr. Shoaib Raza
URL (if any)	
Current Catalog Description	The learning and skill based objectives of this course resolve around the following questions: • How does the global network infrastructure work and what are the design principles on which it is based? • In what ways are these design principles compromised in practice? • How should Internet applications be written, so they can obtain the best possible performance both for themselves and for others using the infrastructure? • How do we ensure that it will work well in the future in the face of rapidly growing scale and heterogeneity? The course will focus on the design & undergraduate level analysis of large-scale networked systems and tool (wireshark, packet tracer) based implementation and evaluation of small-scale networked systems in the Lab.

Textbook (or **Laboratory Manual** for Laboratory Courses)	J. F. Kurose and K. W. Ross --- **Computer Networking: A Top Down Approach, 8th Edition**
Reference Material	A. S. Tannenbaum and D. J. Wetherall --- **Computer Networks, 6th Edition**

Course Goals

A. Course Learning Outcomes (CLOs)

No.	Course Learning Outcomes (CLO)	Domain	Taxonomy Level	PLO	Tools
01	Describe and evaluate the protocols, services and functions provided by each layer in the Internet protocol stack.	Cognitive	C2 (Describe)	1	Q, M, F
02	Apply network protocol and communication services for client/server and other application layouts.	Cognitive	C3 (Apply)	3,5	A, CP, M, F
03	Analyze the architectural principles of computer networking and compare different approaches to organizing networks.	Cognitive	C4 (Analyze)	2	Q, M, F

Tool: A = Assignment, Q = Quiz, M = Mid-term, CP=Course Project, F=Final (End-term)

B. Program Learning Outcomes

For each attribute below, indicate whether this attribute is covered in this course or not. Leave the cell blank if the enablement is little or non-existent.

PLO 1	Computing Knowledge	Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of complex computing problems.	✔
PLO 2	Problem Analysis	Identify, formulate, research literature, and analyze complex computing problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing sciences.	✔
PLO 3	Design/Develop Solutions	Design solutions for complex computing problems and design systems, components, and processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.	✔
PLO 4	Investigation & Experimentation	Conduct investigation of complex computing problems using research based knowledge and research based methods	
PLO 5	Modern Tool	Create, select, and apply appropriate	✔

	Usage	techniques, resources and modern computing tools, including prediction and modelling for complex computing problems.	
PLO 6	Society Responsibility	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues relevant to context of complex computing problems.	
PLO 7	Environment and Sustainability	Understand and evaluate sustainability and impact of professional computing work in the solution of complex computing problems	
PLO 8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of computing practice.	
PLO 9	Individual and Team Work	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.	
PLO 10	Communication	Communicate effectively on complex computing activities with the computing community and with society at large.	
PLO 11	Project Mgmnt and Finance	Demonstrate knowledge and understanding of management principles and economic decision making and apply these to one's own work as a member or a team.	
PLO 12	Life Long Learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological changes.	

C. Relation between CLOs and PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

		PLOs											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CLOs	1	✔											
	2			✔		✔							
	3		✔										

Topics Covered in the Course, with Number of Lectures on Each Topic (assume 15-week instruction and one-hour lectures)

Week	Duration	Topics Covered	CLOs
1.	L1 = 1 hour L2 = 1 hour L3 = 1 hour	L1: 1.1 - Introduction, Course L2: 1.2-1.3 - Network Edge, Network Core (ISPs, internet Vs. intranet, Internet) L3: 1.4 - ISPs and Internet Backbones (Tiers of ISPs), Delay, Loss and Throughput in Packet-Switched Networks	1
2.	L1 = 1 hour L2 = 1 hour L3 = 1 hour	L1: 1.5 - Protocol Layers, Service Model L2: 1.6-1.7 Network Under Attacks, History L3: 2.1 Principles of network Applications	1
3.	L1 = 1 hour L2 = 1 hour L3 = 1 hour	L1: 2.2 - Web and HTTP L2: 2.3-2.4 Electronic Mail and DNS L3: 2.5 – P2P Distributions	1,3
4.	L1 = 1 hour L2 = 1 hour L3 = 1 hour	L1: 2.6 Video Streaming and Content Distribution L2-L3: 3.1-3.2 – Transport Layer service, Multiplexing and De-multiplexing	1,2,3
5.	L1 = 1 hour L2-L3 = 2 hours	L1: 3.3 – Connectionless Transport UDP L2-L3: 3.4 – Principles of Reliable data transport	1,2,3
6.	**1 Hour**	**Midterm # 1**	
7.	L1-L2 = 2 hours L3 = 1 hour	L1-L2: 3.5 Connection Oriented Transport: TCP L3: Exam Review	1,2
8.	L1-L2 = 2 hours L3 = 1 hour	L1-L2: 3.6 Principles of Congestion Control L3: 3.7 - TCP Congestion Control	1,2
9.	L1 = 1 hour L2 = 1 hour L3 = 1 hour	L1: 4.1 – Network Layer Overview L2: 4.2 – What's Inside a Router L3: 4.3 – Internet Protocol	1,2
10.	L1 = 1 hour L2 = 1 hour L3 = 1 hour	L1-2: 4.3 – Internet Protocol Continued L3: 4.4 Generalized Forwarded and SDN and 4.5 – Middle Boxes	1,2
11.	**1 Hour**	**Midterm # 2**	
12.	L1 = 1 hour L2 = 1 hour L3 = 1 hour	L1: 4.4 Generalized Forwarded and SDN and 4.5 – Middle Boxes L2: 5.1-5.3 – Routing Algorithms and Intra-AS routing L3: Exam Review	1,2, 3
13.	L1-L3 = 3 hours	L1-2-3: 5.4. Routing Amount the ISP	1,2,3
14.	L1-2 = 2 hours L3 = 1 hour	L1-2: 5.5 – SDN Control Plane L3: 5.6 – ICMP	1,3
15.	L1-3 = 3 hours	L1-3: 6.4 – Switched LANs	1,3
16.	3 hours	Course wrap-up and Project evaluations	1,2,3

Laboratory Projects/Experiments Done in the Course	Project will focus on the application of network fundamentals and practices to develop efficient networking solutions and applications.			
Programming Assignments Done in the Course	Various. Semester Projects will target Network Application which uses cloud components to implement various domains. Socket Programming			
Class Time Spent on (in credit hours)	**Theory**	**Problem Analysis**	**Solution Design**	**Social and Ethical Issues**
	15	15	15	3
Oral and Written Communications	Assignment/ Quizzes and Class Participation			

Instructor Name: Shoaib Raza

Instructor Signature: _____

Date: 11th August 2023

COURSE DESCRIPTION FORM

INSTITUTION National University of Computer and Emerging Sciences-FAST

PROGRAM (S) TO BE EVALUATED Cyber Security

A. Course Description

(Fill out the following table for each course in your computer science curriculum. A filled out form should not be more than 2-3 pages.)

Course Code	CL3001
Course Title	Computer Network Lab
Credit Hours	01
Prerequisites by Course(s) and Topics	CS2001-Data Structures
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	Mid:24 Lab Activity:26 Final: 50
Course Coordinator	Mr. Shoaib Raza
URL (if any)	https://classroom.google.com/c/NjMzMzcxNDE3MDQz?cjc https://classroom.google.com/c/NjE5MjM1NjE3NzE3?cjc=dx2ugzb
Current Catalog Description	This course will significantly benefits security officers, auditors, security professionals, site administrators, and anyone who is concerned about the integrity of their network infrastructure.
Textbook (or **Laboratory Manual** for Laboratory Courses)	Lab Manuals
Reference Material	Cisco Labs

Course Goals

The goal is to enable the students to model their problem in the domain of object oriented programming.in this course this is done by using C++ as the programming language.

A. Course Learning Outcomes (CLOs)

CLO	Course Learning Outcome (CLO)	Domain	Taxonomy Level	PLO	Tools
01	Applying networking, networking media, network topologies and protocol data units	Cognitive	3	1,6,10	LA, M,A
02	Demonstrate and explain switches, their configuration and their usage in VLANs..	Cognitive	3	2,3,4,5	LA,M, F
03	Explain routers, subnetting and their configuration, static routing and dynamic routing	Cognitive	2	3,5	LA, A,F
04	Implementation of the network scenario using different layers of protocol for better understanding of the course	Cognitive	2	1,2,3,4, 5	F

Tool:, Lab Activities = LA, Assignment=A , M = Midterm, F=Final

B. Course Learning Outcomes (CLOs)

1. Applying networking, networking media, network topologies and protocol data units.
2. Demonstrate and explain switches, their configuration and their usage in VLANs.
3. Explain routers, subnetting and their configuration, static routing and dynamic routing.
4. Implementation of the network scenario using different layers of protocol for better understanding of the course.

C. Program Learning Outcomes

PLO		Program Learning Outcome (PLO) Statement
1	**Computing Knowledge**	Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of complex computing problems.

	2	**Problem Analysis**	Identify, formulate, research literature, and analysis complex computing problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing sciences
	3	**Design/Develop Solutions**	Design solutions for complex computing problems and design application, components, and processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
	4	**Investigation & Experiment action**	Conduct investigation of complex computing problems using research based knowledge and research based methods
	5	**Modern Tool Usage**	Create, select, and apply appropriate techniques, resources and modern computing tools, including prediction and modelling for complex computing problems.
	6	**Society Responsibility**	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues relevant to context of complex computing problems
	7	**Environment & Sustainability**	Understand and evaluate sustainability and impact of professional computing work in the solution of complex computing problems
	8	**Ethics**	Apply ethical principles and commit to professional ethics and responsibilities and norms of computing practice.
	9	**Individual and Team Work**	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
	10	**Communication**	Communicate effectively on complex computing activities with the computing community and with society at large.
	11	**Project Management t & Finance**	Demonstrate knowledge and understanding of management principles and economic decision making and apply these to one's own work as a member or a team.
	12	**Life Long Learning**	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological

C. Relation between CLOs and PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

		PLOs											
		1	2	3	4	5	6	7	8	9	10	11	12
	1												
	2												
	3												
	4												
	5												
	6												
	7												
	8												
	9												
	10												
	11												
	12												

Topics Covered in the Course, with Number of Lectures on Each Topic (assume 15-week instruction and one-hour lectures)

Week	Topics Covered	CLO
1	Introduction & History of Networks, Topologies and OSI Model IP Classful addressing (class A to E), identification of different class addresses, network address, and host address and default subnet mask and light introduction of custom subnet mask	1
2	Introduction to Cisco Packet Tracer and Network Devices	1
3	Introduction to Wire Shark and Introduction of Application Layer Protocols Intro about DNS, HTTP, and HTTPS and its exercise on Packet Tracer. Wire Shark analysis of the above protocols.	1
4	To understand and implement: Simple Mail Transfer Protocol (SMTP), & its exercise on Packet Tracer. Wireshark analysis of the above protocols.	2,3

	5	TCP-One Way Communication TCP-Two Way Communication Further Socket Programming Examples: UDP-One Way Communication UDP-Two Way Communication File transfer using TCP Broadcasting}	1,2
	6	Introduction to Telnet & SSH protocol implementation. Hands on Wireshark analysis of above protocol	1
	7	To understand and implementation of File Transfer Protocol (FTP) and Dynamic Host Configuration Protocol (DHCP)	1
	8	Mid Term	
	9	Introduction to NS3. Implementation of flow control & congestion control in NS3	1,2
	10	Intro to Subnetting, CIDR, VLSM. Introduction and Implementation of Subnetting	2,3
	11	Introduction of NAT & its exercise on Packet Tracer. IP & NAT Wireshark Lab	2,3
	12	Introduction to Static Vs Dynamic Routing. Implementation of Dynamic Routing Algorithm: RIP v2 and OSPF.	2,3
	13	Introduction to Vlans and Intervlans routing and continuation of Subnetting	2,3

	14	Introduction to Wireless Routing & it exercise on Packet Tracer.	2,3,4
	15	Revision	2,3,4
	16	Lab Final Exam	1,2,3,4

Laboratory Projects/Experiments Done in the Course	Project will focus on the application of network fundamentals and practices to develop efficient networking solutions and applications.			
Programming Assignments Done in the Course	Semester Assignments will target Network Application which uses cloud components to implement various domains.			
Class Time Spent on (in credit hours)	**Theory**	**Problem Analysis**	**Solution Design**	**Social and Ethical Issues**
	10%	30%	60%	-
Oral and Written Communications				

Instructor Names: Muhammad Ali & Sandesh Kumar

Instructor Signatures: M.Ali & Sandesh

Date: 31/08/2023

COURSE DESCRIPTION FORM: AI2002 Artificial Intelligence (AI)

COURSE DESCRIPTION FORM

INSTITUTION FAST School of Computing, National University of Computer and Emerging Sciences, Karachi

PROGRAM TO BE EVALUATED BS-CS– Spring 2023

Course Description

Course Code	AI2002
Course Title	Artificial Intelligence
Credit Hours	3+1
Prerequisites by Course(s) and Topics	
Grading Policy	Absolute grading
Policy about missed assessment items in the course	Retake of missed assessment items (other than midterm/ final exam) will not be held. For a missed midterm/ final exam, an exam re-take/ pre-take application along with necessary evidence are required to be submitted to the department secretary. The examination assessment and retake committee will decide the exam re-take/ pre-take cases.
Course Plagiarism Policy	Plagiarism in project or midterm/ final exam may result in F grade in the course. Plagiarism in an assignment will result in zero marks in the **whole assignments** category.
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	***75% Theory 25% Practical*** Assessment Items

Assessment Item	Number	Weight (%)
Assignments + Quizzes	3+3	5+5
Midterm Exam	2	15 each
Project (Theory / Lab)	1	10
Final Exam	1	50

Course Instructors	
Lab Instructors (if any)	
Course Coordinator	Dr. Muhammad Farrukh Shahid
URL (if any)	
Current Catalog Description	This course introduces students to the basic knowledge representation, problem solving, and learning methods of artificial intelligence. Upon completion, students should be able to develop

	intelligent systems by assembling solutions to concrete computational problems; understand the role of knowledge representation, problem solving, and learning in intelligent-system engineering; and appreciate the role of problem solving, vision, and language in understanding human intelligence from a computational perspective.
Textbook (or **Laboratory Manual** for Laboratory Courses)	1. Stuart Russell and Peter Norvig, Artificial Intelligence. A Modern Approach, 3rd edition, Prentice Hall, Inc., 2010.
Reference Material	

Course Learning Outcomes

A. Course Learning Outcomes (CLOs)

On successful completion of this course students will have to know how of:

CLO	Name	Domain	Taxonomy Level	PLO	Tools
01	To recognize the notions of rational behavior and intelligent agents.	Cognitive	C2 (Understanding)	2	A, M
02	To identify and relate of methods of blind as well as informed search and ability to practically apply the corresponding techniques.	Cognitive	C2 (Understanding)	2	A, M, F
03	To demonstrate understanding and ability to implement the major concepts, approaches and research in evolutionary algorithms, constraint satisfaction problems, probabilistic reasoning, supervised and unsupervised learning and other AI areas.	Cognitive	C2 (Understanding) C3 (Applying)	3	A, M, F

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

B. Program Learning Outcomes

For each attribute below, indicate whether this attribute is covered in this course or not. Leave the cell blank if the enablement is little or non-existent.

1. Computing Knowledge	Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of complex computing problems.	
2. Problem Analysis	Identify, formulate, research literature, and analyze complex computing problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing sciences.	✔
3. Design/ Develop Solutions	Design solutions for complex computing problems and design systems, components, and processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.	✔
4. Investigation & Experimentation	Conduct investigation of complex computing problems using research-based knowledge and research-based methods.	
5. Modern Tool Usage	Create, select, and apply appropriate techniques, resources and modern computing tools, including prediction and modeling for complex computing problems.	
6. Society Responsibility	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues relevant to context of complex computing problems.	
7. Environment and Sustainability	Understand and evaluate sustainability and impact of professional computing work in the solution of complex computing problems.	
8. Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of computing practice.	

9. Individual and Teamwork	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.	
10. Communication	Communicate effectively on complex computing activities with the computing community and with society at large.	
11. Project Management and Finance	Demonstrate knowledge and understanding of management principles and economic decision making and apply these to one's own work as a member or a team.	
12. Lifelong Learning	Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological changes.	

C. Mapping of CLOs on PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

		PLOs											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CLOs	1		✔										
	2		✔										
	3			✔									

	Topics to be covered				
Topics covered in the course with number of lectures on each topic (Assume 15 weeks of instruction and 1 hour lecture duration)	**List of Topics**	**Week**	**No. of Weeks**	**Contact Hours**	**CLO(s)**
	Introduction: Introduction to AI, Foundations of AI, History of AI, AI in industry, the concept of neurons and neural networks, Basic components of AI ***(1 Lecture)*** --- Identifying AI systems, Branches of AI, ***(1 Lecture)*** --- Intelligent Agents Agents and Environments, sensors, actuators, ***(1 Lecture)***	**1**	**1**	**3**	**1**
	The Concept of Rationality, Performance measures, Rationality, Rationality V/S Omniscience (***1 Lecture)*** --- The Nature of Environment, Performance, Environment, Actuators and Sensors (PEAS), Agent Types, Properties of environments, The structure of Agents ***(1 Lecture)*** --- Problem Representation: Introduction to Trees and Graphs ***(1 Lecture)*** **Assignment no 1 Release (End of Week 2)**	**2**	**1**	**3**	**1,2,3**
	--- Problem Solving by Searching: Problem Solving agents, Components of Problem, formulating problems, Searching for Solutions ***(2 Lecture)*** --- Measuring problem-solving performance, Uniformed Searching, ***(1 Lecture)***	**3**	**1**	**3**	**1,2,3**
	Informed Heuristic search strategies		**1**	**3**	**1,2,3**

	(1 Lecture) **----------** Local searching: **(1 Lecture)** **----------** Constraint Satisfaction Problems **(1 Lecture)** **Assignment no 1 Submission (Start of Week 4)**	**4**			
	Constraint Satisfaction Problems Backtracking search for CSPs, Local search constraint satisfaction problems ***(2 Lectures)*** **----------** The structure of problems ***(1 Lecture)***	**5**	**1**	**3**	
	WEEK 6	***MID -1 Exam***			
	Adversarial Search, Games, Optimal decisions in Games, The minimax algorithm, Alpha beta pruning (***2 Lectures)*** **----------** Logical Agents, First Order Logic, Inference in First-Order Logic ***(1 Lecture)*** **Assignment no 2 Release (Start of Week 7)**	**7**	**1**	**3**	**2,3**
	Uncertainty, acting under uncertainty, Uncertainty in AI, Fuzzy Logic Basic Probability, Conditional Probability, Bayes Rule, Probabilistic Reasoning, representing Knowledge in an Uncertain Domain ***(2 Lecture)*** **----------** Bayesian Networks, ***(1 Lecture)***	**8**	**1**	**3**	**2,3**
	Dynamic Bayesian Network ***(1 Lecture)***		**1**	**3**	**2,3**

	---------- Introduction to Model-driven and Data-driven approach and Review on Probability and Linear Algebra, Performance evaluation [ROC, Confusion Matrix]. **Supervised Learning methods:** Linear Regression Logistic Regression ***(2 Lectures)*** **Assignment no 2 Submission (End of Week 9)**	**9**			
	Non-parametric Methods, Decision Trees ***(1 Lectures)*** ---------- Neural Networks, Units in NN, Single Layer Feed-forward and Multi-Layer Feed-Forward NN. ***(1 Lecture)*** **Unsupervised Learning methods** Clustering (K-mean) ***(1 Lecture)***	**10**	**1**	**3**	
	Week 11	***MID -2 Exam***			
	Reinforcement Learning Agent, environment, reward, state, policy, Q value, model of the environment. Reinforcement learning algorithms, ***(3 Lectures)*** **Assignment no 3 Release (Start of Week 12)**	**12**	**1**	**3**	**2,3**
	Reinforcement Learning Type of Reinforcement learning Popular models of RL (Q and Markov decision process ***(3 Lectures)***	**13**	**1**	**3**	**2,3**

	Recent trends in AI and applications of AI algorithms Trends, Case study of AI systems [Anomaly Detection], ***(3 Lectures)*** **Assignment no 3 Submission (Start of Week 14)**	**14**	**1**	**3**	**1,2**
	Revision	**15**	**1**	**3**	
	Week 16	***Final Exam***			
	Review		**1**	**3**	**1,2,3**
	Total		**16**	**48**	

Laboratory Projects/Experiments Done in the Course	**Lab content is mentioned on the page number 11 of this document.**			
Programming Assignments Done in the Course	All the assignments would be programming based (e.g., C++, Java, Python)			
Class Time Spent (in percentage)	**Theory (%)**	**Problem Analysis (%)**	**Solution Design (%)**	**Social and Ethical Issues (%)**
	50	25	20	5
Oral and Written Communications	Every student is required to submit at least 1 written report of typically 10 pages in IEEE research report format. Students will also be called for viva/presentation of the project and any assignment where necessary.			

AI Lab Learning Outcomes

A. LAB Course Learning Outcomes (CLOs)

On successful completion of this course lab students will have to know how of:

CLO	Name	Domain	Taxonomy Level	PLO	Tools
01	To identify and implement the methods of blind as well as informed search and ability to practically apply the corresponding techniques.	Cognitive, Psychomotor	C2 (Understanding) C3 (Applying)	3	A, M, F
02	To demonstrate understanding and ability to implement the major concepts, approaches and research in evolutionary algorithms, constraint satisfaction problems, probabilistic reasoning, supervised and unsupervised learning and other AI areas.	Cognitive, Psychomotor	C2 (Understanding) C3 (Applying)	3	A, M, F

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

B. Program Learning Outcomes

For each attribute below, indicate whether this attribute is covered in this course or not. Leave the cell blank if the enablement is little or non-existent.

1. Computing Knowledge	Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of complex computing problems.	
2. Problem Analysis	Identify, formulate, research literature, and analyze complex computing problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing sciences.	
3. Design/ Develop Solutions	Design solutions for complex computing problems and design systems, components, and processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.	
4. Investigation & Experimentation	Conduct investigation of complex computing problems using research-based knowledge and research-based methods.	
5. Modern Tool Usage	Create, select, and apply appropriate techniques, resources and modern computing tools, including prediction and modeling for complex computing problems.	
6. Society Responsibility	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues relevant to context of complex computing problems.	
7. Environment and Sustainability	Understand and evaluate sustainability and impact of professional computing work in the solution of complex computing problems.	
8. Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of computing practice.	

9. Individual and Teamwork	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.	
10. Communication	Communicate effectively on complex computing activities with the computing community and with society at large.	
11. Project Management and Finance	Demonstrate knowledge and understanding of management principles and economic decision making and apply these to one's own work as a member or a team.	
12. Lifelong Learning	Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological changes.	

C. Mapping of CLOs on PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

		PLOs											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CLOs	1			✔									
	2			✔									

Lab/ Practical Component of the course

Weeks	Contents/Topics	Assessment Items (Case Study/ Exercise Assignment/ Quiz etc.)
Week 01	Getting familiarization to the Python- It's famous **IDE** and, Introduction to the AI with Practical Examples	Task-1
Week-02	Introduction to Python Libraries	Task-2
Week-03	Searching Problem Solving by Searching – Uninformed/Blind Search Algorithms Searching Problem Solving by Searching – Informed/Heuristic Based Search	Task 3
Week-04	Demonstration on Raspberry *Pi* and *Arduino board* (HARDWARE) ***Project Announcement***	Task 4
Week-05	Constraint Satisfaction Problem ***Project Proposal Submission***	Task 5,
Week-06	**Theory MID-1 Exam**	
Week-07	Adversarial Search Evolutionary Search Algorithms	Task 6
Week-08	**LAB MID**	
Week-09	Dynamic Bayesian Networks, HMM, KF	Task 7
Week-10	Supervised Learning	Task 8
Week-11	**Theory MID-2 Exam**	
Week-12	Un-Supervised Learning	Task 9
Week-13	Reinforcement Learning	Task 10
Week-14	Project Evaluation / Case Study	Task 11
Week-15	**Lab Final Exam**	Term Project

Practical/ Programming Work/ Tools:
1) Python / Google Colab / Jupyter Notebook

Assessment Instruments with Weights *(Homework, quizzes, midterms, final, programming assignments, lab work, etc.)*

Assessment Item	Number	Weight (%)
Project	1	10
Lab Tasks	10	20

Lab Mid Term	1	20
Final Exam	1	50

Grading Policy: Absolute

National University

of Computer and Emerging Sciences

Department	Computer Science	**Dept. Code**	CS
Course Title	Technical and Business Writing	**Course Code**	SS153
Pre-requisite(s)	SS152	**Credit Hrs.**	3
Course Objective:	The purpose of this course is to enable students to understand the definition and the style of technical communication. The students will learn how to produce effective technical documents, like, reports, user manuals, specification, etc. in business and industry. They will learn the universally accepted and international standards of technical communication. Using principles of analyzing and planning to meet the reader's informational needs, students produce proposals, instructions and the various types of informative and persuasive reports used in organizations. In this way, they will develop skills necessary for effective performance in professional life.		

PLO	**Program Learning Outcome (PLO) Statement**	
10	Communication	Communicate effectively on complex computing activities with the computing community and with society at large.
12	Life-long Learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological changes.

CLO	**Course Learning Outcome (CLO)**	**Domain**	**Taxonomy Level**	**PLO**	**Tools**
01	Utilize efficient writing style for producing an effective technical document.	Cognitive	3	10	**A, M**
02	Compose reports for effective performance in professional life.	Cognitive	6	10	**A, F, CA**
03	Design, document, and develop a research project.	Cognitive	6	12	**RP, M, F**
04	Displays the internationally accepted standards of technical communication.	Affective	5	12	**M, F,RP**

Tool: A = Assignment, M = Midterm, F=Final, CA =Class Activity ,RP = Research Project

Text Book(s)	**Title**	Technical Communication and its applications
	Author	Jerome N. Borowick
	Publisher	Prentice Hall
Ref. Book(s)	**Title**	Technical Writing
	Author	John M. Lannon
	Publisher	Scott Foresman & Co.
	Title	Writing for Computer Science
	Author	Justin Zobel.
	Publisher	Springer.

Assessment

Particulars	**% Marks**
1. Assignments	8 %
2. Oral Presentation	2 %
3. Final Project	5 %
4. Class Performance	5%
5. Mid-Terms	30 %
6. Final Exam	50 %
Total:-	**100**

Weeks	Contents/Topics	CLOs	Tools
Week-01	• Orientation class • Technical Writing: Definitions, History, Purposes, Functions, Defining Characteristics	1	A1, M1
Week-02	• The Technical Style: Clarity, Precision, Objectivity, Simplicity, & Economy	1	A1, M1
Week-03	• The Technical Writing Process- Purpose analysis & Audience Analysis • Data Collection & Analysis- Primary & Sources, Qualitative & Quantitative Data	1	A2, M1
Week-04	• Constructing Effective Paragraphs for the technical prose • Writing Synthesis Essay • **Assignment 1: Synthesis Essay (Deadline: week 5)**	1	A1, M1
Week-05	• How to write instructions in user guides • **Assignment 2: Making a User guide (Deadline: week 8)**	2	A2, F
Week -06	**MID 1**		
Week-07	• CV/Resume Writing • Cover Letters • **Assignment 3: Resume writing (Deadline: week 10)**	2,4	A3, M2
Week-08	• Introduction to Scientific Research • The Technical Report: Writing the Introduction and Literature Review Sections	3,4	FP, M2
Week-09	• Technical Reports: Method, Results, Conclusion and Recommendation Sections	3,4	FP, M2,F
Week-10	• Preparing Prefatory Parts for Technical Reports: Title Page, Table of Contents, Letter of Transmittal, Abstract, & Executive Summary	3,4	FP, M2
Week-11	• Supplementary Parts • Citation & Referencing	3,4	FP, M2
Week-12	**MID-II**		
Week-13	• Writing Project Proposals • Software Management Plan • Software Requirements Specifications • Software Design Specifications	3,4	F
Week-14	• Feasibility Studies **(Class Participation 1-Activity)** • Progress Reports **(Class Participation 2- Activity)**	2,4	F, CP
Week-15	• Technical Proposals (**Class Participation 3- Activity)** • Business Letters: Format, Tone, Structure **(Class Participation 4- Activity)**	2,4	F, CP
Week-16	• Memo Writing, Minutes of the Meeting **(Class Participation 5- Activity)** • **Project Presentation** • Revision	2,3, 4	F, CP

COURSE DESCRIPTION FORM INSTITUTION

National University of Computer & Emerging Sciences (FAST-NUCES) Karachi

PROGRAM (S) TO BE EVALUATED BS (Computer Science) / BS (Software Engineering)

A. Course Description

Course Code	**CS3002**
Course Title	Information Security (Fall 2023)
Credit Hours	3
Prerequisites by Course(s) and Topics	CS3001 Computer Networks
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	• Semester Assessments – 20% (2 Assignments 5% + 4 Quizzes 10% + Project 5%) • Mid-Term 1 Exam – 15% • Mid-Term 2 Exam – 15% • End-Term Exam – 50% • **Late submissions will only awarded a maximum of 20% weightage of the respective assessment.** • **Plagiarism punishment up to 20 weightage.** ❖ Project topics are limited to **IT Security Management and Risk Assessment Problems and their solutions including use of any tools covered in this course.** ❖ **Proposals based on programming are not entertained.** ❖ Marks distribution: 20% proposal , 60 Documentation and Execution, 20% Presentation
Course Coordinator	Dr. Nadeem Kafi Khan
URL (if any)	Individual URLs of Google classroom for each sections to be pasted here before posting the PDF version.
Current Course Description	Information security foundations, security design principles; security mechanisms, symmetric and asymmetric cryptography, encryption, 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.
Textbook (or **Laboratory Manual** for Laboratory Courses)	1– Computer Security, Principles and Practice, William Stallings, 4th Edition, Pearson Publication, 2018 (Main Textbook for Theory) 2- Computer and Internet Security, A Hands-On Approach, Wenliang Du, 3rd Edition, Create Space Publications, 2022 (for labs)
Reference Material	1- Security in Computing, FIFTH EDITION by Charles P. Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies, 2015 2- Principles of Information Security, M. Whitman and H. Mattord, 7th Edition, CENGAGE Learning Inc., 2022
Course Goals	In this course, students learn basics of information security, in both management aspect and technical aspect. Students understand of various types of security incidents and attacks, and learn methods to prevent detect and react incidents and attacks. Students will also learn basics of application of cryptography, which are one of the key technologies to implement security functions. In the last session, teams of students will make presentation of their study project for a topic related to information security.

CLO	Course Learning Outcome (CLO)	Domain	Taxonomy Level	PLO			
01	**Explain** key concepts of information security such as design principles, cryptography, risk management, and ethics	Cognitive	C2 (Understanding)	1			
02	**Discuss** legal, ethical, and professional issues in information security.	Cognitive	C2 (Applying)	2			
03	**Apply** various security and risk management tools for achieving information security and privacy.	Cognitive	C3 (Applying)	5			
04	**Identify appropriate techniques to tackle** and solve problems in the discipline of information security.	Cognitive	C4 (Analyzing)	2			

Topics Covered in the Course, with Number of Lectures on Each Topic (assume 15-week instruction and three one-hour lectures per week)

Week #	Topic	Reference Text	CLO
1	**Information Security Foundations**: Definition of Computer Security with Examples, The Challenges of Computer Security, A Model for Computer Security, Threats, Attacks, and Assets, Functional Requirements, Security Design Principles, Attack Surfaces and Attack Trees, Security Policy, Security Implementation Assurance and Evaluation, Standards	Main Textbook, Chapter 1 Sections 1.1, 1.2, 1.4, 1,6, 1,7	1
2	**Cryptographic Tools**: Symmetric encryption, Feistel cipher structure. Structure and function of DES and AES, Compare and contrast stream encryption and block cipher encryption. Distinguish among the major block cipher modes of operation.	Textbook Chapter 2, Sections 2.1 and 2.2 + Slides provided for DES and AES	1,3,4
3	**Cryptographic Tools:** Message Authentication and Hash Functions, Authentication Using Symmetric Encryption, Message Authentication without Message Encryption, Secure Hash Functions, Public-Key Encryption, Public-Key Encryption Structure, Applications for Public-Key Cryptosystems **Quiz # 1**	Textbook Chapter 2, Section 2.3, 2.4	1,3,4
4	**Cryptographic Tools:** RSA (Asymmetric Encryption Algorithm), Digital Signature, Public-Key Certificates, Symmetric Key Exchange Using Public-Key Encryption Digital Envelopes	Textbook Chapter 2, Sections 1.1 and 1.2	1,3,4
5	**User Authentication:** Digital User Authentication Principles, Password based authentication, Token-based, and Biometric authentication and related security issues **ASSIGNMENT # 1 (18th Sep ← → 28th Sep)**	Textbook Chapter 3, Sections 3.1 to 3.6	1,3,4
	MIDTERM-I EXAM		

6	**Access Control**: Principles, Discretionary Access Control, Role-based Access Control and Attribute based Access Control	Textbook Chapter 4, Sections 4.1 to 4.7	**1,3,4**	
7	**Database Security:** Need, SQL Injection Attacks, Database Access Control and Database Encryption **Quiz # 2** **PROJECT PROPOSAL SUBMISSION**	Textbook Chapter 5, Sections 5.1 to 5.7	**1,3,4**	
8	**Malicious Software:** Types, Propagation, Payload, and Countermeasures	Textbook Chapter 6, Sections 6.1 to 6.10	**1,3,4**	
9	**Cloud Security and Approaches:** Service and Deployment models, Security Issues for Cloud Computing, Addressing Security Concerns, Data Protection, Security approaches in cloud Computing Assets **Quiz # 3 +** **ASSIGNMENT # 2 (16th Oct ← → 26th Oct)**	Textbook Chapter 13, Section 13.1, 13.2, 13.3	**1,3,4**	
	MIDTERM-II EXAM			
10	**IT Security Management and Risk Assessment:** security policies, policy formation and enforcement, risk assessment	Textbook Chapter 14, Sections 14.1 to 14.3	**2**	
11	**Legal and Ethical Aspects:** Cybercrime, Intellectual Property, Privacy and Anonymity of Data and Ethical Issues.	Textbook Chapter 14, Sections 19.1 to 19.4	**2**	
12	**Intrusion Detection**: Basics, Types and Examples **PROJECT SUBMISSION**	Textbook Chapter 8, Sections 8.1 to 8.6	**1,3,4**	
13	**Firewalls and Intrusion Prevention**: Basics, Types, and Prevention Systems **Quiz # 4 (Latest by 17th Nov)**	Textbook Chapter 9, Sections 9.1 to 9.3 and 9.6	**1,3,4**	
14	**Software Security:** Software Vulnerabilities and Protection Mechanisms	Textbook Chapter 11, Sections 11.1 to 11.3	**1,3,4**	
15	**PROJECT PRESENTATIONS**			
	FINAL EXAM			

Laboratory Projects/Experiments Done in the Course				Students will be given assignments related to the theory concepts they learn in classroom lectures. A project (research / development) discussing issues related to the state-of-the-art information security concepts will also be assigned.				
Programming Assignments Done in the Course				A few programming labs are given to apply the key concepts of information security.				
Class Time Spent on (in % credit hours)	**Theory**			**Problem Analysis**	**Solution Design**			**Social and Ethical Issues**
	40%			25%	25%			10%

COURSE DESCRIPTION FORM

INSTITUTION Fast University of Computer and Emerging Sciences

PROGRAM (S) TO BE EVALUATED BS(CS)

A. Course Description

(Fill out the following table for each course in your computer science curriculum. A filled out form should not be more than 2-3 pages.)

Course Code	CS-4048
Course Title	Data Science
Credit Hours	3
Prerequisites by Course(s) and Topics	Data Structures
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	Assignments, Project, MidTerm1, MidTerm2 (Programming based), Final
Course Coordinator	Dr. Muhammad Nouman Durrani
URL (if any)	
Current Catalog Description	Data Science is a dynamic and fast-growing field at the interface of Statistics and Computer Science. It is an interdisciplinary field about processes and systems to extract knowledge or insights from data in various forms (Wikipedia). This course will introduce students to this rapidly growing field and equip them with some of its basic principles and tools including data collection and integration, data cleaning, data analysis using machine learning, visualization and effective communication. The main focus of these topics with be on understanding and integration of concepts and their application to solving problems.
Textbook (or **Laboratory Manual** for Laboratory Courses)	Lecture Notes Davy Cielen, Arno D. B. Meysman, and Mohamed Ali, Introducing Data Science, Big data, machine learning, and more, using Python tools, May 2016
Reference Material	Journals: Machine Learning, Pattern Recognition

	Conferences: ICPR, ICDM, ICML, KDD www.datacamp.com (Students are given free access on many tutorials)			
Program Learning Outcomes	PLO1	Computing Knowledge	Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of complex computing problems.	✔
	PLO2	Problem Analysis	Identify, formulate, research literature, and analyse complex computing problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing sciences.	✔
	PLO3	Design/Develop Solutions	Design solutions for complex computing problems and design systems, components, and processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.	✔
	PLO4	Investigation & Experimentation	Conduct investigation of complex computing problems using research based knowledge and research based methods	✔
	PLO5	Modern Tool Usage	Create, select, and apply appropriate techniques, resources and modern computing tools, including prediction and modelling for complex computing problems.	✔
	PLO6	Society Responsibility	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues relevant to context of complex computing problems..	✔
	PLO7	Environment and Sustainability	Understand and evaluate sustainability and impact of professional computing work in the solution of complex computing problems	✔
	PLO8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of computing practice.	✔
	PLO9	Individual and Team Work	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.	✔
	PLO10	Communication	Communicate effectively on complex computing activities with the computing community and with society at large.	✔
	PLO11	Project Managment and Finance	Demonstrate knowledge and understanding of management principles and economic decision making and apply these to one's own work as a member or a team.	✔
	PLO12	Life Long Learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological changes.	✔

Course Goals

Course Learning Objectives:

CLO 1: Student should able to describe what Data Science is and the skill sets needed to be a data scientist.

CLO 2: Students should able to get inside knowledge about data such as using data to get information about an unknown quantity of interest.

CLO 3: Students should able to understand supervised and unsupervised modelling, over fitting and its avoidance, visualization

CLO 4: Students should able to apply most important data science methods, using open-source tools

CLO 5: Students should able to work as a team while integrating important components in data science

Student Outcomes Addressed by the Course (From ABET)

(a) An ability to apply knowledge of computing and mathematics appropriate to the program's student outcomes and to the discipline

(b) An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution

(f) An ability to communicate effectively with a range of audiences

(j) An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices [CS]

(k) An ability to apply design and development principles in the construction of software systems of varying complexity [CS]

Relation between CLOs and PLOs

CLO No.	Domain	Taxonomy level	PLO
1	Cognitive	3	1
2	Cognitive	4	2
3	Cognitive	5	2
4	Cognitive	4	5
5	Cognitive	5	9

Topics Covered in the Course, with Number of Lectures on Each Topic (assume 15-week instruction and one-hour lectures)

1. Topics to be covered:

List of Topics	No. of Weeks	Contact Hours	CLO
Basics of Data Science, Motivating Examples, Introduction to Python	**1**	**3**	**1, 4**
Data Preparation: Data Cleaning EDA: Compute Simple Statistics, Simple Visualization, Case	**2**	**6**	**1,2, 4**

Studies, Practical Examples				
Supervised Classification (kNN, Naïve Bayes, SVM, Decision Tree, Logistic Regression, Neural Networks)	**3**	**9**	**3,4**	
Unsupervised Classification & Feature Extraction (K-means, PCA, SVD, LDA)	**2**	**6**	**3,4**	
Regression Analysis	**1**	**3**	**2,3,4**	
Ensemble Classifiers	**2**	**6**	**2,3,4**	
Associative Learning	**1**	**3**	**3,4**	
Introduction to Graph Analytics / Visualization, Hadoop Map Reduce	**3**	**9**	**1,3,4**	
Group Project Presentations	**1**	**3**	**5**	
Total	**16**	**48**		

Laboratory Projects/Experiments Done in the Course	Yes. Project and Regular Lab Classes once a week			
Programming Assignments Done in the Course	Yes. Infect Midterm 2 was conducted on Lab totally based on programming			
Class Time Spent on (in credit hours)	**Theory**	**Problem Analysis**	**Solution Design**	**Social and Ethical Issues**
	40 %	25 %	25%	10%
Oral and Written Communications	Every student is required to submit at least __1___ written reports of typically _4____ pages and to make __1___ oral presentations of typically __10___ minute's duration. Include only material that is graded for grammar, spelling, style, and so forth, as well as for technical content, completeness, and accuracy.			

Instructor Name ____**Dr Muhammad Nouman Durrani**_____

Instructor Signature _____

Date _____**08/02/2023**_____

Course Title: DevOps / Applied DevOps
Course Code: CS4067- SE4007
Credit Hours: 3
Instructor: Murtaza Munawar Fazal

Course Objectives:

The objective of the course is introduction to Continuous Integration and Continuous Delivery with usage of source control, project management tools like GitHub Projects and Azure Boards, study different deployment strategies, Virtualization, Containerization and incorporate different approval process for continuous delivery.

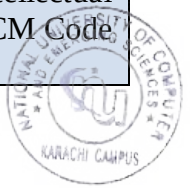
Tentative Weekly Plan

Week	Topic
1.	→ Course Introduction → DevOps Basics → GitHub Project
2.	→ Azure Boards → GitHub Basics and branch control → GitHub Branching options
3.	→ GitHub Hooks → Integrating GitHub and Azure → Continuous Integration with Pipeline
4.	→ Continuous Integration with Pipeline continued → Creating Pipeline with YAML file → Azure Resource Manager
5.	→ Integrating Azure Pipelines with External Source Control → Infrastructure as Code → ARM Templates → Azure Bicep Templates
6.	→ Midterm I
7.	→ Continuous Delivery → Creating Release Pipeline → Release Approvals using manual approvals and Automated Approvals (Release Gates)
8.	→ Implementing Release Gates → Monolithic v/s Microservices Architecture → Virtualization, Containerization with Docker and Kubernetes
9.	→ Release Process and Different DevOps Tools

	→ Continuous Deployment and Blue-Green Deployment → Deployment Slots
10.	→ Feature Toggle → Canary Release → Dark Launching
11.	→ Midterm II
12.	→ A/B Testing → Deployment Rings → Implementing Unit Test and Functional Test using Selenium in Release Pipeline
13.	→ Package Dependency Management → Versioning Artifacts
14.	→ Intro to Continuous Monitoring and Feedback → Feedback integration with Azure Boards and Telemetry services
15.	→ Intro to Secure DevOps → Implement Static Analyzer (SonarCloud) → Implement Dynamic Analyzer (OWASP)
16.	→ Project Presentations and Demonstration
17.	→ Final Exam

TEACHING PLAN

Course Title:	Professional Practices in IT
Course Code:	CS4001
Credit:	3+0
Contact Hours:	3 hour's lecture per week
Semester:	
Prerequisite:	None
Instructor:	Dr. Rauf Ahmed Shams Malick
Website: **Email:**	
Objectives:	After completing the course, the students will be able to: ● Understand positive and negative ways in which computer technology alters modes of social interaction at the personal level. ● Able to evaluate ethical / social trade-offs in technical decisions. ● Evaluate the professional code of ethics from the ACM, the IEEE Computer Society, and other organizations. ● Identify contemporary examples of intangible digital intellectual property. ● Investigate the impact of technological solutions to privacy problems.
Synopsis:	The major areas of study include Social Context, Ethical Argumentation, Community Values, Intellectual Property, the global, Social and Environmental Impacts of Computer Use and Disposal; IEEE CS/ACM Code of Ethics and Professional Practice.



Lecture Schedule:

WEEK	TOPICS/SUBTOPICS	Quiz	Activities	Case Studies
1.5	**Introduction to Professional Practices** ● Introduction of Professional practices. ● Rights. Negative vs positive rights. ● Legal Rights vs Moral rights ● Character, morals, personality, culture, self identity, ● Professional Ethics Introduction to Information ethics, types of ethics and stages of ethics in information systems, Standards in ethical thinking, ● profession and role of collective body, course accreditation ● Historic review of information ethics, key contributors, knowledge areas for information related ethics. ● Professionalism in Business, Self-Professionalism ● Ethical Decision-Making scenarios: Case studies for Public, Client and employer, Product, Judgement, Management, Profession, Colleagues, Self, professional responsibilities in context of code of conduct ● Work from home	Managing Oneself, 2 page note (Quiz 1 Mark) Deadline: before 4th Lecture	Class Activity Group Discussion. Class Activity Group Discussion. **5th Lec Assign 1.5 Marks A 1**	1. Managing OneSelf 2. Dark side of IT Class discussion **Quiz 1 Mark**

1.5(3)	**Organizations: (Kinds of organization, registrations, legal formal framework)** ● Open, closed, hierarchy vs flat structure, Google/Facebook ● Google /Seith (Freedom of discussion, challenging environment, sense of ownership) ● Organizations, Commercial organization, corporates ● Private limited companies Constitution of limited companies (the *memorandum of association* and *articles of association*) ● Directors ● Non commercial bodies ● How to start a company.	2 Lectures 1 Lecture (Guest Speaker)	Local presenter from local company registration/ Taxation process MOU/Article of Association	HBR Case 1.Culture at Google pg 1-12
04	**Good and Bad (Google vs Seith Organization)** ● Your Startup ● Seith Organization ● Google/Facebook Culture of Organization ● Decision making, independence, micro/macro management, ownership, talent acquisition ● Remote Teams (Work from home) ● Corporate social responsibility	2 Lectures Theory 1 Guest Speaker	Presenter from North America. Apple, Google, Facebook etc. Venture Drive, Attribe Solutions	2. 1996 Mount Everest Collapse
05	**Case Study : Build a great place to work** Assignment and discussions		Assignment Reading 7th Sept Start 9th Sept Due : 16th Sept	
6	**mid term**			

7	**Professional Contracts** ● Focus areas for contract terms and conditions, what is to be produced, what is to be delivered, ownership of rights, confidentiality, mode of payments, A model to calculate payments for delays and changes, penalty terms and conditions, obligations of the client, standards and methods for working, ● Progress meetings, parties nominated focal persons, Acceptance procedure, Warranty and maintenance clauses Effect of Inflation for long, force de majeure circumstances, termination of the contract, Arbitration nomination, Applicable laws, Contract hire Time and material, consultancy contract, liability for the defective software programs. ● NDA, MOU, Proposals, Legal Issues (demonstrating NDA & MOU) ● Software related contracts, Legal value of contract for software development, professional practices for writing quality software contracts, structure of fixed price contracts for custom built software programs ● Risk	3 Theory Lectures + 1 hr Guest Speaker		NDA, & MOU **Assignment no. 2** **5 Marks**
08	**Human Resource Management and health/ safety of employees** ● Introduction ● Model of human resource management, features of HRM ● Training of employees, keeping track of skill of employees, problems in organization faced by HRM. ● Health and safety of employee is a major concern ● Act of 1974 related to health and safety ● Employee/Employer contracts, HR activities, appraisals, descrimination, **Harassment**	2 hrs Lecture Theory + HR Guest Speaker + Scaling a solo startup to SMEs		**1.5 Marks Quiz**

		Guest Speakers		
09	**Intellectual Property and copyright laws** ● IP Principles and Laws basic definitions and concepts, Key challenges for protection of IP rights in new technologies. ● Ethical Arguments About Copying software products, common causes of IP violations in society ● Forms of IP, Patents, trademarks and copyright laws, applications in society and social aspects ● Case studies for applications of IP violations ● Plagiarism ● Demonstration of Patent Document, How to write a patent	2 hrs Lectures Theory + 1 Guest Speaker		**1.5 Marks Quiz**
10	**MID 2**			
11	**Descrimination** Ethnic, racial, gender, age. Perspectives (perceptions), Judgement Anti descrimination legislation Direct/Indirect Positive/Negative (Lawful/unlawful) Professional descrimination Nepotism Disability (For blinds, autistics, deafs. etc)			HBR Case Three cases of workplace descrimination. **CP 1 Quiz Mark** **Assignment 3 5 Marks**
12	**Service Oriented Organizations** ● Legal liability and mechanism, safety related applications ● Regularity issues, standards, certificate and licensing, professional code of practices, regulation by law. ● Product liability and consumer protection act (CPA) 1987, negligence ● Work from home, human/professional perspective, ● Risk	2 hrs Theory + 1 hr Guest Speaker **2 page note CP 2 Marks Quiz**		

		'Performance during work from home' System HR (tentative)		
13	**Cyber Law, computer misuse** ● Categories of misuse ● computer frauds, unauthorized access to a computer ● Computer misuse, hacking, types of hacking ● Tools of hacking, computer security ● Ethical hacking, penetration testing ● Hacker code of conduct **Data Protection** Data protection and privacy of data importance. ● Impact of internet, factors affecting regulation ● Defamation and protection ● Key weakness in code of conduct, future challenges ● Defining privacy, Common privacy threats, New Technologies rising risks, managing personal data, Critical need for privacy protection. ● Digital Frauds ● Risks	3 Theory Lectures 2 hrs Guest Speaker 1. Careem 2. Financial Sector (IS Audit Professional) 1 hr article review and CP **2 Marks Quiz**		**1. New Laws on Data Privacy and Security Are Coming. Is Your Company Ready?** by Andrew Burt July 31, 2019 2. **Customer Data: Designing for Transparency and Trust** https://hbr.org/2015/05/customer-data-designing-for-

				transparency -and-trust
14	**Internet Issues** ● Information security basic concepts, CIA principles ● Information classification, IS organizational structure ● Security plans and case studies ● Cyber Bullying ● Defamation ● Fake content/Rumours/Digital Blackmailing ● Cyber Crime Legistelation in Pakistan ● Social platform Tik Tok, Youtube ● Risks	3 hrs Theory Lectures		Cyber Security, HBR, 2019. Ch 1. Internet Security **Assignment No 4.** **5 Marks**
15	**You and Your Future** Managing relationships Work/life balance Pleasure vs Desires Self Recognition Self Comparison	activity template career/life planning		How will you measure your life, HBR Article
16	**Project Breakup (Team: max 3 members)** **Proposal 2 Marks** **Presentation 3 Marks** **scenario (analysis) 5 Marks (Concept mapping what learnt during the course/guest speakers on the analyzed problem) discussion**	Start Date Proposal Deadline :9th week Presentation: 14-15th week		10 Marks

TEXT BOOKS:

Main	Ethical and Social Issues in Information Age, Kizza J. M., 5th Edition (2013), Springer-Verlag
Reference	▪ Ethics in Information Technology, Reynolds, G., 5th Edition (2014), Cengage Course Technology. ▪ A Gift of Fire, Social, Legal, and Ethical Issues for Computing Technology, Baase, S., 4th Edition (2013), Pearson Inc. ▪ Ethics for the Information Age, Quinn, M.J., 5th Edition (2013), Pearson Education.

COURSE DESCRIPTION FORM

INSTITUTION National University of Computer and Emerging Sciences (NUCES-FAST)

PROGRAM (S) TO BE EVALUATED BS (CS)

A. Course Description

Course Code	CS-4053
Course Title	Recommender Systems
Credit Hours	3+0
Prerequisites by Course(s) and Topics	-
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	Midterm I: 15 marks Midterm II: 15 marks Course Project: 10 marks Assignments: 10 marks Finals: 50 marks
Course Coordinator	Syed Zain Ul Hassan
URL (if any)	-
Current Catalog Description	-
Textbook (or **Laboratory Manual** for Laboratory Courses)	*Recommender systems handbook*, by F. Ricci, L Rokach, B. Shapira and P.B. Kantor, (Springer)
Reference Material	To be provided in the form of slides and tutorials. **Resources link:** TBA

Course Goals

A. Course Learning Outcomes (CLOs)

1. *Describe different techniques in making automatic personalized recommendations in various scenarios*
   [Bloom's Taxonomy Level: 3**, Learning Domain:** Cognitive**]**
2. *Solve mathematical optimization problems pertaining to recommender systems*
   [Bloom's Taxonomy Level: 3**, Learning Domain:** Cognitive**]**
3. *Discuss how a recommender system should be evaluated in terms of the system's performance and the user's satisfaction with the system*
   [Bloom's Taxonomy Level: 6**, Learning Domain:** Cognitive**]**
4. *Learn about advanced topics and current applications of recommender systems in realms like social networks and communities*
   [Bloom's Taxonomy Level: 6**, Learning Domain:** Cognitive**]**

B. Program Learning Outcomes

1. Computing Knowledge	Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of complex computing problems.	CLO-1
2. Problem Analysis	Identify, formulate, research literature, and analyze complex computing problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing sciences.	CLO-2
3.Design/Develop Solutions	Design solutions for complex computing problems and design systems, components, and processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.	CLO-3
4. Investigation & Experimentation	Conduct investigation of complex computing problems using research based knowledge and research based methods	CLO-4

C. Relation between CLOs and PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

		PLOs											
		1	2	3	4	5	6	7	8	9	10	11	12
CLOs	1	✓											
	2		✓										
	3			✓									
	4				✓								

Topics Covered in the Course, with Number of Lectures on Each Topic (assume 15-week instruction and one-hour lectures)

1. Topics to be covered:

List of Topics	No. of Weeks	Contact Hours	CLO
Introduction to Recommender System (RS), goals, applications and taxonomy of RS techniques	1	3	1
Recommendations using Collaborative Filtering, types of ranking, cold start problem and serendipity	1	3	1
Neighborhood based methods, similarity measures	1	3	1
Long-tail principle and curse of dimensionality	1	3	2
Rule-based and Naïve Bayes CF	1	3	1
Mid-term I			
Introduction and basic components of Content-based recommendation system	1	4	1
Content-based Filtering	2	6	2
Content-based vs CF recommendations	1	3	1
Mid-term II			
Knowledge-based recommendations, Constraint-based and case-based recommendation system	1	3	1
Matrix Factorization	1	3	3
Neural Recommender Systems	1	2	4
Transformers	1	3	3

	Generative Recommendations: 1 / 3 / 4 Evaluation measures for recommendation systems and performance issues: 1 / 3 / 3 **Final Exam** **Total: 15 / 45**
Laboratory Projects/Experiments Done in the Course	The lab work to be done in the course include hands-on exercises for the following topics: ▪ Simple CF Recommender System for products recommendation ▪ Feature selection ▪ Social media recommendation One group project will be submitted by the students in the penultimate week of the semester.
Programming Assignments Done in the Course	Assignments related to collaborative filtering, similarity measures, knowledge-based recommendations and evaluation techniques

Class Time Spent on (in credit hours)	**Theory**	**Problem Analysis**	**Solution Design**	**Social and Ethical Issues**
	15	15	13	0

Oral and Written Communications	A project report detailing the problem, tools, methods used in the course project to be submitted by every student.

Instructor Name: Syed Zain Ul Hassan

Instructor Signature: _____

Dated: 31st July 2023

National University

of Computer & Emerging Sciences

Department	Department of Computer Science	**Dept. Code**	CS
Course Title	Deep Learning for Perception	**Course Code**	CS4045
Pre-requisite(s)		**Credit Hrs.**	3

Course Objective:	Deep neural networks have achieved state of the art performance on several compute vision and speech recognition benchmarks. Deep learning algorithms extract layered high and low-level features from raw data. With increasing non-line hidden layers, the discriminative power of the network improves. This course builds on the fundamentals of Neural networks and artificial intelligence and covers advanced topics in neural networks, convolutional and recurrent network structures, deep unsupervised and reinforcement learning. It also embeds applications of these algorithms to several real-world problem in computer vision, speech recognition, natural language processing, game theory, etc.

PLO	Program Learning Outcome (PLO) Statement
1	**Computing Knowledge:** Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of complex computing problems.
4	**Investigation & Experimentation:** Conduct investigation of complex computing problems using research based knowledge and research based methods.
5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources and modern computing tools, including prediction and modelling for complex computing problems.
9	**Individual & Team Work** Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.

CLO	Course Learning Outcome (CLO)	Domain	Taxonomy Level	PLO	Tools
1	Student should be able to describe what Deep Learning is and the skill sets needed for Deep Learning	Cognitive	2	1	A, L, M1, F
2	Students should be able to understand supervised and unsupervised methods of Deep Learning,	Cognitive	2	4	A, L, M1, M2, F
3	Students should be able to apply most important deep learning methods, using open-source tools	Cognitive	4	5	A, P, L, M2, F
4	Students should be able to work as a team while integrating important components in deep learning	Cognitive	6	9	P, A
Tool: A = Assignment, L = Labs, M = Midterm, F=Final					

Text Book(s)	**Title**	Research Papers
	Author	
	Title	1. Deep Learning Tutorial, LISA lab, University of Montreal

Ref. Book(s)		2. Deep Learning by Ian Goodfellow, Yoshua Bengio, and Aaron Courville, http://www.deeplearningbook.org/
	Author	Ian Goodfellow, Yoshua Bengio, and Aaron Courville

No. of Weeks	Course Contents/Topics	Contact Hours	CLO
2	Introduction, Logistic Regression	**6**	**2,3**
1	Neural Networks	**3**	**2,3**
1	Introduction to Deep Neural Network	**3**	**1**
1	Regularization, Dropout, Drop Connect	**3**	**1,2,3**
-	Midterm 1	**1**	**1,2**
2	CNN / CNN Architectures	**6**	**2/4**
2	RNN, LSTM, GRP	**6**	**2,3**
1	Midterm 2 including 1 hour from Midterm1	**2**	**3**
1	Ensemble of Deep Learning	**3**	**2,4**
1	AutoEncoders	**3**	**2,3**
2	Recent Advances in Deep Learning	**6**	**4**
1	Project Demo	**3**	**4**
15	Total	**45**	

Assessment Plan:

Assessment	Weightage
Assignments	10
Labs / DataCamp	10
Midterm Exams	25 (10 + 15)
Project	10
Final	45

COURSE DESCRIPTION FORM

INSTITUTION National University of Computer and Emerging Sciences (NUCES-FAST)

PROGRAM (S) TO BE EVALUATED BS(SE)

A. **Course Description** (Fill out the following table for each course in your computer science curriculum. A filled-out form should not be more than 2-3 pages.)

Course Code	
Course Title	International Business
Credit Hours	3
Prerequisites by Course(s) and Topics	
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	Mid Term: 30 Marks Assignments/Quizzes: 10 Marks Project: 10 Marks Final: 50 Marks
Course Coordinator	
URL (if any)	
Current Catalog Description	An Overview of International Business, Global Marketplaces and Business Centres, Legal, Technological, and Political Environments, The Role of Culture, Ethics and Social Responsibility in International Business, International Trade and Investment, The International Monetary System and the Balance of Payments, Foreign Exchange and International Financial Markets, Formulation of National Trade Policies, International Cooperation Among Nations, International Strategic Management, Strategies for Analyzing and Entering Foreign Markets, International Strategic Alliances, International Organization Design and Control, Leadership and Employee Behavior in International Business
Textbook (or **Laboratory Manual** for Laboratory Courses)	International Business: A Managerial Perspective, 9th Edition by Ricky W. Griffin and Michael W. Putsay
Reference Material	1) • Charles, E. Hill (2015): International Business: Competing in the Global Marketplace, 10th ed., Mc Graw Hill / Irwin

Course Goals

A. Course Learning Outcomes (CLOs)

1. Understand recent research and practice regarding international business and management issues and explain international business issues by considering the world as a marketplace.
2. Use different perspectives to interpret and analyses business, social and cultural problems in an international setting.
3. Understand business practice and research in the context of globalization from a comparative management point of view.

B. Program Learning Outcomes

For each attribute below, indicate whether this attribute is covered in this course or not. Leave the cell blank if the enablement is little or non-existent.

1. Computing Knowledge	Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of complex computing problems.	
2. Problem Analysis	Identify, formulate, research literature, and analyse complex computing problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing sciences.	
3. Design / Develop Solutions	Design solutions for complex computing problems and design systems, components, and processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.	
4. Investigation & Experimentation	Conduct investigation of complex computing problems using research-based knowledge and research-based methods.	
5. Modern Tool Usage:	Create, select, and apply appropriate techniques, resources and modern computing tools, including prediction and modelling for complex computing problems.	
6. Society Responsibility	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues relevant to context of complex computing problems.	
7. Environment and Sustainability	Understand and evaluate sustainability and impact of professional computing work in the solution of complex computing problems	
8. Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of computing practice.	
9. Individual and Teamwork	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.	✓

10. Communication	Communicate effectively on complex computing activities with the computing community and with society at large.	
11. Project Management and Finance	Demonstrate knowledge and understanding of management principles and economic decision making and apply these to one's own work as a member or a team.	✓
12. Lifelong Learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological changes	

C. Relation between CLOs and PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

		PLOs										
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
CLOs	1									✓		✓
	2									✓		✓
	3									✓		✓
	4											
	5											
	6											
	7											
	8											

Topics Covered in the Course, with Number of Lectures on Each Topic (assume 15-week instruction and one-hour lectures)

1. Topics to be covered:

List of Topics	No. of Weeks	Contact Hours	CLO
<u>An Overview of International Business</u> What Is International Business? Why Study International Business? International Business Activities The Contemporary Causes of Globalization **<u>Global Marketplaces and Business Centers</u>** The Marketplaces of North America	**2**	**6**	**1**

	The Marketplaces of Western Europe The Marketplaces of Eastern Europe and Central Asia The Marketplaces of Asia The Marketplaces of Africa and the Middle East The Marketplaces of South America			
	Legal, Technological, and Political Environments The Legal Environment The Technological Environment The Political Environment **The Role of Culture** Characteristics of Culture Elements of Culture Seeing the Forest, Not the Tree International Management and Cultural Differences	**2**	**6**	**1**
	Ethics and Social Responsibility in International Business The Nature of Ethics and Social Responsibility in International Business Ethics in Cross-Cultural and International Contexts Managing Ethical Behavior across Borders Corporate Social Responsibility in Cross-Cultural and International Contexts Managing Social Responsibility across Borders Difficulties of Managing CSR across Borders	**1**	**3**	**1,2**
	========== *MID 1* ==========			
	International Strategic Management The Challenges of International Strategic Management Strategic Alternatives Components of an International Strategy Developing International Strategies	**1**	**3**	**1,2**
	Strategies for Analyzing and Entering Foreign Markets Foreign Market Analysis Choosing a Mode of Entry Exporting to Foreign Markets International Licensing International Franchising	**1**	**3**	**1,2**

	Specialized Entry Modes for International Business Foreign Direct Investment			
	International Strategic Allaiances International Corporate Corporation Benefits of Strategic Alliance Scope of Strategic Alliances Implementation of Strategic Alliances Pitfalls of Strategic Alliances	**1**	**3**	
	========== *MID 2* ==========			
	International Organization Design and Control Global Organization Designs Related issues in Global Organization Design The Control Function in International Business Managing the Control Function in International Business **Leadership and Employee Behavior in International Business** Individual Behavior in International Business Motivation in International Business Leadership in International Business Decision Making in International Business Groups and Teams in International business **International Marketing** International Marketing Management Product Policy Pricing Issues and Decisions Promotion Issues and Decisions Distribution Issues and Decisions	**3**	**9**	**3**
	International Operations Management The Nature of International Operations Management Production Management International Service Operations Managing productivity in International Business Managing Quality in International Business Managing Information in International Business **International Financial**	**2**	**6**	**2,3**

	Management Financial Issues in International Trade Managing Foreign Exchange Risk Management of Working Capital International Capital Budgeting Sources of International Investment Capital			
	Review	**1**	**3**	**1,2,3,4**
	Project Presentations	**1**	**3**	**1,2,3,4**
	Total	**15**	**45**	

Laboratory Projects/Experiments Done in the Course				
Programming Assignments Done in the Course				
Class Time Spent on (in credit hours)	**Theory**	**Problem Analysis**	**Solution Design**	**Social and Ethical Issues**
	30	10	5	0
Oral and Written Communications	Every student is required to submit at least __1__ written report of typically _2__ pages and to make _1__ oral presentations of typically __10__ minute's duration. Include only material that is graded for grammar, spelling, style, and so forth, as well as for technical content, completeness, and accuracy.			

Instructor Name __Dr. Muhammad Saad

Instructor Signature _____

Date __January 31, 2023

Course Outline

INSTITUTION National University of Computer and Emerging Sciences-FAST

PROGRAM (S) TO BE EVALUATED Computer Science

Course Name **CS4037 -Introduction to Cloud Computing**

Catalog Number

Instructor Name **Dr. Hassan Jamil Syed**

Date	Duration	Topics Covered	Evaluation Instruments used	Signature
	L1 = 1 hr. L2 = 1 hr. L3 = 1 hr.	L1: Introduction , Network-centric computing and network-centric content, L2: Peer-to-peer systems ,Cloud computing: an old idea whose time has come L3: Cloud computing delivery models and services (SaaS, PaaS, and IaaS)		
	L1 = 1 hr. L2 = 1 hr. L3 = 1 hr.	L1: Ethical issues in cloud computing, Cloud vulnerabilities L2: Major challenges faced by cloud computing L3: Basics of OpenStack (LAB)		
	L1 = 1 hr. L2 = 1 hr. L3 = 1 hr.	L1: Cloud Infrastructure: Cloud computing at Amazon, L2: AWS services: Elastic Compute Cloud (EC2), L3: OpenStack Lab: Launch an instance (all step from scratch)		
	L1 = 1 hr. L2 = 1 hr. L3 = 1 hr.	L1: AWS services (continued) : Simple Storage System (S3), Elastic Block Store (EBS), Simple DB, Simple Queue Service (SQS), Virtual Private Cloud (VPC), Elastic Beanstalk, L2: SaaS services offered by Google, PaaS and SaaS services from Microsoft, Open-source platforms for private clouds, OpenStack: Component of OpenStack: Controller, Compute, Block Storage, Object Storage. L3: OpenStack (Access the instance remotely, OpenStack Dashboard)		
	L1 = 1 hr. L2 = 1 hr. L3 = 1 hr.	L1: Cloud storage diversity and vendor lock-in, Cloud computing interoperability: the Intercloud, Energy use and ecological impact of large-scale data centers, Service- and compliance-level agreements L2: Cloud Resource Virtualization: Virtualization, Layering and virtualization, Virtual machine monitors		NATIONAL UNIVERSITY OF COMPUTER & EMERGING SCIENCES KARACHI CAMPUS

		L3: OpenStack Lab (Assigning floating IP to the instance,		
		Mid 1 Week		
	L1 = 1 hr. L2 = 1 hr. L3 = 1 hr.	L1: Virtual Machine Migration; Live VM Migration, Pre-copy VM Migration, Post-Copy VM Migration, Hybrid Methods, Non-live VM Migration. , L2: OpenStack Horizon Lab [OpenStack lab videos, OpenStack web manual] L3: What is a Container and Why? , Advantages of Virtualization, Problems of Virtualization, Solution: Containers, VM vs. Containers.		
	L1 = 1 hr. L2 = 1 hr. L3 = 1 hr.	L1: Docker; Docker Engine Components, Image Registries, Layers, Building Container Images, Docker Commands L2: Open Container Initiative (OCI), Swarm, Docker Swarm Commands, Docker Overlay Networking, Docker Security, L3: Docker Lab [Docker lab video, Docker web manual]		
	L1 = 1 hr. L2 = 1 hr. L3 = 1 hr.	L1: Kubernetes, Hyper-V Containers, Intel Clear Containers, Kata Containers, L2: Big Data Enabled by Networking, Google File System, BigTable, MapReduce, MapReduce Example, MapReduce Optimization, Story of Hadoop, Hadoop. L3:		
	L1 = 1 hr. L2 = 1 hr. L3 = 1 hr.	L1: Hadoop File System; Basic Features: HDFS, Fault tolerance, Data Characteristics, Architecture; Namenode and Datanodes, HDFS Architecture, File system Namespace Data Replication, Replica Placement, Replica Selection, Safemode Startup L2: HDFS; Filesystem Metadata, Namenode, Datanode, The Communication Protocol, Robustness; Objectives, DataNode failure and heartbeat, Re-replication, Cluster Rebalancing, Data Integrity, Metadata Disk Failure, Data Organization: Data Blocks, Staging, Replication Pipelining. L3: Hadoop: The Definitive Guide Chap. 2 MapReduce; MapReduce, Example: Analysis of Weather Dataset, Analyzing the Data with Unix Tools, How Can We Parallelize This Work?, Hadoop MapReduce, MapReduce Design of NCDC Example.		
	L1 = 1 hr. L2 = 1 hr. L3 = 1 hr.	**Mid Term 2**		
	L1 = 1 hr. L2 = 1 hr. L3 = 1 hr.	L1: Cloud Security; Cloud security risks, Security: L2: Cloud Security; The top concern for cloud users, Privacy and privacy impact assessment, Trust,		

		L3: Operating system security, Virtual machine security, Security of virtualization, Security risks posed by shared images		
	L1 = 1 hr. L2 = 1 hr. L3 = 1 hr.	L1: Storage Systems; The evolution of storage technology L2: Storage models, file systems, and databases L3: Distributed file systems: The precursors		
	L1 = 1 hr. L2 = 1 hr. L3 = 1 hr.	L1: General Parallel File System, Google File System L2: OpenStack Current trends and deployments, L3: Lab: Launching and instance and How to Set Up SSH Keys on Ubuntu, using parallel-ssh utility on multiple VMs.		
	L1 = 1 hr. L2 = 1 hr. L3 = 1 hr.	Course wrap-up and Project evaluations		

Instructor Signature: Dr. Hassan Jamil Syed

Date