Bachelor of Science in Computer Science and Engineering

Outcome-Based (OBE) Curriculum

Department of Computer Science and Engineering

UNIVERSITY OF ASIA PACIFIC

CONTENTS

PART A: PROGRAM OUTLINE

PART B: STRUCTURE OF THE CURRICULUM

PART C: DESCRIPTION OF ALL COURSES

PART D: GRADING/EVALUATION

PART A: PROGRAM OUTLINE

1. Title of the Academic Program

Bachelor of Science in Computer Science and Engineering, Bangladesh National Qualifications Framework (BNQF) Code: 061

2. Name of the University

University of Asia Pacific (UAP)

University at a Glance

University of Asia Pacific (UAP) is a government-approved private university established by the University of Asia Pacific Foundation (UAPF). UAP was established in 1996 as a private university under the Private University Act 1992, with a vision to enhance the opportunities for higher education in Bangladesh. The curriculum of UAP has been approved by the University Grants Commission (UGC) of the GoB. The university started its operation in 1996 and offered four years bachelor degree programs in Computer Science and Engineering and Business Administration. At present UAP offers undergraduate programs in nine disciplines and graduate programs in eight disciplines.

UAPF is a non-profit, non-commercial foundation based in Dhaka, Bangladesh. The principal aim of the foundation is to promote human and social development through improved educational opportunities, innovative educational programs relevant to the needs of an emerging society and to develop skills, know-how and awareness of the youth through appropriate institutional grooming. The foundation has been established by a group of eminent educationists, industrialists, and administrators who share the same vision and social commitments. UAP is the first project of the foundation aimed at realizing these noble goals.
The main objective of UAP is to provide high quality education at tertiary level relevant to the demands of a high-quality dynamic academia in Bangladesh. The courses and curricula are designed to enable and equip a student to enter into the national and international job market or pursue higher academic and professional goals with a solid academic foundation. The sole objective of the university is not to make the students pass the exam only. The university equips its students with the means to become productive and proactive members of the community and continue the practice of continuous learning to become future leaders and useful members of the society.

3. Vision of the University

UAP steadfastly holds its passion to do better and better in fulfilling our young generation's needs and aspirations for a caring and quality education in casting their future career and becoming a desirable destination for an identity.

4. Mission of the University

The mission of UAP is to offer the best possible education to our young generation. Towards the fulfillment of the mission, UAP continues to develop a sustained culture of ascending to a top-tier of vibrant academic environment; maintain and foster well qualified faculty, provide adequate research support for cutting-edge research in-house and in collaboration national and international peers; update curricula to keep up with the advancing trend in science and technology, use state-of-the-art practices in teaching-learning and modern facilities in laboratories and libraries; and provide other supports in aid to the students becoming competent graduates with their potential fully realized and personality well-developed for joining the global forces in making a better future for the society in changing world.

5. Name of the Program Offering Entity (Department/Faculty/Institute)

Department of Computer Science and Engineering

6. Vision of the Department of Computer Science and Engineering

The department of Computer Science and Engineering (CSE), University of Asia Pacific (UAP) is striving for pioneer role in ICT through excellence in education, research and development towards preparing graduates as a global leader with quality education, innovative ideas, extra-curricular activities and collaboration between industry and academia.

7. Mission of the Department of Computer Science and Engineering

Department of CSE believes in the pursuit of excellence by developing students in creating, applying and imparting knowledge of ICT. Educational curriculum, research and collaboration between academia and industry are given highest priority. CSE, UAP aspires to produce graduates capable of taking leadership on the field of their best interest. We nurture graduates in

- Equipping students with a strong foundation in computer science theory, engineering principles, and practical skills required to excel in diverse careers and pursue advanced studies.
- Providing opportunities for lifelong learning, professional development, and satisfying career demands by embracing technological advancements and engaging in cutting-edge research.
- Cultivating an entrepreneurial mindset, fostering innovation, and empowering individuals to develop sustainable solutions and technologies.
- Fostering ethical values, social responsibility, and a commitment to serving the community, emphasizing the responsible use of technology for the betterment of society.

8. Program Educational Objectives (PEOs) of the Department of Computer Science and Engineering

The program educational objective of the Department of Computer Science and Engineering is to produce graduates with strong fundamental concepts and high technical competence in computer science and technology, who will be able to use these tools in the industry and/or institutes wherever necessary for success. The prime objective in establishing the Computer Science & Engineering Department at University of Asia Pacific is to make a concerted effort towards achieving the goal of providing quality education for the duration of 4 years at the undergraduate level. Later it is to be followed by higher academic degree programs such as MS/Ph. D. The courses in the undergraduate programs are designed to give students a rigorous and comprehensive academic training on both the fundamental and advanced aspects of Computer Science & Engineering (CSE). It would concentrate both on software and hardware aspects.

9. Name of the Degree

Bachelor of Science in Computer Science and Engineering (B.Sc. in CSE)

10. Description of the Program

This program consists of 153 credit hours. The program is proposed to have theory courses, laboratory courses, thesis or project work where students work in a team for 1 year, industrial training, and optional co-curricular and extra-curricular activities.

11. Graduate Attributes (Based on Need Assessment)

This degree will prepare our graduates with the knowledge to solve real-world problems. The graduates will possess skills and knowledge to become a global leader in IT world. They will gain a solid platform to learn necessary theoretical knowledge, implement them in laboratory sessions. Our graduates are well-trained to analyze problems, provide solutions to the problems that use minimum resources and automate for the ease of the users. We continue to upgrade our syllabus to include latest technology and remove irrelevant parts. We strive to meet the demands of the students and they regularly take their feedback on the courses that we offer.

12. Statements of Program Educational Objectives (PEOs) of the Department of Computer Science and Engineering

PEO1	Graduates will demonstrate **successful careers in various sectors** such as software development, IT consulting, research and development, entrepreneurship, or pursuing advanced studies in computer science or related fields at home and beyond.
PEO2	Graduates will **apply in-depth engineering knowledge and skills** to **solve** complex real-life problems.
PEO3	Graduates will engage in **lifelong learning and professional development** by adapting to technological advancements.
PEO4	Graduates will make valuable **contributions to society** by leveraging their engineering knowledge, skills, and ethical values.

13. Statements of Program Learning Outcomes (PLOs) of the Department of Computer Science and Engineering

PLOs	Statements	Differentiating Characteristics
1	Engineering Knowledge	Breadth and depth of education and type of knowledge, both theoretical and practical
2	Problem Analysis	Complexity of analysis
3	Design/ development of solutions	Breadth and uniqueness of engineering problems i.e. the extent to which problems are original and to which solutions have previously been identified or codified
4	Investigation	Breadth and depth of investigation and experimentation
5	Modern Tool Usage	Level of understanding of the appropriateness of the tool
6	The Engineer and Society	Level of knowledge and responsibility
7	Environment and Sustainability	Type of solutions.
8	Ethics	Understanding and level of practice
9	Individual and Team work	Role in and diversity of team
10	Communication	Level of communication according to type of activities performed
11	Project Management and Finance	Level of management required for differing types of activity
12	Lifelong learning	Preparation for and depth of Continuing learning.

14. Mapping of Mission of the University with PEOs

Mission statement	PEO1	PEO2	PEO3	PEO4
To offer the best possible education to our young generation	√	√	√	√

15. Mapping of PLOs with the PEOs

Program Learning Outcomes (PLOs)	Program Educational Objectives (PEOs)			
	PEO 1	PEO 2	PEO 3	PEO 4
PLO1: Engineering Knowledge	√	√		
PLO2: Problem Analysis	√	√		
PLO3: Design/Development of Solutions	√	√		
PLO4: Investigation	√	√		
PLO5: Modern Tool Usage	√	√	√	
PLO6: The Engineer and Society		√		√

PLO7: Environment and Sustainability		√		√
PLO8: Ethics		√		√
PLO9: Individual and Teamwork	√			
PLO10: Communication	√			
PLO11: Project Management and Finance	√			
PLO12: Lifelong Learning	√		√	

16. Mapping of Courses with the PLOs

Course Code	Course Title	PLO -1	PLO -2	PLO -3	PLO -4	PLO -5	PLO -6	PLO -7	PLO -8	PLO -9	PLO -10	PLO -11	PLO -12
CSE 101	Computer Fundamentals and Programming	√	√	√									
CSE 102	Computer Fundamentals and Programming Lab			√		√							
MTH 101	Math-I : Calculus I	√	√										
PHY 101	Physics for Computer Science	√	√										
PHY 102	Physics for Computer Science Lab	√			√	√							
HSS 111	Bangladesh Studies: History, Society, and Culture	√	√	√									
ENG 101	English					√					√		
CSE 103	Structured Programming	√	√	√		√							
CSE 104	Structured Programming Lab		√	√									
CSE 105	Discrete Mathematics	√											
CSE 108	Competitive Programming		√			√							
MTH 103	Math-II: Calculus II	√	√										
CHM 111	Chemistry	√											
EEE 101	Electrical Circuits	√	√										
EEE 102	Electrical Circuits Lab			√									
CSE 201	Object-Oriented Programming I	√	√		√								
CSE 202	Object-Oriented Programming I Lab		√			√							√
CSE 203	Data Structures and Algorithms I	√	√										
CSE 204	Data Structures and Algorithms I Lab	√		√	√								
CSE 205	ICT Law and Ethics	√		√									
MTH 201	Math-III: Vector Geometry and Linear Algebra	√	√										

EEE 201	Electronic Devices and Circuits	√	√	√									
EEE 202	Electronic Devices and Circuits Lab		√	√									
CSE 207	Data Structures and Algorithms II	√	√	√									
CSE 208	Data Structures and Algorithms II Lab	√	√	√	√								
CSE 209	Digital Logic Design	√			√	√							
CSE 210	Digital Logic Design Lab	√			√	√							
CSE 211	Database Systems	√	√	√		√	√						
CSE 212	Database Systems Lab	√	√	√		√	√		√	√	√		
MTH 203	Math-IV: Probability and Statistics	√	√										
ECN 201	Engineering Economics	√	√										
CSE 301	Object Oriented Programming II and Web Programming	√	√	√		√							
CSE 302	Object Oriented Programming II and Web Programming Lab	√	√	√		√							
CSE 303	Computer Architecture and Organization	√	√	√			√						
CSE 305	Systems Analysis and Design	√	√	√									
CSE 307	Project Strategy and Management	√	√	√									
BIE 301	Bioinformatics Engineering	√	√		√								
BUS 301	Business and Entrepreneurship	√	√								√	√	
ENG 300	Technical Writing and Presentation	√	√			√							
CSE 311	Data Communication and Computer Networks	√	√		√	√							
CSE 312	Data Communication and Computer Networks Lab		√			√							
CSE 313	Software Engineering	√	√				√					√	
CSE 314	Software Engineering Lab		√	√		√	√		√	√	√	√	√
CSE 315	Microprocessors and Microcontrollers	√	√		√	√							
CSE 316	Microprocessors and Microcontrollers Lab	√			√	√							√
CSE 317	Computer and Cyber Security	√	√										
PHY 301	Modern and Quantum Physics	√	√	√									
CSE 400-A	Final Year Design Project		√	√	√	√	√	√	√	√	√	√	√

CSE 401	Operating System	√	√										
CSE 402	Operating System Lab	√		√						√			
IMG 401	Industry and Operational Management	√		√	√	√	√			√		√	
	Option I												
	Option II												
	Option II Lab												
	Option III												
	Option III Lab												
CSE 400-B	Final Year Design Project		√	√	√	√	√	√	√	√	√	√	√
CSE 404	Industrial Training					√	√		√	√	√		√
BNG 401	Functional Bengali Language	√	√	√									
	Option IV												
	Option IV Lab												
	Option V												
	Option V Lab												

PART B: STRUCTURE OF THE CURRICULUM

17. Structure of the Curriculum

The entire bachelor program is covered through a set of theoretical and practical courses including project work and industrial training. A lecture of one hour per week per semester will be equivalent to one credit. Thus, a three-credit hour course will have three-hour lectures per week throughout the semester.

a. Duration of the Program

Four years comprising of 8 semesters (2 semesters/year)

b. Admission Requirements

Eligibility for Admission

Minimum GPA Requirements

Total GPA in SSC & HSC = 7.50

Total GPA in O & A level = 7.50

(Candidates with minimum GPA of 2.5 in five subjects in O level and two subjects in A level).

Subject Requirements

Students must have Physics, Mathematics in HSC (or equivalent) and Chemistry either in SSC or HSC (or equivalent).

Date of Admission

The admission is held twice a year. The first admission (for Fall semester) is held in January and the second one (for Spring semester) is held in July of each year. Classes begin in January and July respectively.

Admission Procedure

UAP circulates notice for undergraduate admission tests through the website of UAP (http://www.uap-bd.edu). Candidates have to submit their applications through the online admission portal of UAP by paying required fees. The Registrar office also advertises in the leading Bengali and English newspapers to inform prospective candidates.

Generally, there are two tests with a gap of one month in between. Applicants are allowed to appear in one test only (except some reasonable cases, for which the authority will follow a thorough scrutiny). All exams are conducted within the two months window before the semester class starts. Detailed timing is circulated both in daily newspapers and in our website "NOTICE" link.

In special cases where ELPC (English Language Proficiency Course) is advised by the department for students having relatively weaker proficiency in English, the applicant has to complete an additional English language course offered by the university before or during the semester.

For Transfer Students

Credit transfer students from other universities are also considered for admission, however their application is considered case-by-case, taking into account their previous results and track record and also must pass the admission test if the department requires. The minimum GPA for a course is “B” to be considered as transferable. A transfer student must complete 50% of the required total credit hour in the university to be eligible for a degree from UAP.

For a student who has a study gap of more than two years prior to her/his application for admission is advised to contact directly to the admission office.

For International Students

It is necessary for a prospective student from abroad to demonstrate commitment and readiness to operate in a different cultural context. The selection process is relatively similar, with options of submitting the necessary documents online. All documents must be translated in English and attested by legal authorities. The applicant must fulfill if the department asks for some special documents (i.e. Portfolio, recommendation letter etc.) or interview (via Skype or telephone). For further information please contact directly to the links below.

c. Total minimum credit requirement to complete the program:

Students are required to complete all the assigned credits (144) to attain the Bachelor of Computer Science and Engineering degree.

d. Total class weeks in a Year/Semester:

The university confers the degree of Bachelor of Computer Science and Engineering after a student has satisfactorily completed all the required courses offered over a period of four academic years. The academic year is divided into two semesters each of which will be as follows:

Classes	15 weeks
Recess before final examination	1 week
Semester final examination	2 weeks
Total	18 weeks

Class Duration and Schedule

The duration of each class depends on the credit of the courses. One credit means one-hour class per week. Therefore, in a three-credit course, three hours of class per course will be held in a week. Class schedule is published at the beginning of the semester as per university rules.

Course Load per Semester

Students have to complete all the courses as offered within the eight semesters. However, if any student fails in one or more course(s) in any semester, he/she can retake it in the next semester along with other regular courses. The maximum course load in a semester is 24 (twenty-four) credits. For special cases, permission from the Registrar office will be required.

Academic Calendar (Spring and Fall)

There will be two semesters (Fall and Spring) in an academic year. Duration of Fall and Spring Semester will be as follows:

Name of semester	Duration
Fall	January to June
Spring	July to December

Total activity of Spring and Fall semester will be as follows:

1st - 7th week	Classes
8th week	Mid semester examination
9th - 15th Week	Classes
16th week	Preparatory leave
17th -18th week	Final examination and viva voce
19th -21st week	Thesis, project submission and presentation
24th week	Publication of result
25th-26th week	Registration for next semester

e. Minimum CGPA requirements for graduation

The students have to secure a minimum CGPA of 2.25 to get a Bachelor degree.

f. Maximum academic years of completion

Generally, the stipulated time limit for completion of Bachelor of Computer Science and Engineering degree is four years. However, on compassionate grounds this time limit may be extended to a maximum of eight years.

g. Category of Courses

I. **General educational courses:** Courses are mentioned below.

II. **Core courses (Courses that characterize the discipline):** Courses are mentioned below.

III. **Elective courses (Courses for specialization within the discipline):** Courses are mentioned below.

IV. **Capstone course/Internship/Thesis/Project:** Courses are mentioned below.

18. Year/Level/Semester/Term Wise Distribution of Courses

Course Code	FIRST YEAR, FIRST SEMESTER	Credit
CSE 101	Computer Fundamentals and Programming	3
CSE 102	Computer Fundamentals and Programming Lab	1.5
MTH 101	Math-I : Calculus I	3
PHY 101	Physics for Computer Science	3
PHY 102	Physics for Computer Science Lab	1.5
HSS 111	Bangladesh Studies: History, Society, and Culture	3
ENG 101	English	3
	FIRST YEAR, SECOND SEMESTER	
CSE 103	Structured Programming	3
CSE 104	Structured Programming Lab	1.5
CSE 105	Discrete Mathematics	3
CSE 108	Competitive Programming	1.5
MTH 103	Math-II: Calculus II	3
CHM 111	Chemistry	3
EEE 101	Electrical Circuits	3
EEE 102	Electrical Circuits Lab	1.5
	SECOND YEAR, FIRST SEMESTER	
CSE 201	Object-Oriented Programming I	3
CSE 202	Object-Oriented Programming I Lab	1.5
CSE 203	Data Structures and Algorithms I	3
CSE 204	Data Structures and Algorithms I Lab	1.5
CSE 205	ICT Law and Ethics	3
MTH 201	Math-III: Vector Geometry and Linear Algebra	3
EEE 201	Electronic Devices and Circuits	3
EEE 202	Electronic Devices and Circuits Lab	1.5

	SECOND YEAR, SECOND SEMESTER	
CSE 207	Data Structures and Algorithms II	3
CSE 208	Data Structures and Algorithms II Lab	1.5
CSE 209	Digital Logic Design	3
CSE 210	Digital Logic Design Lab	1.5
CSE 211	Database Systems	3
CSE 212	Database Systems Lab	1.5
MTH 203	Math-IV: Probability and Statistics	3
ECN 201	Engineering Economics	3
	THIRD YEAR, FIRST SEMESTER	
CSE 301	Object Oriented Programming II and Web Programming	3
CSE 302	Object Oriented Programming II and Web Programming Lab	1.5
CSE 303	Computer Architecture and Organization	3
CSE 305	Systems Analysis and Design	3
CSE 307	Project Strategy and Management	0
BIE 301	Bioinformatics Engineering	3
BUS 301	Business and Entrepreneurship	3
ENG 300	Technical Writing and Presentation	1.5
	THIRD YEAR, SECOND SEMESTER	
CSE 311	Data Communication and Computer Networks	3
CSE 312	Data Communication and Computer Networks Lab	1.5
CSE 313	Software Engineering	3
CSE 314	Software Engineering Lab	1.5
CSE 315	Microprocessors and Microcontrollers	3
CSE 316	Microprocessors and Microcontrollers Lab	1.5
CSE 317	Computer and Cyber Security	3
PHY 301	Modern and Quantum Physics	3
	FOURTH YEAR, FIRST SEMESTER	
CSE 400-A	Final Year Design Project	3
CSE 401	Operating System	3
CSE 402	Operating System Lab	1.5
IMG 401	Industry and Operational Management	3
	Option I	3
	Option II	3
	Option II Lab	1.5
	Option III	3
	Option III Lab	1.5
	FOURTH YEAR, SECOND SEMESTER	
CSE 400-B	Final Year Design Project	3
CSE 404	Industrial Training	1.5
BNG 401	Functional Bengali Language	3

	Option IV	3
	Option IV Lab	1.5
	Option V	3
	Option V Lab	1.5
TOTAL CREDIT HOUR		**153**

Optional Courses

Course Code	Theory	Credit
CSE 405	Numerical and Mathematical Analysis for Engineers	3
CSE 407	Theory of Computation	3
CSE 409	Compiler Design	3
CSE 411	Artificial Intelligence and Expert Systems	3
CSE 413	Machine Learning	3
CSE 415	Deep Learning	3
CSE 417	Data Science and Applications	3
CSE 419	Big Data Analytics	3
CSE 421	Natural Language Processing	3
CSE 423	Computer Graphics	3
CSE 425	Pattern Recognition	3
CSE 427	Bioinformatics	3
CSE 429	Cryptography and Network Security	3
CSE 431	Digital Forensics	3
CSE 433	Blockchain and Distributed Security	3
CSE 435	Computer Peripherals and Embedded Systems	3
CSE 437	Robotics	3
CSE 439	Internet of Things	3
CSE 441	Embedded Systems	3
CSE 443	Human Computer Interaction	3
CSE 445	Quantum Computing	3
CSE 447	Digital System Design	3
CSE 449	Design and Testing of VLSI	3
CSE 451	Topics of Current Interest	3
Course Code	**Lab**	**Credit**
CSE 412	Artificial Intelligence and Expert Systems Lab	1.5
CSE 414	Machine Learning Lab	1.5
CSE 416	Deep Learning Lab	1.5
CSE 418	Data Science and Applications Lab	1.5
CSE 420	Big Data Analytics Lab	1.5
CSE 422	Natural Language Processing Lab	1.5
CSE 424	Computer Graphics Lab	1.5

CSE 426	Pattern Recognition Lab	1.5
CSE 428	Bioinformatics Lab	1.5
CSE 430	Cryptography and Network Security Lab	1.5
CSE 432	Digital Forensics Lab	1.5
CSE 434	Blockchain and Distributed Security Lab	1.5
CSE 436	Computer Peripherals and Embedded Systems Lab	1.5
CSE 438	Robotics Lab	1.5
CSE 440	Internet of Things Lab	1.5
CSE 442	Embedded Systems Lab	1.5
CSE 444	Human Computer Interaction Lab	1.5
CSE 446	Quantum Computing Lab	1.5
CSE 448	Digital System Design Lab	1.5
CSE 450	Design and Testing of VLSI Lab	1.5
CSE 452	Topics of Current Interest Lab	1.5

SUMMARY

<table>
<tr><th rowspan="2">SL</th><th rowspan="2">Broader Discipline/ Category</th><th></th><th></th><th></th><th></th><th colspan="2">No. of Courses</th><th colspan="3">Theory 3.0 and Lab 1.5 CH</th></tr>
<tr><th>Course Code</th><th>Theory</th><th>Course Code</th><th>Lab</th><th>Theory</th><th>Lab</th><th colspan="2">Credit</th><th>Percentage</th></tr>
<tr><td rowspan="4">1</td><td rowspan="4">Language and General Education</td><td>ENG 101</td><td>English</td><td>ENG 300</td><td>Technical Writing and Presentation</td><td rowspan="2">2</td><td rowspan="2">1</td><td rowspan="2">7.5</td><td rowspan="4">19.50</td><td rowspan="4">12.75</td></tr>
<tr><td>BNG 401</td><td>Functional Bengali Language</td><td></td><td></td></tr>
<tr><td>HSS 111</td><td>Bangladesh Studies: History, Society, and Culture</td><td></td><td></td><td rowspan="2">4</td><td rowspan="2">0</td><td rowspan="2">12</td></tr>
<tr><td>ECN 301</td><td>Engineering Economics</td><td></td><td></td></tr>
</table>

		BUS 301	Business and Entrepreneurship						
		IMG 401	Industry and Operational Management						
2	Basic Science	PHY 101	Physics for Computer Science	PHY 102	Physics for Computer Science Lab	3	1	10.5	6.86
		CHEM 111	Chemistry						
		PHY 301	Modern and Quantum Physics						
3	Mathematics	MTH 101	Math-I : Calculus I			4	0	12	7.84
		MTH 103	Math-II : Calculus II						
		MTH 201	Math-III: Vector Geometry and Linear Algebra						
		MTH 203	Math-IV: Probability and Statistics						
4	Others Engineerin	EEE 101	Electrical	EEE 102	Electrical	3	2	12	7.84

	g		Circuits		Circuits Lab				
		EEE 201	Electronic Devices and Circuits	EEE 202	Electronic Devices and Circuits Lab				
		BIE 301	Bioinformatics Engineering						
5	CSE Core	CSE 101	Computer Fundamentals and Programming	CSE 102	Computer Fundamentals and Programming Lab	19	14	78	50.98
		CSE 103	Structured Programming	CSE 104	Structured Programming Lab				
		CSE 105	Discrete Mathematics	CSE 108	Competitive Programming				
		CSE 201	Object-Oriented Programming I	CSE 202	Object-Oriented Programming I Lab				
		CSE 203	Data Structures and Algorithms I	CSE 204	Data Structures and Algorithms I Lab				
		CSE 207	Data Structures and Algorithms II	CSE 208	Data Structures and Algorithms II				

					Lab				
		CSE 209	Digital Logic Design	CSE 210	Digital Logic Design Lab				
		CSE 211	Database Systems	CSE 212	Database Systems Lab				
		CSE 301	Object Oriented Programming II and Web Programming	CSE 302	Object Oriented Programming II and Web Programming Lab				
		CSE 303	Computer Architecture and Organization						
		CSE 305	Systems Analysis and Design						
		CSE 311	Data Communication and Computer Networks	CSE 312	Data Communication and Computer Networks Lab				
		CSE 313	Software Engineering	CSE 314	Software Engineering Lab				
		CSE 315	Microprocessors and	CSE 316	Microprocessors and				

			Microcontrollers		Microcontrollers Lab				
		CSE 400 A	Final Year Design Project						
		CSE 400 B	Final Year Design Project						
		CSE 401	Operating Systems	CSE 402	Operating Systems Lab				
		CSE 403	Computer and Cyber Security	CSE 404	Industrial Training				
7	Elective	Option I				5	4	21	13.73
		Option II		Option II Lab					
		Option III		Option III Lab					
		Option IV		Option IV Lab					
		Option V		Option V Lab					
	Non Credit	CSE 307	Project Strategy and Management						
					Total	**40**	**22**	**153**	**100.00**

Part C: DESCRIPTION OF COURSES OF BACHELOR OF COMPUTER SCIENCE AND ENGINEERING

19. DESCRIPTION OF COURSES OF BACHELOR OF COMPUTER SCIENCE AND ENGINEERING

First Year First Semester

Course Outline: Computer Fundamentals and Programming

Part A – Introduction

1. Course Code:	CSE 101
2. Course Title:	Computer Fundamentals and Programming
3. Course Type:	Core course
4. Level:	1^{st} year 1^{st} Semester (Section: A, B, C, D)
5. Academic Session:	Fall 2023
6. Course Instructor:	Dr. Nasima Begum (DNB), Associate Professor-Sec C, D Sabiha Tahsin Soha (STS), Lecturer-Sec B Nakiba Nuren Rahman (NNR), Lecturer-Sec A
7. Prerequisite:	None
8. Credit Value:	3.0
9. Contact Hours:	3.0
10. Total Marks:	100

11. Course Objectives and Course Summary:

The objectives of this course are to:

1. **Introduce** computer hardware, software, and their functionalities.
2. **Provide a** thorough understanding of the number system, base conversion, and Boolean algebra.
3. **Introduce** basic programming and different program planning tools.

The course will offer a comprehensive introduction to the foundational concepts of computer software, hardware, and programming. Students will be able to gather elementary programming language knowledge as well. This course begins with the computer system, input and output devices, multiple ways of inputting data, and the transformation of data into information, and then moves further towards number systems, boolean algebra, and programming planning tools. After that, programming is introduced followed by basic input-output, data types, constants and variables, operators and expression, type conversion, decision making, repetition and loop statements, array, etc.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Describe** the fundamentals of Computer Systems, Software, and Hardware
CLO 2	**Understand** the fundamentals of Boolean algebra and number systems
CLO 3	**Design** flowcharts, algorithms, and pseudocodes of problem solutions
CLO 4	**Develop** simple programs using conditionals, loops, and arrays

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):
*Note: Course Outcome (CO) is the same as the Course Learning Outcome (CLO) and Program Outcome (PO) is the same as the Program Learning Outcome (PLO).

CLO No.	**CLO Statements:** Upon successful completion of the course, students should be able to:	**Corresponding PLOs (Appendix-1)**	**Bloom's taxonomy domain/level (Appendix-2)**	**Delivery methods and activities**	**Assessment Tools**
CLO1	**Describe** the fundamentals of Computer Systems, Software, and Hardware	a	1/Understand	Lecture, Classwork, Assignments	Quiz, Written exam
CLO2	**Understand** the fundamentals of Boolean algebra and number systems	a	1/Apply	Lecture, Classwork, Assignments	Quiz, Written exam
CLO3	**Design** flowcharts, algorithms, and pseudocodes of problem solutions	b	1/Apply	Lecture, Classwork, Assignments	Quiz, Written exam
CLO4	**Develop** simple programs using conditionals, loops, and arrays	c	1/Apply	Lecture, Classwork, Assignments	Quiz, Written exam

Part B – Content of the Course

14. Course Content:
Computer Hardware: mouse, keyboard, monitor, CPU, printer, scanner, router, modem; **Computer Software:** application software, system software; **Boolean Algebra:** logic gates, Boolean addition, and

multiplication; **Number Systems:** binary, decimal, octal, hexadecimal number systems and their conversions, addition, subtraction; **Program Planning Tools:** flowcharts, algorithms, pseudocodes; **Introduction to Programming:** basic input-output, data types, constants and variables, operators and expressions, type conversion; **Decision making:** branching and selection structures, if-else and switch statements, conditional operators; **Repetition and Loop Statements:** for loop, while loop, do-while loop, branching and looping, loop nesting; **Arrays:** introduction to arrays.

15. Alignment of topics of the course with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Looking Inside the Computer System, Using the Keyboard and Mouse, Inputting Data in Other Ways, Video and Sound, Transforming Data into Information	CLO1
2	Number system, Boolean algebra	CLO2
3	Programming planning tools	CLO3
4.	Introduction to programming, Decision Making, Repetition and Loop Statements, Array	CLO4

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Program Outcome (PO) (s)	Time Frame	Suggested Activities	Teaching Strategy (s)	Alignment with CLO
Chap 1B - Looking Inside the Computer System ● Parts of the Computer System ● Computer Hardware and Software ● Information Processing Cycle	To gain the basic idea of hardware and software	Week 1	Assignment on basic hardware and software	Lecture, Multimedia	CLO1
Chap 3A - Using the Keyboard and Mouse ● Keyboard, mouse, and variants of mouse ● Ergonomics	To gain basic idea of fundamental input devices	Week 1	assignment/ quiz on the primary functionalities of keyboards, mouse and other input-	Lecture, Multimedia	CLO1

Chap 3B - Inputting Data in Other Ways ● Hand-held devices, embedded computers, touchscreen ● Optical input devices ● Audio-visual input devices			output devices		
Chap 4A - Video and Sound ● Monitor and printer, its type, and working principle ● Other output devices - data projectors, sound system	To gain basic idea of fundamental output devices	Week 2	assignment/ quiz on the primary functionalities of different output devices	Lecture, Multimedia,	CLO1
Chap 5A - Transforming Data into Information ● How computers represent and process data ● Factors affecting processing speed **CT1: Class Test 1**	To understand the transformation process of data	Week 2	Assignment on data transformatio n	Lecture, Multimedia	CLO1
Number System ● binary, decimal, octal, hexadecimal, etc. number systems and their conversions. ● addition, subtraction, and multiplication using different number system ● Complements in the number system	To understand the conversion system among different number systems	Week 3	Practice problems on number conversions with interchanging number bases	Lecture, Multimedia	CLO2
Boolean Algebra ● logic gates, truth tables, Boolean expression simplification,	To relate boolean expressions with logic gates and truth tables	Week 4	Practice exercises on Boolean expression simplification,	Lecture, Multimedia	CLO2

Boolean addition, and multiplication **CT2: Class Test 2**	and simplify them		truth table generation, logic gate designing		
Program Planning Tools: ● flowcharts, algorithms, pseudocodes	To apply flowcharts, algorithm and pseudocodes to plan program solutions	Week 5	Practice problems on flowcharts, algorithms and pseudocodes	Lecture, Multimedia	CLO3
Introduction to Programming: ● basic input-output, ● data types, constants, and variables; ● operators and expressions; ● type conversion;	To understand fundamentals of programming	Week 5, 6, 7	Practice problems/ exercises on fundamentals of programming	Lecture, Multimedia	CLO4
Review Class		Week 7			
MID-SEMESTER EXAMINATION					
Decision Making: ● branching and selection structures; ● if-else ● switch statements, ● conditional operators;	To understand the concept of branching and conditional statements	Week 8, 9	Problem solving on if-else, switch statements, conditional operators	Lecture, Multimedia	CLO4
CT3: Class Test 3		Week 10			CLO4
Repetition and Loop Statements: ● branching and looping, ● for loop, while loop, do-while loop, ● loop nesting;	To understand the concept of repetitions, looping and nesting	Week 10, 11, 12	Problem solving on repetitions, looping and nesting	Lecture, Multimedia	CLO4
CT4: Class Test 4		Week 12		Lecture, Multimedia	CLO4
Arrays: ● introduction to arrays; ● 1D array, 2D array	To understand the basic concept of array	Week 13, 14	Problem solving on array	Lecture, Multimedia	CLO4

Review Class		Week 14		Lecture, Multimedia	
FINAL EXAMINATION					

17. Teaching-Learning Strategies:

Practical examples will be incorporated with the class lectures from the beginning. The class lectures will be broken down into interactive examples where students will be encouraged to ask questions to create an open atmosphere for exploration and relate computer fundamentals and programming concepts to real-world examples and applications. Progressively challenging assignments will be built and assigned to the students to reinforce learning. Feedback will be provided on students' work to guide their progress and address misconceptions.

18. Assessment Techniques of each topic of the course:

Assessment Type	% weight	CLO1	CLO2	CLO3	CLO4
Final Exam	50%	10	10	10	20
Mid Term Exam	20%	10	10	-	-
Class performance (Class Test, Assignment, Problem solving session)	30%	10	10	-	10
Total	**100%**	**30**	**30**	**10**	**30**

<u>Part C – Assessment and Evaluation</u>

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester, 2 class tests will be taken for midterm and 2 class tests will be taken for final term. 3 out of 4 class tests will be considered. (Best must be chosen among CTs from the same CLO). No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: Assignment (Written and/or presentation.) will be given throughout the semester. Late submission will result in a 50% deduction in score. Students will have to do the presentation on the given topic as an assignment.

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 30)	**Tests (20)**	**Assignments (10)**
Remember		
Understand		
Apply	**20**	**10**

Analyze		
Evaluate		
Create		

SMEB- Semester Mid & End Examination (70 Marks)

Bloom's Category	**Test**
Remember	14
Understand	
Apply	42
Analyze	14
Evaluate	
Create	

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual students will be evaluated based on the following criteria with respective weights.

1. Assessment 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00

Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Introduction to Computers - Peter Norton
2. Teach Yourself C - Herbet Schildt
3. Structured C/C Plus Plus Programming - Dr. Mohammad Kaykobad
4. Esho Programming Shikhi - Tamim Shariar Subeen

Course Outline - Computer Fundamentals and Programming Lab

Part A – Introduction

1. Course Code: CSE 102

2. Course Title: Computer Fundamentals and Programming Lab

3. Course Type: Core course

4. Level: 1st year 1st Semester (Section: A, B, C, D)

5. Academic Session: Fall 2023

6. Course Instructor: Sabiha Tahsin Soha (STS), Lecturer
Nakiba Nuren Rahman (NNR), Lecturer
Noor Mairukh Khan Arnob (NMK), Lecturer

7. Prerequisite: None

8. Credit Value: 1.5

9. Contact Hours: 3.0

10. Total Marks: 100

11. Course Objectives and Course Summary:

The objectives of this course are to:

1. **Gain** confidence in using a computer for composing documents and communicating with the internet.
2. **Learn** the basic syntaxes and functionalities of C Programming Language
3. The course will provide a comprehensive introduction to the foundational concepts of computer software, hardware, and programming. Students will acquire elementary knowledge of programming languages. The course begins with an introduction to basic concepts in Microsoft Word, Excel, and presentations. Following this, C programming is introduced, covering fundamental concepts such as input-output, data types, constants,

and variables, as well as operators and expressions. The course then progresses to advanced topics such as decision-making, repetition and loop statements, arrays.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Create** documents, presentations and spreadsheets using related tools
CLO 2	**Design** algorithms and flowcharts of problem solution
CLO 3	**Develop** simple C programs using, data types, operators, conditionals, loops and array

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):
*Note: Course Outcome (CO) is the same as the Course Learning Outcome (CLO) and Program Outcome (PO) is the same as the Program Learning Outcome (PLO).

CLO No.	**CLO Statements:** Upon successful completion of the course, students should be able to:	**Corresponding PLOs (Appendix-1)**	**Bloom's taxonomy domain/level (Appendix-2)**	**Delivery methods and activities**	**Assessment Tools**
CLO1	**Create** documents, presentations and spreadsheets using related tools	e	1/Apply	Lecture, Practice sessions	Lab evaluation, assignments, presentation
CLO2	**Design** algorithms and flowcharts of problem solution	c	1/Apply	Lecture, Problem Solving, Practice sessions	Lab evaluation, problem solving
CLO3	**Develop** simple C programs using, data types, operators, conditionals, loops and array	c	1/Apply	Lecture, Problem Solving, Practice sessions	Lab evaluation, problem solving

Part B – Content of the Course

14. Course Content:

Computer Hardware: mouse, keyboard, monitor, CPU, printer, scanner, router, modem, memory, RAM; **Application Software:** Word Processing Software, Spreadsheet Software, Presentation Software, **Programme Planning Tools:** flowcharts, algorithms, pseudocodes; **Introduction to Programming:** basic input-output, data types, constants and variables; operators and expressions; type conversion; **Decision making:** branching and selection structures; if-else and switch statements, conditional operators; **Repetition and Loop Statements:** for loop, while loop, do-while loop, branching and looping, loop nesting; **Arrays:** introduction to arrays.

15. Alignment of topics of the course with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Introductory class, Microsoft Word, Microsoft Excel, Microsoft Powerpoint	CLO1
2	Programming planning tools: Algorithms and flowcharts	CLO2
3	Command prompt and Introduction to C Programming, branching concept, if-else and switch case, basic of loops, nested loops, Introduction to array & 2D array	CLO3

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific ProgramOutcome (PO) (s)	Time Frame	Suggested Activities	Teaching Strategy (s)	Alignment with CLO
Basic introductory class	To provide an overview of the course	Week 1	Overview of the course outline and discussing the week-by-week development of the topics in the syllabus	Lecture, Multimedia	CLO1

Microsoft Word (Text basics, Formatting texts and paragraph, Proofing features, Modifying page layout, Working with tables, Creating table of contents, logos, etc., Inserting illustrations, header, footer, add-ins, links, comments, equations, Insert citations and bibliography etc.)	To explore the functionalities and professional options in MS Word	Week 2	Word document Practice problems	Lecture, Multimedia, practice problems	CLO1
Microsoft Excel (demonstration) Lab Test on MS Word	To explore the functionalities and professional options in MS Excel	Week 3	Excel Practice problems	Lecture, Multimedia, practice problems	CLO1
Microsoft Powerpoint (Slide creation, Slide Design and Animation. Transition, Slideshow, etc.) Lab Test on MS Excel	To explore the functionalities of MS Powerpoint and learn professional presentation techniques	Week 4	Powerpoint example templates	Lecture, Multimedia, Powerpoint templates	CLO1
Microsoft Powerpoint (Individual/group presentation)	To acquaint the students with the experience of presenting in a professional environment	Week 5	Multimedia powerpoint presentation	Multimedia	CLO1
Programming planning tools: Algorithms, flowcharts **Computer components, command prompt and Introduction to C Programming:** (input-output, data types, constants and variables; operators and expressions, type conversion)	To acquire primary concepts of C programming	Week 6	Basic level programing problem examples	Lecture, Multimedia	CLO2, CLO3

C Programming: branching concept, if-else	To understand the basic concept of branching and if else statements	Week 7	Branching Practice exercises and if-else practice problems	Lecture, Multimedia	CLO3
C Programming: if-else and switch case	To understand the difference between if-else and switch case structure	Week 8	if-else and switch case practice problems	Lecture, Multimedia	CLO3
C Programming: Basic of loops Lab Test on Fundamentals of C	To grasp the fundamentals idea of loops	Week 9	Practice problems on loops	Lecture, Multimedia	CLO3
C Programming: Problem solving on loops, Introduction to nested loops	To understand the advanced concept of nested loops	Week 10	Practice problems on nested loops	Lecture, Multimedia	CLO3
C Programming: Problem solving on nested loops, Introduction to array	To gain the elementary concept of array	Week 11	Practice problems on array	Lecture, Multimedia	CLO3
C Programming: Problem solving on Array and Introduction to 2D array	To practice pattern structure practice problems to rationalize the concept of array	Week 12	Pattern printing/structured practice problems on array, 2D array	Lecture, Multimedia	CLO3
Review Class	To go through all the topics covered in the syllabus so far and discuss the lab final exam	Week 13	Practice problems	Lecture, Multimedia	CLO1, CLO2, CLO3
Week 14 - Lab Final Examination					

17. Teaching-Learning Strategies:

Practical examples will be incorporated with each of the lab classes from the beginning. The class lectures will be broken down into interactive examples where students will be encouraged to ask questions to create an open atmosphere for exploration and relate computer fundamentals and programming concepts to real-world examples and applications. Progressively challenging assignments will be built and assigned to the students to reinforce learning, evaluate understanding and adjust teaching accordingly. Feedback will be provided on students' work to guide their progress and address misconceptions. It will be discussed throughout the weekly lab classes on how programming is used in various industries from game development to scientific research, to make the subject matter more relevant and engaging.

18. Assessment Techniques of each topic of the course:

Assessment Type	% weight	CLO1	CLO2	CLO3
Final Exam and Viva	40%	-	-	40
Lab Tests	40%	20	-	20
Continuous Evaluation: Class performance, Problem Solving Sessions, assignments	20%	-	10	10
	100%	**20**	**10**	**70**

Part C – Assessment and Evaluation

19. Assessment Strategy

Lab exams: Altogether 4 to 6 lab exams may be taken during the semester. 3 out of 4/4 out of 5/5 out of 6 lab exams may be considered depending on the number of lab exams taken. No makeup lab exam will be taken. Students are strongly recommended not to miss any lab exams.

Assignment: Assignment (Written and/or presentation.) will be given throughout the semester. Late submission will result in a 50% deduction in score. Students will have to do the presentation on the given topic as an assignment.

CIE- Continuous Internal Evaluation (60 Marks)

Bloom's Category **Marks (out of 60)**	**Tests (40)**	**Assignments (20)**
Remember		
Understand		
Apply	**40**	**20**
Analyze		
Evaluate		
Create		

SEB- Semester End Examination (40 Marks)

Bloom's Category	Test
Remember	
Understand	
Apply	40
Analyze	
Evaluate	
Create	

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual students will be evaluated based on the following criteria with respective weights.

1. Lab Tests 40%
2. Term Examination 40%
3. Continuous Evaluation 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Introduction to Computers - Peter Norton
2. Teach Yourself C - Herbet Schildt
3. Structured C/C Plus Plus Programming - Dr. Mohammad Kaykobad
4. Esho Programming Shikhi - Tamim Shariar Subeen

Course Outline – Math-I: Calculus I

Part A – Introduction

1.	**Course No. / Course Code:**	MTH 101
2.	**Course Title:**	Math-I: Calculus I
3.	**Course Type:**	Theory
4.	**Level/Term and Section:**	1^{st} year 1^{st} Semester
5.	**Academic Session:**	Fall 2023
6.	**Course Instructor:**	
7.	**Pre-requisite (If any):**	None
8.	**Credit Value:**	3.00
9.	**Contact Hours:**	3.00
10.	**Total Marks:**	100

11. Course Objectives and Course Summary:

- Define the limit, continuity and differentiability of functions, identify the rate of change of a function with respect to independent variables and describe the different techniques of evaluating indefinite and definite integrals.
- Apply the concepts or techniques of differentiation and integration to solve the problems related to engineering study.
- Calculate the length, area, volume, center of gravity and average value related to engineering study.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	Define the limit, continuity and differentiability of functions, identify the rate of change of a function with respect to independent variables.
CLO 2	Describe the different techniques of evaluating indefinite and definite integrals.
CLO 3	Apply the concepts or techniques of differentiation and integration to solve the problems related to engineering study.
CLO 4	Use of Gamma and Beta functions to evaluate integrals.
CLO 5	Calculate the length, area, volume, center of gravity and average value related to engineering study.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	PLO1	Define	Lecture, Problem Solving	Class Test, Mid-term
CLO2	PLO1	Describe	Lecture, Problem Solving	Class Test, Mid-term
CLO3	PLO1	Calculate	Face to Face Learning (lecture)	Class Test, Mid-term
CLO4	PLO2	Evaluate	Problem Solving	Class Test, Assignment, Final Exam
CLO5	PLO2	Apply	Multimedia	Class Test, Assignment, Final Exam

Part B – Content of the Course

14. Course Content: Functions: Graphing Functions, Mathematical Models and Commonly used Functions (Linear, Polynomial, Power), Mathematical Models and Commonly Used Functions (Algebraic, Trigonometric, Exponential, and Logarithmic Functions), Transformations (Scaling, Reflection, Composition), Inverse of Functions, Growth of Functions. **Limits:** Concepts, One Sided Limits, Infinite limits, Limit Laws, Sandwich Theorem, Formal Definition of Limits and Continuity of Functions, Intermediate Value Theorem and Its Application, Limits at Infinity and the Horizontal Asymptotes. **Derivatives:** Derivatives and Rate of Change, Derivatives as Functions, Differentiability of Functions, Rules and Techniques of Differentiation. **Applications of Differentiation:** Rates of Change in Natural and Social Sciences, Exponential Growth and Decay, Linear Approximation and Differentials, Finding Minimum and Maximum Value of Functions and the first and Second Derivative Tests, Indeterminate Forms and L'Hospital's Rule, Curve Sketching. **Integrals:** Riemann Sum and Definite Integrals, Properties of Integrals, Fundamental Theorem of Calculus, Anti-Derivative and Indefinite Integral, Net Change Theorem, Substitution Rule. **Application of Integration:** Finding Area between Curves, Volumes, Volumes by Cylindrical Shells, Average Value of a Function,Mean Value Theorem for Integrals.

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Limit, continuity and differentiability	**CLO1**

2	Indefinite and definite integrals	**CLO2**
3	Applied problems related to integration	**CLO3**
4	Gamma and Beta functions	**CLO4**
5	Length, area, volume	**CLO5**

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	**Specific Outcome(s)**	**Time Frame**	**Suggested Activities**	**Teaching Strategy(s)**	**Alignment with CLO**
Function, Limit Continuity		Week 1		Multimedia or, Lecture	CLO1
Differentiability, Successive differentiation		Week 2		Multimedia or, Lecture	CLO1
Leibnitz's theorem, Mean Value theorem, Taylor theorem		Week 3		Multimedia or, Lecture	CLO1
Partial Differentiation		Week 4		Multimedia or, Lecture	CLO2
Maxima and minima of functions		Week 5		Multimedia or, Lecture	CLO2
MID-TERM EXAMINATION		Week 6			
Tangent and Normal		Week 7		Multimedia or, Lecture	CLO2
Method of substitution		Week 8		Multimedia or, Lecture	CLO2
Techniques of integration		Week 9		Multimedia or, Lecture	CLO3
Definite integration, Reduction formula		Week 10		Multimedia or, Lecture	CLO3
Gamma and Beta function		Week 11		Multimedia or, Lecture	CLO4
Area , Volume problems		Week 12		Multimedia or,	CLO5

				Lecture	
Area , Volume problems in polar co-ordinates		Week 13		Multimedia or, Lecture	CLO5
Multiple integrals		Week 14		Multimedia or, Lecture	CLO5
FINAL EXAMINATION		Week 15			

17. **Teaching-Learning Strategies:** Face to Face Learning (lecture), Guided Learning, Independent Learning, Assessment
18. **Assessment Techniques of each topic of the course:** Class Test, Assignment, Mid-Term Exam, Final Exam

Part C – Assessment and Evaluation

19. **Assessment Strategy**

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignment in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 30)	**Tests (15)**	**Assignments (5)**	**Quizzes (5)**	**External Participation in Curricular/Co-Curricular Activities (5)**
Remember			**3**	
Understand	**2**		**2**	
Apply	**3**	**5**		
Analyze	**5**			
Evaluate	**5**			
Create				**5**

SMEB- Semester Mid & End Examination (70 Marks)

Bloom's Category	**Test**
Remember	5

Understand	10
Apply	15
Analyze	15
Evaluate	15
Create	10

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

<u>Part D – Learning Resources</u>

21. Text Book

1. Howard Anton, Irl C. Bivens, Stephen Davis, Calculus, 10th Edition.

   Reference Books & Materials

2. Morris Kline, Calculus: An Intuitive and Physical Approach, 2nd Edition.

3. Schaum's Outline of Calculus, Seventh Edition.

Course Outline: Bangladesh Studies: History, Society, and Culture

Part A – Introduction

1. Course Code:	HSS 111
2. Course Title:	Bangladesh Studies: History, Society, and Culture
3. Course Type:	Core course
4. Level:	1st year 1st Semester (Section: A, B, C, D)
5. Academic Session:	Fall 2023
6. Course Instructor:	
7. Prerequisite:	None
8. Credit Value:	3.0
9. Contact Hours:	3.0
10. Total Marks:	100

11. Course Objectives and Course Summary:

The objectives of this course are to:

1. **Introduce** knowledge about different theoretical perspectives.
2. **Provide** a fundamental course required for building a basic knowledge about history, society and culture of Bangladesh and the globe as well.
3. **Introduce** the world of cultural diversity with a broader vision.

This course explores the rich and diverse history of Bangladesh, from its ancient civilizations and medieval periods under the Bengal Sultanate and Mughal Empire to its colonial experiences under British rule. It delves into the significant movements leading to the country's independence, particularly the Language Movement and the Liberation War of 1971, emphasizing key figures and events. Post-independence, the course examines the political, economic, and social transformations, including issues like environmental challenges, urbanization, and human rights. Additionally, it highlights the vibrant culture of Bangladesh, covering religion, literature, arts, and festivals, while providing practical learning through case studies and fieldwork. The course aims to offer a comprehensive understanding of Bangladesh's past, present, and future prospects within a global context, supplemented by recommended readings and resources.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO1	**Describe** knowledge about different theoretical perspectives.
CLO2	**Understand** different social structures and stratification patterns.

CLO3	**Design** world of cultural diversity with a broader vision
CLO4	**Learn** to deal with any social problems at the same time coping with it.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

*Note: Course Outcome (CO) is the same as the Course Learning Outcome (CLO) and Program Outcome (PO) is the same as the Program Learning Outcome (PLO).

CLO No.	**CLO Statements:** Upon successful completion of the course, students should be able to:	**Corresponding PLOs (Appendix-1)**	**Bloom's taxonomy domain/level (Appendix-2)**	**Delivery methods and activities**	**Assessment Tools**
CLO1	**Describe** knowledge about different theoretical perspectives.	a	1/Understand	Lecture, Classwork, Assignments	Quiz, Written exam
CLO2	**Understand** different social structures and stratification patterns.	a	1/Apply	Lecture, Classwork, Assignments	Quiz, Written exam
CLO3	**Design** world of cultural diversity with a broader vision.	b	1/Apply	Lecture, Classwork, Assignments	Quiz, Written exam
CLO4	**Learn** to deal with any social problems at the same time coping with it.	c	1/Apply	Lecture, Classwork, Assignments	Quiz, Written exam

<u>Part B – Content of the Course</u>

14. Course Content:

Computer Hardware: mouse, keyboard, monitor, CPU, printer, scanner, router, modem; **Computer Software:** application software, system software; **Boolean Algebra:** logic gates, Boolean addition, and multiplication; **Number Systems:** binary, decimal, octal, hexadecimal number systems and their conversions, addition, subtraction; **Program Planning Tools:** flowcharts, algorithms, pseudocodes; **Introduction to Programming:** basic input-output, data types, constants and variables, operators and expressions, type conversion; **Decision making:** branching and selection structures, if-else and switch statements, conditional operators; **Repetition and Loop Statements:** for loop, while loop, do-while loop, branching and looping, loop nesting; **Arrays:** introduction to arrays.

15. Alignment of topics of the course with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Land and Geography, Climate, Anthropological Roots of People. Origin of the name 'Bangladesh'. Different janapadas (territorial divisions). Rising of the Muslims, Socio-economic and cultural changes. The Independent Sultanate of Bengal: Iliyas Shahi and Husain Shahi dynasty. The establishment of Mughal rule in Bengal, the Bara Bhuiyans of Bengal. Bengal in Modern Times: Coming of the Europeans. Process of political consolidation of British rule in 1757 and 1764. Granting of Diwani (1765), Dual or Double System, Permanent Settlement (1793), Resistance and anti-British movements, English education and its impact.	CLO1
2	Socio-economic disparities during Pakistan period, Language Movement of 1948 and 1952, Election of 1954, Constitution of 1956, Foundation of Awami League, Military rule in Pakistan. Bangladesh War of Liberation: Military action and genocide in the then East Pakistan. War of Liberation in 1971: Civil and Military resistance, Role of different social and political groups in the War, Regional and Global reactions: Role of India, United States, Soviet Union and China. The emergence of Bangladesh as a sovereign and independent state in 1971.	CLO2
3	the development of Sociology, major theoretical perspectives -- Functionalism, Conflict theory, Feminism and Interactionism; Gerhard Lenski's Theory of Socio-cultural Evolution -- Society and Technology - Hunting and Gathering Societies - Horticultural and Pastoral Societies - Agrarian Societies -- Industrial Societies - Postindustrial Societies; Socialization - Nature versus Nurture - Theories of awareness of social self, Socialization Agents - Life course - Re-socialization; Culture: Elements of Culture – Symbols –Language - Values, Beliefs and Norms, Cultural Diversity, Subculture, Counterculture, Multiculturalism, Cultural Change, Ethnocentrism and Cultural Relativism;	CLO3
4.	Historical Overview, Economic Systems, Global Economy; Politics and Economy: Types of Authority, Types of Governments; Urbanization and Urbanism: The Development of the City and the Modern Cities, Urbanization in the Developing World; Environment and Sociology: Environmental Issues:	CLO4

	Pollution and waste, Resource depletion, Organic food, Genetic modification of food, Global Warming and Climate Change.	

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Program Outcome (PO) (s)	Time Frame	Suggested Activities	Teaching Strategy (s)	Alignment with CLO
Roots of Bengal: Land and Geography, Climate, Anthropological Roots of People. Origin of the name 'Bangladesh'. Different janapadas (territorial divisions). Rising of the Muslims, Socio-economic and cultural changes. The Independent Sultanate of Bengal: Iliyas Shahi and Husain Shahi dynasty. The establishment of Mughal rule in Bengal, the Bara Bhuiyans of Bengal.	a	Week 1	Assignment	Lecture, Multimedia	CLO1
Bengal in Modern Times: Coming of the Europeans. Process of political consolidation of British rule in 1757 and 1764. Granting of Diwani (1765), Dual or Double System, Permanent Settlement (1793), Resistance and anti-British movements, English education and its impact.	a	Week 1	assignment/ quiz	Lecture, Multimedia	CLO1
Socio-economic disparities during Pakistan period, Language Movement of 1948 and 1952, Election of 1954, Constitution of 1956, Foundation of Awami League, Military rule in Pakistan.	a	Week 2	assignment/ quiz s	Lecture, Multimedia,	CLO1
Military action and genocide in the then East Pakistan. War of Liberation in 1971: Civil and Military resistance, Role of different social and political groups in the War, Regional and Global reactions: Role of India, United States, Soviet Union and China. The emergence of Bangladesh as a sovereign and independent state in 1971.	b	Week 2	Assignment	Lecture, Multimedia	CLO1

the development of Sociology, major theoretical perspectives -- Functionalism, Conflict theory, Feminism and Interactionism; **Gerhard Lenski's Theory of Socio-cultural Evolution** -- Society and Technology - Hunting and Gathering Societies - Horticultural and Pastoral Societies - Agrarian Societies -- Industrial Societies - Postindustrial Societies;	b	Week 3	Practice problems	Lecture, Multimedia	CLO2
the development of Sociology, major theoretical perspectives -- Functionalism, Conflict theory, Feminism and Interactionism; **Gerhard Lenski's Theory of Socio-cultural Evolution** -- Society and Technology - Hunting and Gathering Societies - Horticultural and Pastoral Societies - Agrarian Societies -- Industrial Societies - Postindustrial Societies;	b	Week 4	Practice exercises	Lecture, Multimedia	CLO2
Theory of Socio-cultural Evolution -- Society and Technology - Hunting and Gathering Societies - Horticultural and Pastoral Societies - Agrarian Societies -- Industrial Societies - Postindustrial Societies;	b	Week 5	Practice problems	Lecture, Multimedia	CLO3
Socialization - Nature versus Nurture - Theories of awareness of social self, Socialization Agents - Life course - Re-socialization;	c	Week 5, 6, 7	Practice problems	Lecture, Multimedia	CLO4
Review Class		Week 7			
MID-SEMESTER EXAMINATION					
Culture: Elements of Culture – Symbols –Language - Values, Beliefs and Norms, Cultural Diversity, Subculture, Counterculture, Multiculturalism, Cultural Change, Ethnocentrism and Cultural Relativism;	c	Week 8, 9	Problem solving	Lecture, Multimedia	CLO4
CT3: Class Test 3		Week 10			CLO4
The Economy: Historical Overview, Economic Systems, Global Economy;	c	Week 10, 11,	Problem solving	Lecture, Multimedi	CLO4

Politics and Economy: Types of Authority, Types of Governments;		12		a	
CT4: Class Test 4		Week 12		Lecture, Multimedia	CLO4
Urbanization and Urbanism: The Development of the City and the Modern Cities, Urbanization in the Developing World; **Environment and Sociology:** E**nvironmental Issues**: Pollution and waste, Resource depletion, Organic food, Genetic modification of food, Global Warming and Climate Change.	c	Week 13, 14	Problem solving	Lecture, Multimedia	CLO4
Review Class		Week 14		Lecture, Multimedia	
FINAL EXAMINATION					

17. Teaching-Learning Strategies:

Practical examples will be incorporated with the class lectures from the beginning. The class lectures will be broken down into interactive examples where students will be encouraged to ask questions to create an open atmosphere for exploration and relate computer fundamentals and programming concepts to real-world examples and applications. Progressively challenging assignments will be built and assigned to the students to reinforce learning. Feedback will be provided on students' work to guide their progress and address misconceptions.

18. Assessment Techniques of each topic of the course:

Assessment Type	% weight	CLO1	CLO2	CLO3	CLO4
Final Exam	50%	10	10	10	20
Mid Term Exam	20%	10	10	-	-
Class performance (Class Test, Assignment, Problem solving session)	30%	10	10	-	10
Total	**100%**	**30**	**30**	**10**	**30**

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester, 2 class tests will be taken for midterm and 2 class tests will be taken for final term. 3 out of 4 class tests will be considered. (Best must be chosen among CTs from the same CLO). No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: Assignment (Written and/or presentation.) will be given throughout the semester. Late submission will result in a 50% deduction in score. Students will have to do the presentation on the given topic as an assignment.

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 30)	**Tests (20)**	**Assignments (10)**
Remember		
Understand		
Apply	**20**	**10**
Analyze		
Evaluate		
Create		

SMEB- Semester Mid & End Examination (70 Marks)

Bloom's Category	**Test**
Remember	14
Understand	
Apply	42
Analyze	14
Evaluate	
Create	

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual students will be evaluated based on the following criteria with respective weights.

1. Assessment 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50

45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Richard T. Schaefer. 2013. Sociology in Modules. 2nd edition New York, NY: McGraw-Hill.
2. James M. Henslin. 2015. Sociology: A Down-to-Earth Approach. 11th ed. New Jersey: Pearson
3. Sirajul Islam (ed.), History of Bangladesh
4. Bangla Pedia, Asiatic Society of Bangladesh

Course Outline: English

Part A – Introduction

1.	**Course No. / Course Code:**	ENG (CSE) 101
2.	**Course Title:**	English
3.	**Course Type:**	Core Course
4.	**Level/Term and Section:**	1st Year
5.	**Academic Session:**	Fall 2023
6.	**Course Instructor:**	Nusrat Hossain; Lecturer Marzia Hossain Chaity; Lecturer
7.	**Pre-requisite (If any):**	N/A
8.	**Credit Value:**	3.00
9.	**Contact Hours:**	Sunday 9.30 am - 2.00 pm (Nusrat Hossain) Sunday 11.00 am - 2.00 pm (Marzia Hossain Chaity)
10.	**Total Marks:**	100

11. **Course Objectives and Course Summary:** The objective of this course is to make the students acquire comprehensive knowledge on grammar and writing skills so that they can use it for effective learning of their own subject, answer in English during their examinations and for communicative purposes.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Understand** the basics of English grammar
CLO 2	**Use** reading techniques like scanning and skimming
CLO 3	**Write** various types of reports, letters, applications, and presentations using IT tools
CLO 4	**Demonstrate** basic communication skills in the target language

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	PLO10	2	Lecture, multimedia, Problem solving classes	Quiz, Written exam
CLO2	PLO10	2	Lecture, Practice, Problem solving	Quiz, Written exam
CLO3	PLO05	3, 4	Lecture, Multimedia, Pair Work	Written exam
CLO4	PLO10	3	Lecture, discussion	Written exam, Presentation

<u>Part B – Content of the Course</u>

14. Course Content:

15. Alignment of topics of the courses with CLOs:

SL	Topic/ Content	Course Outcome
1	Overview of the syllabus, Introduction to basic grammar like Articles	CLO1
2	Subject Verb Agreement and Prepositions; **Quiz 1**	CLO1
3	Pronouns and possessives, Reading comprehension	CLO1, CLO2
4	Tense; **Class Test 1**	CLO1
5	letter writing (Order, Apology, Complain, Request)	CLO3
6	Email Writing	CLO4
7	Review of Midterm Syllabus	
	MIDTERM EXAM	
8	Discussion of Midterm Exam Result, Conditional Sentences	CLO1, CLO2
9	Joining sentences	CLO1
10	Modals Verbs, **Quiz 2**	CLO1

11	Commonly confusing words	CLO2
12	Punctuation, capital letters and Spelling (Error Correction)	CLO1, CLO2
13	Film and book review; **Presentation**	CLO4
14	Paragraph writing and Review of Final Exam Syllabus	CLO3, CLO4

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	**Specific Outcome(s)**	**Time Frame**	**Suggested Activities**	**Teaching Strategy(s)**	**Alignment with CLO**
Introduction to Articles	Understanding the use of article in writing	Week 1	Class notes and exercise sheets on article	Lecture and problem solving	CLO1
Subject Verb Agreement and Prepositions; Quiz 1	Understanding the position of subject, verb and preposition for proper sentence construction	Week 2	Class notes and exercise sheets on subject-verb agreement and preposition	Lecture and problem solving	CLO1
Pronouns and possessives, Reading comprehension	Constructing proper sentence and learning to use reading techniques	Week 3	Class notes and exercise sheets on pronouns and practicing reading comprehension from suggested textbook	Lecture and problem solving	CLO1, CLO2
Tense; Class Test 1	Understanding the use of tense and changes in verb forms	Week 4	Class notes and exercise sheets on tense	Lecture and problem solving	CLO1
letter writing (Order, Apology, Complain, Request)	Learning correct format of formal letters and constructing sentence in formal English	Week 5	Letter format and samples from Oxford Handbook of Correspondence	Lecture and Pair work	CLO3
Email Writing	Understanding the use of email and proper format of a professional email	Week 6	Email format and samples from Oxford Handbook of Correspondence	Lecture and Pair work	CLO4
Review of Midterm Syllabus		Week 7			
MID-TERM EXAMINATION					

Discussion of Midterm Exam Result, Conditional Sentences	Understanding the use of conditionals sentences	Week 8	Class notes and exercise sheets on conditional sentences	Lecture and problem solving	CLO1, CLO2
Joining sentences	Constructing sentences in simple, complex and compound structures	Week 9	Class notes and exercise sheets on joining sentences	Lecture and problem solving	CLO1
Modals Verbs, Quiz 2	Understanding the use of modal verbs in a sentence	Week 10	Class notes and exercise sheets on modal verbs	Lecture and problem solving	CLO1
Commonly confusing words	Identifying homonyms and homophones and learning their proper usage	Week 11	Class notes and exercise sheets on homophones and homonyms	Lecture and problem solving	CLO2
Punctuation, capital letters and Spelling (Error Correction)	Learning different types of punctuation marks and use of capitalization in constructing sentences. Focusing on common spelling mistakes	Week 12	Class notes and exercise sheets on punctuation marks and capitalization. List of common spelling mistakes and practice	Lecture and problem solving	CLO1, CLO2
Film and book review; Presentation	Demonstrating communication skills	Week 13	Slides on presentation and samples of Film and book review from newspapers	Lecture and Multimedia	CLO4
Paragraph writing and Review of Final Exam Syllabus	Understanding the correct format of paragraph and writing in formal English	Week 14	Paragraph writing from Writing Essays with Ease	Lecture and Group Discussion	CLO3, CLO4
FINAL EXAMINATION					

17. Teaching-Learning Strategies: Lecture, Problem solving, Pair work, Group discussion, Multimedia

18. Assessment Techniques of each topic of the course:

Topic/ Content	Assessment Technique
Introduction to Articles	Quiz
Subject Verb Agreement and Prepositions	Quiz
Pronouns and possessives, Reading	Class Test

comprehension	
Tense	Class Test
letter writing (Order, Apology, Complain, Request)	Written Examination
Email Writing	Class Work
Conditional Sentences	Written Examination
Joining sentences	Written Examination
Modals Verbs	Written Examination
Commonly confusing words	Written Examination
Punctuation, capital letters and Spelling (Error Correction)	Written Examination
Film and book review	Presentation
Paragraph writing and Review of Final Exam Syllabus	Written Examination

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Test and Quizzes: Altogether 1 class test and 2 quizzes may be taken during the semester, 1 class test and 1 quiz will be taken for midterm and 1 quiz will be taken for final term. Marks for all of the class tests and quizzes will be counted. No makeup class tests and quizzes will be taken. Students are strongly recommended not to miss any class tests.

Presentation: The students will have to give individual presentations. The topic will be given during the class which they have to prepare at home and will submit on or before the due date. No late submission of presentations will be accepted. Students will have to do the presentation on the given topic.

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 50)	Tests (10)	Presentation (10)	Quizzes (5+5=10)
Remember	**10**		**5**
Understand			
Apply			**5**
Analyze		**10**	
Evaluate			
Create			

SMEB- Semester Mid & End Examination (70 Marks)

Bloom's Category	**Mid**	**Final**
Remember	**4**	**5**
Understand		**5**
Apply	**6+10 = 16**	**40**
Analyze		
Evaluate		
Create		

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual students will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Soars, J., Soars, L. (4th Edition) New Headway Pre-Intermediate Student's Book. London, Oxford University Press.

2. A. Ashley (2nd Edition) Oxford Handbook of Commercial Correspondence. London, Oxford University Press.

Reference Books & Materials

1. Wren, Martin. (2013-2014) New Headway Pre-Intermediate Workbook without key. London, Oxford University Press.
2. High School English Grammar & Comprehension, (Wren & Martin)
3. Grammar in Use, (Raymond Murphy)

First Year Second Semester

Course Outline – Structured Programming

Part A – Introduction

1.	**Course No. / Course Code:**	CSE 103
2.	**Course Title:**	Structured Programming
3.	**Course Type:**	Core course
4.	**Level/Term and Section:**	1st Year 2nd Semester
5.	**Academic Session:**	Fall 2023
6.	**Course Instructor:**	i. Dr. A.K.M. Ashikur Rahman, Professor , ii. Fahad Ahmed, Assistant Professor
7.	**Prerequisite (If any):**	CSE 101
8.	**Credit Value:**	3.00
9.	**Contact Hours:**	3.00
10.	**Total Marks:**	100

11. Course Objectives and Course Summary:

The objectives of this course are to:

1. Provide good programming principles to the **design** and **implementation** of C/C++ programs.

2. Show the use of industrial-strength software development **tools** in the programming process.

3. Demonstrate algorithmic issues and analyze solutions to real-life interesting problems.

4. Apply knowledge of data structures.

The summary of this course are to:

Course Synopsis: This course is a basic course to programming languages using C. The objectives of the course are to attain a basic knowledge of programming, an understanding of algorithmic issues and an ability to analyze solutions to real-life interesting mathematical problems. The topics to be covered include introduction and history of C; data types, constants and variables; operators and expressions; type conversion; decision making, branching and looping; arrays and strings; library functions and user defined functions; structures;
pointers; and file management.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Understand** the basic concepts of programming language, the general problems and methods related to syntax & semantics.
CLO 2	**Analyze** the sequence control and data control.
CLO 3	**Apply** the subprogram calls and returns.
CLO 4	**Create** storage management concepts using programming languages.
CLO 5	**Apply** the concept of Array and Strings for different problem solving.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	1	1	Lecture , Multimedia	Quiz, Written exam
CLO2	2	1	Lecture , Multimedia	Written exam
CLO3	2	1	Lecture , Problem Solving	Written exam
CLO4	3	1	Lecture, Group discussion	Assignment
CLO5	5	1	Lecture, multimedia,	Quiz, Written exam

Part B – Content of the Course

14. Course Content:

This course offers a comprehensive introduction to programming using the C language, covering fundamental concepts and essential programming techniques. Students will learn about the history and evolution of C, along with its role in computer programming. Topics include data types, variables, operators, decision-making structures, loops, arrays, functions, strings, structures, pointers, file input/output and structure. Additionally, the course touches on advanced topics such as bitwise operators, macros. By the end of the course, students will have a solid understanding of C programming fundamentals, enabling them to write efficient and structured code for various applications.

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Structured Programming Basic Concept	CLO 1, CLO 2
2	Loop Statement: for loop, while loop, do-while loop	CLO 2
3	Arrays: 1 dimensional, Multidimensional array, character type array(string)	CLO 5
4.	Function , recursions	CLO 3
5.	Structure	CLO 4
6.	Pointers, File access	CLO 4

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	**Specific Outcome (s)**	**Time Frame**	**Suggested Activities**	**Teaching Strategy(s)**	**Alignment with CLO**
Overview of computers and programming; history of C; data types, constants and variables; operators and expressions; type conversion;		Week 1	Study C's historical context, practice data type declarations.	Lecture, multimedia, Discussions	CLO1, CLO2
Decision making: branching and selection structures; if-else and switch statements, conditional operators;		Week 2	Practice writing code examples utilizing if-else and switch statements.	Lecture, Problem Solving	CLO1
Repetition and Loop Statements: for loop; while loop; do-while loop; branching and looping; loop nesting.		Week 3-4	Practice loop structures.	Lecture, Case study	CLO1, CLO2
Arrays: 1 dimensional, Multidimensional array.		Week 5	Extensive exercise using arrays.	Case study	CLO4, CLO5
Top -down design with functions; parameter passing conventions, scope rules and storage classes,		Week 6	Study function design and implementation.	Lecture	CLO2, CLO3

recursions and library functions.					
String manipulation with and without library functions.		Week 7	Practice string manipulation techniques thoroughly.	Lecture	CLO5
MID-TERM EXAMINATION					
Structures, array of structures, structure as function parameter		Week 8	Practice with structures and arrays. Read others' code.	Lecture, Problem Solving	CLO3, CLO5
Pointers: Concept, pointer arithmetic, multi - dimensional pointers		Week 9	Study pointer concepts thoroughly, practice. Follow different books.	Lecture, multimedia Group discussion	CLO3
File access. Text vs. binary mode. Different library functions for File I/O		Week 10	Experiment with file input/output extensively.	Lecture	CLO4
Recursion		Week 11	Understand, practice, implement recursive algorithms.	Lecture, multimedia	CLO2, CLO3
Dynamic memory allocation, Linked list		Week 12	Practice dynamic memory allocation extensively.	Lecture, Group discussion	CLO4
Bitwise operators and macros		Week 13	Experiment with bitwise operators, macros.	Lecture, multimedia	CLO1
From C to C++, concept of object oriented programming, class		Week 14	Transition to object-oriented paradigm, practice.	Lecture, Group discussion	CLO1
FINAL EXAMINATION					

17. Teaching-Learning Strategies:

18. Assessment Techniques of each topic of the course:

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignments in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 50)	**Assignments (10)**	**Quizzes (20)**
Remember		
Understand		**10**
Apply	**10**	
Analyze		**10**
Evaluate		
Create		

SMEB- Semester Mid & End Examination (70 Marks)

Bloom's Category	**Marks(out of 70)**
Remember	
Understand	**15**
Apply	**20**
Analyze	**35**
Evaluate	
Create	

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual students will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

<u>Part D – Learning Resources</u>

21. Text Book

1. Arora, Renu and Sood S.K, Fundamentals of Entrepreneurship and Small Business, 1't Edition (2003), Kalyani Publishers, New ‘Delhi, India’.

Reference Books & Materials

2. Barringer, Bruce R. and Ireland Duane R., Entrepreneurship Successfully Lunching New Ventures. 3'd Edition (2010) Pearson Education Inc., New Delhi, India
3. Others

Course Outline – Structured Programming Lab

Part A – Introduction

1.	**Course No. / Course Code:**	CSE 104
2.	**Course Title:**	Structured Programming Lab
3.	**Course Type:**	Core course
4.	**Level/Term and Section:**	1st Year 2nd Semester
5.	**Academic Session:**	Fall 2023
6.	**Course Instructor:**	i.Fahad Ahmed, Assistant Professor ii.Nuzhat Tabassum Progga, Lecturer
7.	**Prerequisite (If any):**	Nil
8.	**Credit Value:**	1.50
9.	**Contact Hours:**	3.00
10.	**Total Marks:**	100

11. Course Objectives and Course Summary:

The objectives of this course are to

1. Provide opportunities to develop basic programming skills with respect to structured programming methodology.

2. Describe programming approaches that avoid common coding errors.

3. Explain how to solve a problem using Object Oriented Programming features in C++.

The summary of this course are to:

Structured Programming: introduction and flow control, Function: argument and parameter of a function return type. Recursive Function, Arrays: introduction to array, declaration and definition of an array, types of array, multidimensional array, Character Strings: String manipulation, Dynamic memory allocation. Recursive functions: Defining and working procedure, base condition. Structures: Concepts, Accessing members, Arrays of structures. Pointers: Fundamentals, declarations, Pointers and structures/arrays, Arrays of Pointers. File Operations: opening and closing a file, Operation on a file, Binary I/O, Random access.

12. **Course Learning Outcomes: at the end of the Course, the Student will be able to –**

CLO 1	**Solve** problems using Structured Programming approaches.
CLO 2	**Develop** solutions for real life problems using Structured Programming approach.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	b	1/Apply	PPT, Lecture, Problem Solving	Problem Solving, Viva, Final Exam
CLO2	c	1/Apply	PPT, Lecture, Problem Solving	Problem Solving, Viva, Final Exam

Part B – Content of the Course

14. Course Content:

This course offers a comprehensive introduction to programming using the C language, covering fundamental concepts and essential programming techniques. Students will learn about the history and evolution of C, along with its role in computer programming. Topics include data types, variables, operators, decision-making structures, loops, arrays, functions, strings, structures, pointers, file input/output and structure. Additionally, the course touches on advanced topics such as bitwise operators, macros. By the end of the course, students will have a solid understanding of C programming fundamentals, enabling them to write efficient and structured code for various applications.

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Structured Programming Basic Concept	CLO 1
2	Loop Statement: for loop, while loop, do-while loop	CLO 1, CLO2
3	Arrays: 1 dimensional, Multidimensional array, character type array(string)	CLO 1
4.	Function , recursions	CLO 1
5.	Structure	CLO 2
6.	Pointers, File access	CLO 1

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome (s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Structured Programming introduction and flow control		Week 1	Study the following topic	PPT Lecture, Problem Solving, Practice sessions	CLO1, CLO2
Flow control: flow control, Nested Loop Class performance/ Assignment		Week 2-3	Practice writing code examples utilizing	PPT Lecture, Problem Solving, Practice sessions	CLO1
Arrays: introduction to the array, declaration and definition of an array, types of array, multidimensional array, programs using array, matrix multiplication using the array. Class performance/ Assignment		Week 4-5	Practice loop structures.	PPT Lecture, Problem Solving, Practice sessions	CLO1
Function: argument and parameter of a function return types, inline declaration, and forward declaration of a function. Class performance/ Assignment		Week 6-7	Study function design and implementat ion.	PPT Lecture, Problem Solving, Practice sessions	CLO1
Character Strings: Variable length character strings, String manipulation Class performance/ Assignment		Week 8	Practice string manipulatio n techniques thoroughly	PPT Lecture, Problem Solving, Practice sessions	CLO1, CLO2
Pointers: Fundamentals, declarations, Pointers and structures/arrays, Operations on Pointers, Pointers to function, Pointer and memory address, Arrays of Pointers Structures: Concepts, Accessing members, Arrays of structures Class performance		Week 9	Study pointer concepts thoroughly, practice. Follow different books.	PPT Lecture, Problem Solving, Practice sessions	CLO1, CLO2
Structures, array of structures, structure as function parameter		Week 10	Practice with structures and arrays. Read others'	PPT Lecture, Problem Solving, Practice	CLO1, CLO2

			code.	sessions	
File Operations: opening and closing a file, Operation on a file, Binary I/O, Random access. + mini project Class performance\ (if possible)		Week 11-12	Experiment with file input/output extensively.	PPT Lecture, Problem Solving, Practice sessions	CLO1, CLO2
Dynamic memory allocation, Bitwise operators and		Week 13	Study the following topic	PPT Lecture, Problem Solving, Practice sessions	CLO1, CLO2
FINAL EXAMINATION		Week 14			

17. Teaching-Learning Strategies:

18. Assessment Techniques of each topic of the course:

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignments in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 50)	**Assignments (10)**	**Quizzes (20)**
Remember		
Understand		**10**
Apply	**10**	
Analyze		**10**
Evaluate		
Create		

SMEB- Semester Mid & End Examination (70 Marks)

Bloom's Category	**Marks(out of 70)**
Remember	
Understand	**15**
Apply	**20**

Analyze	**35**
Evaluate	
Create	

19. Evaluation Policy

Grades will be calculated as per the university grading structure and individual students will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

20. Text Book

1. Arora, Renu and Sood S.K, Fundamentals of Entrepreneurship and Small Business, 1't Edition (2003), Kalyani Publishers, New ‘Delhi, India’.

Reference Books & Materials

2. Barringer, Bruce R. and Ireland Duane R., Entrepreneurship Successfully Lunching New Ventures. 3'd Edition (2010) Pearson Education Inc., New Delhi, India
3. Others

Course Outline – Discrete Mathematics

Part A – Introduction

1. **Course No. / Course Code:** CSE 105
2. **Course Title:** Discrete Mathematics
3. **Course Type:** Core
4. **Level/Term and Section:** 1st year 2nd semester
5. **Academic Session:** Fall 2023
6. **Course Instructor:** Prof. Dr. Bilkis Jamal Ferdosi
7. **Pre-requisite (If any):** Nil
8. **Credit Value:** 3
9. **Contact Hours:** 3
10. **Total Marks:** 100
11. **Course Objectives and Course Summary:**

12. **Course Learning Outcomes: at the end of the Course, the Student will be able to –**

CLO 1	**Recognize and manipulate** various types and properties of sets, relations, functions, graphs, and trees.	
CLO 2	**Construct** mathematical reasoning using propositions, predicates, logical connectives, quantifiers, rules of inference, direct proof, proof by contradiction, proof by contraposition, and existence proof, among others.	
CLO 3	**Utilize** counting principles, permutations, combinations, the pigeonhole theorem, and discrete probability to address related problems.	

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	**1**	1/Apply	Lecture, multimedia, Problem Solving,	Quiz, Written exam Assignment
CLO2	**1**	1/Apply	Lecture, Problem Solving, Group discussion	Quiz, Written exam, Assignment
CLO3	**1**	1/Apply	Lecture, Problem Solving,	Quiz, Written exam, Assignment

Part B – Content of the Course

14. Course Content:

Set Theory: Introduction to sets and set elements. Set operations, Algebra of sets. **Relations**: Product sets, relations, representing relations, n-array relations, properties of relations, partial order and equivalence relations. **Functions**: Introduction to functions, Properties of functions, Inversion, composition, Recursive definition of a function, **Logic:** Proposition, logical operators, logical equivalence, tautology, contradiction, Propositional Functions & Predicates, Universal Quantification, Existential Quantification. Mathematical Reasoning: Valid arguments and Fallacies, Operational Method of Validation, Rules of Inference, Direct proof, proof by contradiction, proof by contraposition, proof by induction, etc. **Counting Principle**: Basic counting principle, permutations, combinations, the pigeonhole principle, the inclusion-exclusion principle, binomial coefficient, **Discrete Probability:** Basic definitions, Complementary Events, Conditional Probability, **Graph theory**: Graphs, types of graphs, different approaches, memory representation, application, **Trees**: Introduction, basic definitions, types of trees, application, etc.

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Sets, relations, functions, graphs, and trees.	**CLO 1**
2	Propositions, predicates, logical connectives, quantifiers, rules of inference, proof,	**CLO2**
3	Counting principles, permutations, combinations, the pigeonhole theorem, and discrete probability	**CLO3**

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	**Specific Outcome(s)**	**Time Frame**	**Suggested Activities**	**Teaching Strategy(s)**	**Alignment with CLO**
Set Theory: Introduction to sets and set elements. Set operations, Algebra of sets.	Understanding Sets, Notation and Terminology, Set Cardinality, Set Operations, Venn Diagrams, Algebra of Sets,	Week 1 & 2	problem-solving, discussions, and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer	CLO 1

	Applications			Instruction	
Relations: Product sets, relations, representing relations, n-ary relations, properties of relations, partial order, and equivalence relations.	Understanding Product Definition and Representation of Relations Sets, Types of Relation, Identify Properties of Relations, Partial Order Relations, Equivalence Relations, Applications	Week 3	problem-solving, discussions, and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer Instruction	CLO 1
Functions: Introduction to functions, Properties of functions, Inversion, composition, Recursive definition of a function	Understanding Functions, Properties of Functions: Mastery of properties such as injectivity, surjectivity, and bijectivity is crucial. Students should be able to identify whether a function exhibits these properties and understand their significance in terms of mapping elements between sets. Inversion of Functions, Composition of Function, Define functions recursively using base cases and recursive step.	Week 4 & 5	Quiz 1, problem-solving, discussions, and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer Instruction	CLO 1
Logic: Proposition, logical operators, logical equivalence, tautology, contradiction,	1. Understand the concept of a proposition 2. Recognize and apply logical operators to form compound	Week 6 & 7	problem-solving, discussions, and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer	CLO 2

Propositional Functions & Predicates, Universal Quantification, Existential Quantification.	propositions. 3. Identify when two propositions are logically equivalent. 4. Define a tautology and Contradiction. 5. Understand propositional functions and predicates. 6. Understand and apply quantification.			Instruction	
MID-TERM EXAMINATION		Week 8			
Mathematical Reasoning	1. Apply deductive reasoning to draw conclusions from given mathematical statements using logical rules and principles. 2. Determine the validity of mathematical arguments and proofs based on the rules of logic and mathematical reasoning. 3. Construct counterexamples to disprove incorrect mathematical conjectures or statements. 4. Develop critical thinking skills by evaluating the soundness and validity of mathematical	Week 9 and 10	problem-solving, discussions, and group activities	lectures, Active Learning, Visualization, Concrete Examples, Peer Instruction	CLO 2

	arguments and proofs. 5. Understand and apply various proof techniques such as direct proofs, indirect proofs (proof by contradiction), mathematical induction, and proof by contrapositive.				
Counting Principle: Basic counting principle, permutations, combinations, the pigeonhole principle, the inclusion-exclusion principle, binomial coefficient, **Discrete Probability:** Basic definitions, Complementary Events, Conditional Probability	1. Understanding the Fundamental Counting Principle 2. Understand permutations and Combinations 3. Apply the counting principle in probability problems involving the calculation of the total number of outcomes and the probability of specific events. 4. Apply the counting principle to solve various types of counting problems in real-world scenarios, such as permutations of letters in words, seating arrangements, and selecting items from a set.	Week 11 and 12	problem-solving, discussions, and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer Instruction	CLO 3
Graph theory Graphs, types of graphs, different approaches,	1. Understanding Graphs and types of graphs. 2. Understand	Week 13	problem-solving, discussions, and group	Lecture, Active Learning, Visualization,	CLO 1

memory representation, application	various methods for representing graphs. 3. Understand concepts of connectivity in graphs. 4. Understand algorithms for finding shortest paths in graphs, such as Dijkstra's algorithm. 5. Identify and analyze real-world applications of graph theory, such as in computer networks, social networks, transportation networks, circuit design, and recommendation systems.		activities	Concrete Examples, Peer Instruction	
Trees: Introduction, basic definitions, types of trees, application, etc.	1. Define what a tree is and Understand and define key terms related to trees. 2. Understand and apply tree traversal algorithms. 3. Understand the properties and operations of different trees such as Binary Search trees	Week 14	problem-solving, discussions, and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer Instruction	CLO 1
FINAL EXAMINATION		Week 15			

17. **Teaching-Learning Strategies:**

Active Learning: Encourage students to actively engage with the material through problem-solving, discussions, and group activities.

Visualization: Discrete mathematics often deals with abstract concepts that can be difficult to grasp. Utilize visual aids such as diagrams, graphs, and animations to illustrate key concepts like graph theory, combinatorics, and logic.

Concrete Examples: Relate abstract concepts to real-world applications whenever possible. Show how discrete mathematics is used in computer science.

Peer Instruction: Implement peer instruction techniques where students teach and learn from each other. Encourage peer tutoring, group study sessions, and peer evaluation of problem-solving approaches.

18. **Assessment Techniques of each topic of the course:**

Part C – Assessment and Evaluation

19. **Assessment Strategy**

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. CT1, best of CT2 and CT3, best of CT4 and (Average marks on Assignment) will be considered. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment:

Problem-solving assignments (written) will be given throughout the semester. Average marks obtained in all given assignments will be considered as another CT. Late submission will result in a 50% deduction in the score.

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 50)	**Tests (20)**	**Assignments (10)**
Remember		
Understand		
Apply	**20**	**10**
Analyze		
Evaluate		
Create		

SMEB- Semester Mid & End Exanimation (70 Marks)

Bloom's Category	**Test**
Remember	
Understand	**20**
Apply	**50**
Analyze	
Evaluate	
Create	

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

<u>Part D – Learning Resources</u>

21. Text Book

1. Kenneth H. Rosen, Discrete Mathematics and its Application, 8th edition, 2021, McGraw-Hill.

Reference Books & Materials

2. Seymour Lipschutz, Discrete Mathematics, Last Edition, 2020, Schaum's outline Series.

<u>**Course Outline – Competitive Programming**</u>

Part A – Introduction

1.	**Course No. / Course Code:**	CSE 108
2.	**Course Title:**	Competitive Programming
3.	**Course Type:**	Core course
4.	**Level/Term and Section:**	1st Year 2nd Semester
5.	**Academic Session:**	Fall 2023
6.	**Course Instructor:**	Sumaiya Akhtar Mitu, Lecturer
7.	**Prerequisite (If any):**	Nil
8.	**Credit Value:**	1.50
9.	**Contact Hours:**	3.00
10.	**Total Marks:**	100

11. Course Objectives and Course Summary:

The objectives of this course are:

1. To grow enthusiasm in Problem Solving and Competitive Programming
2. To demonstrate the basic programming tools to start Competitive Programming

The summary of this course are to:

Introduction to Problem Solving and Competitive Programming, Introduction to Online Judges, Verdicts Analysis; Number Theory: Mathematical Series, Arithmetic Progression, Binary Exponentiation, Geometric Progression, Logarithmic Functions, Modular Arithmetic, Odd-Even, Leap Year, Factorial, Natural Number, GCD, LCM, Prime Checker, Fibonacci Numbers and Series; Recursion: Recurrence Relation; Ad-hoc Techniques: Basic Chess; Sorting and Searching: Bubble Sort, Selection Sort, Linear Search, Binary Search; Basic STL: Vector, Map;

Solving Problems in Online Judge Platforms: BeeCrowd, UVa, LightOJ, CodeChef, CodeForces, Toph, AtCoder, HackeRank, VJudge etc.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Demonstrate** the use of different programming tools
CLO 2	**Explain** the problem-solving methodology
CLO 3	**Apply** basic and Ad-hoc level problem solving
CLO 4	**Solve** problems in various online judges and contests

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	5	Understand	Lecture	Problem Solving
CLO2	2	Understand	Lecture, Problem Solving, Practice Sessions	Problem Solving
CLO3	2	Apply	Lecture, Problem Solving, Practice Sessions	Programming Contest
CLO4	2	Apply	Lecture, Problem Solving, Practice Sessions	Programming Contest

Part B – Content of the Course

14. **Course Content:** Introduction to Problem Solving and Competitive Programming, Introduction to Online Judges, Verdicts Analysis; Number Theory: Mathematical Series, Arithmetic Progression, Binary Exponentiation, Geometric Progression, Logarithmic Functions, Modular Arithmetic, Odd-Even, Leap Year, Factorial, Natural Number, GCD, LCM, Prime Checker, Fibonacci Numbers and Series; Recursion: Recurrence Relation; Ad-hoc Techniques: Basic Chess; Sorting and Searching: Bubble Sort, Selection Sort, Linear Search, Binary Search; Basic STL: Vector, Map.

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	**Introduction to Online Judges, Verdicts Analysis, Problem Solving: Tools, Basic Syntax, Statements etc.**	**CLO1**
2	**Number Theory: Mathematical Series, Arithmetic Progression, Binary Exponentiation**	**CLO1, CLO3**
3	**Geometric Progression, Logarithmic Functions, Modular Arithmetic**	**CLO2, CLO3**
4	**Recursion: Recurrence Relation; Ad-hoc Techniques: Basic Chess**	**CLO3, CLO4**
5	**Sorting and Searching: Bubble Sort, Selection Sort, Linear Search, Binary Search**	**CLO3, CLO4**

6	**Basic STL: Vector, Map**	**CLO3, CLO4**

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	**Specific Outcome(s)**	**Time Frame**	**Suggested Activities**	**Teaching Strategy(s)**	**Alignment with CLO**
Introduction to Problem Solving and Competitive Programming, Motivation to Participate in Programming Contests		Week 1	To be Shared in Google Classroom	Lecture, Multimedia	CLO1
Introduction to Online Judges, Verdicts Analysis, Problem Solving: Tools, Basic Syntax, Statements etc.		Week 2	https://icpc.global/	Lecture, multimedia	CLO1
Number Theory: Mathematical Series, Arithmetic Progression, Binary Exponentiation, Weekly Contest-1		Week 3	To be shared in Google Classroom	Lecture, Practice sessions	CLO1, CLO3
Geometric Progression, Logarithmic Functions, Modular Arithmetic, Weekly Contest-2		Week 4	To be shared in Google Classroom	Lecturer, Multimedia	CLO2, CLO3
Odd-Even, Leap Year, Factorial, Natural Number, GCD, LCM, Weekly Contest-3		Week 5	To be shared in Google Classroom	Lecture, multimedia, Practice sessions, Problem solving	CLO3, CLO4
Prime Checker, Fibonacci Numbers and Series, Weekly Contest-4		Week 6	To be shared in Google Classroom	Lecture, Practice sessions	CLO3, CLO4
MID-TERM EXAMINATION		Week 7	To be shared in Google Classroom	Practice Sessions	CLO3, CLO4
Recursion: Recurrence Relation; Ad-hoc Techniques: Basic Chess, Weekly Contest-5		Week 8	Chapter 7 of required text	Lecture, Practice sessions, Problem Solving	CLO3, CLO4
Sorting and Searching: Bubble Sort, Selection Sort, Linear Search, Binary Search,		Week 9	Chapter 8 of required text	Lecture, Practice Sessions,	CLO3, CLO4

Weekly Contest-6				Problem Solving	
Basic STL: Vector, Weekly Contest-7		Week 10	To be shared in Google Classroom	Lecture, Practice Sessions, Problem Solving	CLO3, CLO4
Basic STL: Map, Weekly Contest-8		Week 11	To be shared in Google Classroom	Lecture, Practice Sessions, Problem Solving	CLO3, CLO4
Solving Problems in Online Judge		Week 12	To be shared in Google Classroom	Lecture, Practice Sessions, Problem Solving	CLO3, CLO4
Overview, Weekly Contest-9		Week 13	To be shared in Google Classroom	Problem Solving	CLO3, CLO4
FINAL EXAMINATION		Week 14	To be shared in Google Classroom	Problem Solving	CLO3, CLO4

17. Teaching-Learning Strategies:

18. Assessment Techniques of each topic of the course:

Part C – Assessment and Evaluation

19. Assessment Strategy

Weekly Individual Contest: Altogether 9 programming contests may be taken during the semester, 4 programming contests will be taken for midterm and 5 programming contests will be taken for final term. No makeup programming contests will be taken. Students are strongly recommended not to miss any programming contest.

Lab Assignments: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignments in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

Lab Evaluation: Some lab taste will be assigned to individual students after completing each lecture. The students will have to solve the tasks.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category Marks (out of 50)	**Weekly Individual Contest (20)**	**Lab Assignments (10)**	**Lab Evaluation (20)**
Remember			
Understand	**5**	**5**	
Apply	**15**	**5**	**20**
Analyze			
Evaluate			
Create			

SMEB- Semester Mid & End Examination (50 Marks)

Bloom's Category	**Mid**	**Final**
Remember		
Understand		
Apply	**20**	**30**
Analyze		
Evaluate		
Create		

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual students will be evaluated based on the following criteria with respective weights.

1. Lab Assignment and Evaluation 30%
2. Weekly Individual and Mid Contest 40%
3. Final Contest 30%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. **Art of Programming Contest -** Ahmed Shamsul Arefin

Reference Books & Materials

2. Competitive Programming 3- Steven Halim, Felix Halim, and Suhendry Effendy
3. Others

Course Outline – Math-II: Calculus II

Part A – Introduction

1.	**Course No. / Course Code:**	MTH 103
2.	**Course Title:**	Math-II: Calculus II
3.	**Course Type:**	Theoretical
4.	**Level/Term and Section:**	1^{st} year 2^{nd} term
5.	**Academic Session:**	Fall 2023
6.	**Course Instructor:**	
7.	**Pre-requisite (If any):**	
8.	**Credit Value:**	3.0
9.	**Contact Hours:**	3.00
10.	**Total Marks:**	100

11. Course Objectives and Course Summary:

Use of advanced level calculus in the application-oriented fields of computing, engineering and many more. It also provides important tools in understanding Differential Equations, Parametric Equations and Polar Coordinates, Sequence and Partial Derivatives, Multiple Integral etc.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Identify** differential equations in different forms.
CLO 2	**Compute** polar coordinates in various curves
CLO 3	**Apply** different solution methods to solve multivariable problems
CLO 4	**Analyze** different calculus theorems
CLO 5	**Application** of Different calculus theorem in real life problem

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	PLO1	Identify	Multimedia or Lecture	Tests, Assignments, Quizzes and External Participation in

				Curricular/Co-Curricular Activities
CLO2	PLO1	Compute	Multimedia or Lecture	Tests, Assignments, Quizzes and External Participation in Curricular/Co-Curricular Activities
CLO3	PLO1	Apply	Multimedia or Lecture	Tests, Assignments, Quizzes and External Participation in Curricular/Co-Curricular Activities
CLO4	PLO2	Analyze	Multimedia or Lecture	Tests, Assignments, Quizzes and External Participation in Curricular/Co-Curricular Activities
CLO5	PLO2	Application	Multimedia or Lecture	Tests, Assignments, Quizzes and External Participation in Curricular/Co-Curricular Activities

Part B – Content of the Course

14. Course Content:

Differential Equations: Modeling with Differential Equations, Solving First Order Differential Equations, Direction Fields and Euler's Method, Methods for Separable Equations and Linear Equations. **Parametric Equations and Polar Coordinates:** Curves Defined by Parametric Equations, Calculus with Parametric Curves, Polar Coordinates, Area and Length in Polar Coordinates, Conic Sections in Polar Coordinates. **Sequence and Partial Derivatives:** Functions of multiple variables, Limits and Continuity, Tangent and linear approximations, chain rule, directional derivatives, Max-Min values, Lagrange Multiplier, Derivatives with vectors and matrices, **Multiple Integral:** Change of variables in multiple integral, applications, **Vector Calculus:** Vector fields, line integrals, Green's theorem, Curl and divergence, parametric surfaces, Stroke's theorem, Divergence theorem.

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Identify differential equations in different forms.	**CLO1**
2	Compute polar coordinates in various curves	**CLO2**
3	Apply different solution methods to solve multivariable problems	**CLO3**
4	Analyze different calculus theorems	**CLO4**

5	Application of Different calculus theorem in real life problem	**CLO5**

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	**Specific Outcome(s)**	**Time Frame**	**Suggested Activities**	**Teaching Strategy(s)**	**Alignment with CLO**
Differential Equations: Modeling with Differential Equations, Solving First Order Differential Equations		Week 1 3 hours		Multimedia or Lecture	CLO1
Direction Fields and Euler's Method, Methods for Separable Equations and Linear Equations.		Week 2 3 hours		Multimedia or Lecture	CLO1
Parametric Equations and Polar Coordinates: Curves Defined by Parametric Equations, Calculus with Parametric Curves,		Week 3 3 hours		Multimedia or Lecture	CLO2
Polar Coordinates, Area and Length in Polar Coordinates,		Week 4 3 hours		Multimedia or Lecture	CLO2
Conic Sections in Polar Coordinates.		Week 5 3 hours		Multimedia or Lecture	CLO2
MID-TERM EXAMINATION		Week 6 3 hours			
Sequence and Partial Derivatives: Functions of multiple variables, Limits		Week 7 3 hours		Multimedia or Lecture	CLO3
Continuity, Tangent and linear approximations, chain rule, directional derivatives		Week 8 3 hours		Multimedia or Lecture	CLO3
Max-Min values, Lagrange Multiplier, Derivatives with vectors and matrices		Week 9 3 hours		Multimedia or Lecture	CLO3
Multiple Integral: Change of variables in multiple integral, applications		Week 10 3 hours		Multimedia or Lecture	CLO3, CLO5
Vector Calculus: Vector fields, line integrals, Green’s theorem		Week 11 3 hours		Multimedia or Lecture	CLO4, CLO5
Curl and divergence,		Week 12		Multimedia	CLO4,

parametric surfaces		3 hours		or Lecture	CLO5
Stroke’s theorem, Divergence theorem		Week 13 3 hours		Multimedia or Lecture	CLO4, CLO5
Revision class		Week 14 3 hours			
FINAL EXAMINATION		Week 15 3 hours			

17. Teaching-Learning Strategies:

18. Assessment Techniques of each topic of the course:

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignment in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 30)	**Tests (15)**	**Assignments (5)**	**Quizzes (5)**	**External Participation in Curricular/Co-Curricular Activities (5)**
Remember	**1**		**5**	
Understand	**3**	**1**		
Apply	**2**	**2**		
Analyze	**4**	**1**		
Evaluate	**3**			

Create	**2**	**1**		**5**

SMEB- Semester Mid & End Exanimation (70 Marks)

Bloom's Category	**Test**
Remember	**10**
Understand	**15**
Apply	**10**
Analyze	**15**
Evaluate	**10**
Create	**10**

19. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

4. Class Tests 30%
5. Term Examination 50%
6. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

20. Text Book

4. B. C. Das and B. N. Mukherjee, Differential Calculus.
5. B. C. Das and B. N. Mukherjee, Integral Calculus.
6. James Stewart, Multivariable Calculus, Cengage Learning.

Reference Books & Materials

7. Edwards, Henry C., and David E. Penney. Multivariable Calculus, Prentice Hall

Course Outline – Chemistry

Part A – Introduction

1.	**Course No. / Course Code:**	CHM 111
2.	**Course Title:**	Chemistry
3.	**Course Type:**	
4.	**Level/Term and Section:**	1/2
5.	**Academic Session:**	Fall 2023
6.	**Course Instructor:**	Prof. Dr. Md. Shakhawat Hossain Firoz Prof. Dr. Abu Bin Imran
7.	**Pre-requisite (If any):**	
8.	**Credit Value:**	3
9.	**Contact Hours:**	3 h/week
10.	**Total Marks:**	300

11. Course Objectives and Course Summary:

This course is designed for understanding the fundamental principles of Chemistry for future design of manufacturing materials, and simulation in chemical and biological systems.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Identify** the concepts of atomic structure, chemical bonding, and periodic properties
CLO 2	**Illustrate** the principles of chemical equilibria, chemical kinetics, phase diagram etc.
CLO 3	**Solve** problems associated with physical and chemical changes

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools

CLO1	√			
CLO2	√			
CLO3		√		

Part B – Content of the Course

14. Course Content:

Atomic structure and periodic properties: Atomic structure, quantum number, electronic configuration, periodic table, properties and use of noble gases **Chemical Bonding**: Different types of bonds and their properties, energies involved in bond formation, molecular geometry **Solution:** Solution and properties, effect of temperature, pressure on solubility, dilute solution and colligative properties, electrical properties of solution. **Phase rule:** Phase, component and degrees of freedom, phase rule, phase diagram of water, sulfur and carbon dioxide **Thermochemistry:** Enthalpy and energy, laws of thermochemistry **Chemical kinetics:** Rate law, order and molecularity, reaction mechanism, integrated rate law, effect of temperature **Chemical Equilibrium:** Dynamic nature of equilibrium, reaction quotient and chemical equilibrium, Le Chatelier's principle **pH:** Ionization of water and pH

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	**Atomic structure, Periodic table, Chemical Bonding**	**Identify** the concepts of atomic structure, chemical bonding, and periodic properties
2	**Solution, thermochemistry, chemical kinetics, chemical equilibrium, phase rule, pH**	**Illustrate** the principles of chemical equilibria, chemical kinetics, phase diagram etc.
3	**Chemical bonding, chemical kinetics, chemical equilibrium, pH, thermochemistry**	**Solve** problems associated with physical and chemical changes

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Introduction to chemistry, why computer engineers need to learn chemistry, outline of the course	CO1	Week 1	Discussion	Discussion	-
Atomic structure: history, old atom models, Bohr atom model, photoelectric effect, Heisenberg’s uncertainty principle	CO1	Week 2	Lecture, multimedia,	discussion, Problem solving, Class test	CLO1
de Broglie relation, Schrodinger wave equation, Quantum numbers, size and shape of the orbitals	CO1	Week 3	Lecture, multimedia,	discussion, Problem solving home work	CLO1

Periodic table: Hund's rule, Aufbau principle, paramagnetic and diamagnetic substances,	CO1	Week 4	Lecture, multimedia,	discussion, Problem solving.	CLO1
periodic table, periodic properties	CO1	Week 5	Lecture, multimedia	discussion, Problem solving.	CLO1
Chemical bond: Classification of bonds, ionic bonds and ionic size, Born Haber cycle, covalent bonds	CO1	Week 6	Lecture, multimedia	discussion, Problem solving. group work	CLO1
VSEPR theory and models, geometry of molecules	CO1	Week 7	Lecture, multimedia	discussion, Problem solving, home work	CLO1
MID-TERM EXAMINATION					
Solution: Types of solution, Effect of temperature and pressure, Concentration units and conversion	CO2	Week 8	Lecture, multimedia,	discussion, Problem solving, Class test	CLO2
Colligative properties: Colligative properties, Boiling point elevation, freezing point depression, Osmotic pressure	CO2	Week 9	Lecture, multimedia,	discussion, Problem solving home work	CLO2
Chemical Kinetics: Scope of chemical kinetics, rate and rete laws, order, molecularity, integrated rate expression, effect of temperature on reaction rate	CO2, CO3	Week 10	Lecture, multimedia,	discussion, Problem solving.	CLO2, CLO3
Chemical Equilibria: Reversibility and equilibrium, thermodynamic equilibrium constant, equilibrium for selective reactions, direction of equilibrium, Le Chatelier's Principle	CO2, CO3	Week 11	Lecture, multimedia	discussion, Problem solving.	CLO2, CLO3
Thermochemistry: Different form of energy, System, boundary, surrounding, state function and path function, Specific heat and heat capacity, Laws of thermochemistry, Heat of neutralization	CO2, CO3	Week 12	Lecture, multimedia	discussion, Problem solving. group work	CO2, CO3
pH: Self Ionization of water and pH	CO2, CO3	Week 13	Lecture, multimedia	discussion, Problem solving,	CLO2, CLO3

				home work	
Phase rule: Phase Transitions, Clausius–Clapeyron Equation, Phase, Component, Degree of Freedom, Phase diagram of water, Carbon di oxide and Sulfur, Critical Temperature and Pressure	CO2	Week 14	Lecture, multimedia	discussion, Problem solving, home work	CLO2

17. Teaching-Learning Strategies:

CLOs	Teaching-Learning Strategy
CLO1	Lecture, multimedia
CLO2	Lecture, Group discussion
CLO3	Lecture, Problem Solving, Group discussion

18. Assessment Techniques of each topic of the course:

CLOs	Assessment Strategy
CLO1	Quiz, Written Examination, Assignment
CLO2	Quiz, Written Examination
CLO3	Written Examination

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignment in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 50)	Quiz /Test (20)	Assignments (10)
Remember	**5**	
Understand	**10**	**5**
Apply	**5**	**5**
Analyze		
Evaluate		

Create		

SMEB- Semester Mid & End Exanimation (70 Marks)

Bloom's Category	**Mid**	**Final**
Remember	**7**	**15**
Understand	**7**	**25**
Apply	**6**	**10**
Analyze		
Evaluate		
Create		

19. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25

40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

20. Text Book

General Chemistry by Darrell Ebbing, Steven D. Gammon
Chemistry by Raymond Chang

Reference Books & Materials

1. Principles of Physical Chemistry by Hoque and Mollah
2. Others

Course Outline – Electrical Circuits

Part A – Introduction

1. **Course No. / Course Code** : EEE 101
2. **Course Title** : Electrical Circuits
3. **Course Type** : Others Engineering
4. **Level/Term and Section** : 1st year, 2nd semester
5. **Academic Session** : Fall 23
6. **Course Instructor** : Muhammad Towhidur Rahman
7. **Pre-requisite (If any)** : N/A
8. **Credit Value** : 3.0
9. **Contact Hours** : 3.0
10. **Total Marks** : 100

11. Course Objectives and Course Summary:

The objectives of this course are to:

1. Introduce the fundamentals of Electrical and Electronic circuits.
2. Describe the process of mathematically analyzing basic electrical circuits.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	Analyze electric circuits using basic concepts, laws and network theorems
CLO 2	Apply various network theorems into electrical circuits
CLO 3	Analyze the major components of AC circuit
CLO 4	Use p-n junction in electrical circuits

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1		Apply	PPT presentation, Discussing examples of theoretical and mathematical problems	MCQ/Short question, Assignment, Open book exam, Mid-term exam, final exam
CLO2		Apply	PPT presentation, Discussing examples of theoretical and mathematical problems	MCQ/Short question, Assignment, Open book exam, Mid-term exam, final exam
CLO3		Apply	PPT presentation, Discussing examples of theoretical and mathematical problems	MCQ/Short question, Assignment, Open book exam, Mid-term exam, final exam
CLO4		Apply	PPT presentation, Discussing examples of theoretical problems	MCQ/Short question, Assignment, Open book exam, Mid-term exam, final exam

Part B – Content of the Course

14. Course Content:

This course introduces the fundamentals of Electrical and Electronic circuits.
DC Circuits: The Fundamental Laws of electric circuit, Network Theorems, Work, Power, Energy. AC Circuits: AC Fundamentals, Phasor Algebra, Series AC Circuits, Parallel AC Circuits. Electronics: p-n junction devices.

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Course orientation and basic concept regarding Current, voltage, EMF, power, energy, The fundamental laws of electric circuit,	**1**
2	Nodal analysis along with super node concept, Mesh analysis along with super mesh concept, Nodal analysis along with super node concept, Mesh analysis along with super mesh concept, Superposition, Source Transformation, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem	**2**
3	Capacitor Inductor, AC Fundamentals: Amplitude, frequency, phase,	**3**

	power, power factor, Mathematical Examples from AC circuits	
4	Diode: characteristics, rectification; Zener diode: characteristics and applications; Bipolar Junction, Transistor: characteristics, biasing, Field Effect Transistor: Characteristics.	**4**

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	**Time Frame**	**Suggested Activities**	**Teaching Strategy(s)**	**Alignment with CLO**
Course orientation and basic concept regarding Current, voltage, EMF, power, energy	Week 1	Check the shared class materials.	Class lecture, .ppt presentation, assignment	**1**
The fundamental laws of electric circuit	Week 2	Follow reference book.	Class lecture, .ppt presentation, assignment	**1**
Nodal analysis along with super node concept, Mesh analysis along with super mesh concept	Week 3	Follow reference book.	Class lecture, .ppt presentation, assignment	**2**
Nodal analysis along with super node concept, Mesh analysis along with super mesh concept	Week 4	Follow reference book and look for more examples in the internet.	Class lecture, .ppt presentation, assignment	**2**
Superposition, Source Transformation	Week 5	Follow reference book and look for more examples in the internet.	Class lecture, .ppt presentation, assignment	**2**
Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem	Week 6	Follow reference book, lab manual and look for more examples in the internet.	Class lecture, .ppt presentation, assignment	**2**
Review (Q/A)	Week 7	Come prepared to ask questions.		**1,2**
MID-TERM EXAMINATION				
Diode: characteristics, rectification; Zener diode: characteristics and applications; Bipolar Junction	Week 8	Follow class lecture	Class lecture, multimedia presentation, assignment	**4**
Transistor: characteristics,	Week 9	Follow class lecture	Class lecture,	**4**

biasing, Field Effect Transistor: Characteristics.			multimedia presentation, assignment	
Capacitor Inductor	Week 10	Follow class lecture	Class lecture, .ppt presentation, assignment	**3**
AC Fundamentals: Amplitude, frequency, phase	Week 11	Follow reference book and class lecture	Class lecture, .ppt presentation, assignment	**3**
power, power factor	Week 12	Follow reference book and class lecture	Class lecture, , assignment	**3**
Mathematical Examples from AC circuits	Week 13	Follow reference book, class lecture and internet resources	Class lecture, , assignment	**3**
Review (Q/A)	Week 14	Come prepared to ask questions	Class lecture, , assignment	**1,2,3,4**
FINAL EXAMINATION				

17. Teaching-Learning Strategies:

Strategies	Topics
Active Learning and Discussion	fundamentals of Electrical and Electronic circuits. DC Circuits: The Fundamental Laws of electric circuit, Network Theorems, Work, Power, Energy. AC Circuits: AC fundamentals, Phasor Algebra, Series AC Circuits, Parallel AC Circuits. Electronics: p-n junction devices.
Problem/ Mathematical Example based learning	: The Fundamental Laws of electric circuit, Network Theorems, Work, Power, Series-Parallel AC Circuits.

18. Assessment Techniques of each topic of the course:

SL. No	Topics / Content	Assessment Techniques
1	Course orientation and basic concept regarding Current, voltage, EMF, power, energy, The fundamental laws of electric circuit,	Assignment, Mid-term Examination, Final Examination
2	Nodal analysis along with super node concept, Mesh analysis	Assignment, Mid-

	along with super mesh concept, Nodal analysis along with super node concept, Mesh analysis along with super mesh concept, Superposition, Source Transformation, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem	term Examination, Final Examination
3	Capacitor Inductor, AC Fundamentals: Amplitude, frequency, phase, power, power factor, Mathematical Examples from AC circuits	Assignment, Mid-term Examination, Final Examination
4	Diode: characteristics, rectification; Zener diode: characteristics and applications; Bipolar Junction, Transistor: characteristics, biasing, Field Effect Transistor: Characteristics.	Assignment, Mid-term Examination, Final Examination

Part C – Assessment and Evaluation

19. Assessment Strategy

Assignment: Assignments will be provided and students need to respond individually. Late submission policy applicable [Timely submission- assessed in full marks, 12 hour late submission- assessed in 50% of full marks and otherwise- assessed in 16% of marks.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category Marks (out of 50)	**Assignments (30)**
Remember	
Understand	15
Apply	15
Analyze	
Evaluate	
Create	

SMEB- Semester Mid & End Exanimation (50 Marks)

Bloom's Category	**Mid**	**Final**
Remember		
Understand		
Apply	20	50
Analyze		
Evaluate		

Create		

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

7. Assessments 30%
8. Term Examination 50%
9. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Fundamentals of Electric Circuits, Charles K. Alexander & Matthew N.O. Sadiku, (TATA McGRAW-HILL Edition)
2. Electrical Technology, B.L.& A.K.Theraja

Reference Books & Materials

8. Presentation slides
9. Khan Academy

<u>**Course Outline – Electrical Circuits Lab**</u>

<u>Part A – Introduction</u>

1.	**Course No. / Course Code**	: EEE 102
2.	**Course Title**	: Electrical and Electronic Engineering I Lab
3.	**Course Type**	**:**
4.	**Level/Term and Section**	: 1st Year 2nd Semester
5.	**Academic Session**	: Fall 2023
6.	**Course Instructor**	**:**
7.	**Pre-requisite (If any)**	**:**
8.	**Credit Value**	: 3.0
9.	**Contact Hours**	: 3.0
10.	**Total Marks**	: 100

11. Course Objectives and Course Summary:

The objectives of this course are to:

The primary objective of this Course is to equip students with the theoretical knowledge, practical skills, and ethical understanding necessary to effectively analyze, interpret, and communicate data-driven insights across a variety of domains. Upon successful completion of this course, students will be able to:

Understand different resistor based electronic circuits for proving different laws

Apply NPN & PNP systems and their circuits using transistors in TTL designing

Develop different functional circuits; also calculate their current and voltage

Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Describe** different resistor based electronic circuits for proving different laws
CLO 2	**Interpret** NPN & PNP systems and their circuits using transistors in TTL designing
CLO 3	**Apply** different functional circuits; also calculate their current and voltage
CLO 4	**Implement** the basic characteristics of P-N junctions in AC to DC electricity conversion

12. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	**CLO Statements:** Upon successful completion of the course, students should be able to:	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	**Describe** different resistor based electronic circuits for proving different laws	c	1/Apply	Lecture, Practice sessions	Lab evaluation, assignments, presentation
CLO2	**Interpret** NPN & PNP systems and their circuits using transistors in TTL designing	c	1/Apply	Lecture, Practice sessions	Lab evaluation, assignments, presentation
CLO3	**Apply** different functional circuits; also calculate their current and voltage	c	1/Apply	Lecture, Practice sessions	Lab evaluation, assignments, presentation
CLO4	**Implement** the basic characteristics of P-N junctions in AC to DC electricity conversion to solve real-world data science problems.	c	1/Apply	Lecture, Practice sessions	Lab evaluation, assignments, presentation

Part B – Content of the Course

13. Course Content:

This Course provides a comprehensive hands-on introduction to fundamental concepts in electrical and electronic engineering. Students begin with safety procedures and basic electrical measurements, using multimeters and oscilloscopes. They explore DC and AC circuits, learning about Ohm's Law, Kirchhoff's Laws, and impedance. The course covers the characteristics and applications of diodes, transistors, and operational amplifiers, with practical experiments on rectifiers, amplifiers, and digital logic circuits. Sensor and actuator interfacing is introduced, along with microcontroller basics through simple projects. The course culminates in a lab project where students design, build, and present a functional circuit, reinforcing their learning through practical application and project management skills.

14. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	**Describe** different resistor based electronic circuits for proving different laws	**CLO1**
2	**Interpret** NPN & PNP systems and their circuits using transistors in TTL designing	**CLO2**
3	**Apply** different functional circuits; also calculate their current and voltage	**CLO3**
4	**Implement** the basic characteristics of P-N junctions in AC to DC electricity conversion to solve real-world data science problems.	**CLO4**

15. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Program Outcome (PO) (s)	Time Frame	Suggested Activities	Teaching Strategy (s)	Alignment with CLO
Overview of lab equipment and tools Lab safety rules and regulations Introduction to basic electrical components (resistors, capacitors, inductors)		Week 1	Assignment on basic understanding	Lecture, Multimedia	CLO1
Use of multimeters (voltage, current, and resistance measurements) Understanding and using oscilloscopes Introduction to power supplies and signal generators		Week 2	Practice problems	Lecture, Multimedia	CLO1
Ohm’s Law and Kirchhoff's Laws Series and parallel circuits Voltage and current division **Lab Test 1**		Week 3	Practice problems	Lecture, Multimedia	CLO1

Introduction to alternating current (AC) theory Sinusoidal waveforms and RMS values Impedance and phase relationships in RLC circuits		Week 4	Practical session	Lecture, Multimedia	CLO2
Linear SVM for classification. Kernel SVM for nonlinear data.		Week 5	Practical session	Lecture, Multimedia	CLO3
Characteristics of diodes Rectifier circuits (half-wave, full-wave) Filtering and voltage regulation **Lab Test 2**		Week 6	Practical session:	Lecture, Multimedia	CLO3
Lab Mid Exam		Week 7			
Bipolar Junction Transistor (BJT) basics Common emitter, common base, and common collector configurations DC biasing and load lines		Week 8, 9	Practical session:	Lecture, Multimedia	CLO4
Introduction to operational amplifiers Inverting and non-inverting amplifiers Practical applications: summing amplifiers, integrators, and differentiators **Lab Test 3**		Week 10, 11,	Case studies	Lecture, Multimedia	CLO4
Introduction to digital logic gates (AND, OR, NOT, NAND, NOR, XOR) Combinational logic circuits Flip-flops and basic sequential logic circuits **Lab Test 4**		Week 12, 13		Lecture, Multimedia	CLO4
Week 14 - Lab Final Examination					

16. Teaching-Learning Strategies:

Practical examples will be incorporated with each of the lab classes from the beginning. The class lectures will be broken down into interactive examples where students will be encouraged to ask questions to create an open atmosphere for exploration and relate computer fundamentals and programming concepts to real-world examples and applications. Progressively challenging assignments will be built and assigned to the students to reinforce learning, evaluate understanding and adjust teaching accordingly. Feedback will be provided on students' work to guide their progress and address misconceptions. It will be discussed throughout the weekly lab classes on how programming is used in various industries from game development to scientific research, to make the subject matter more relevant and engaging.

17. Assessment Techniques of each topic of the course:

Part C – Assessment and Evaluation

18. Assessment Strategy

Lab exams: Altogether 4 to 6 lab exams may be taken during the semester. 3 out of 4/4 out of 5/5 out of 6 lab exams may be considered depending on the number of lab exams taken. No makeup lab exam will be taken. Students are strongly recommended not to miss any lab exams.

Assignment: Assignment (Written and/or presentation.) will be given throughout the semester. Late submission will result in a 50% deduction in score. Students will have to do the presentation on the given topic as an assignment.

CIE- Continuous Internal Evaluation (60 Marks)

Bloom's Category Marks (out of 50)	Tests (40)	Assignments (20)
Remember		
Understand		
Apply	**40**	**20**
Analyze		
Evaluate		
Create		

SMEB- Semester Mid & End Exanimation (40 Marks)

Bloom's Category	Mid	Final
Remember		
Understand		
Apply	**40**	
Analyze		
Evaluate		
Create		

19. Evaluation Policy

Grades will be calculated as per the university grading structure and individual students will be evaluated based on the following criteria with respective weights.

Lab Tests 40%

Term Examination 40%

Continuous Evaluation 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

20. Text Book

1. Electronic Devices and Circuit Theory, R L Boylestad & Louis Nashelsky, Prentice Hall.
2. Electrical Technology – B L Thereja, Chand (S) & Co Ltd, India.

Second Year First Semester

Course Outline – Object-Oriented Programming I

Part A – Introduction

1.	**Course No. / Course Code**	**:** CSE 201
2.	**Course Title**	**:** Object-Oriented Programming I
3.	**Course Type**	**:** Core course
4.	**Level/Term and Section**	**:** 3rd Semester (2nd Year/1st Semester)
5.	**Academic Session**	**:** Fall 23
6.	**Course Instructor**	**:** Tanjina Helaly
7.	**Prerequisite (If any)**	**:** CSE 103
8.	**Credit Value**	**:** 3.0
9.	**Contact Hours**	**:** 3.0
10.	**Total Marks**	**:** 100

11. Course Objectives and Course Summary:

The objectives of this course are to:

1. Teach OOP principles and features and how to apply them in Java
2. Teach Inheritance, Encapsulation, Abstraction & Polymorphism in Java
3. Demonstrate how to properly utilize the Java Exception Handling mechanism and write multithreaded applications.
4. Show how to use the advanced library ("Collections & Generics" or "STL & Templates").

This course will cover the main aspects of the Java programming language. Students will learn how to use Java according to proper Object-Oriented Programming principles. This course covers the Java language syntax, and then moves into the object-oriented features of the language. Students will then learn the OOP principles, Data types, Variables, Scoping and life time of variable, Operators, classes and objects, Inheritance, Abstraction, Exception Handling, Threading, File and StringTokenizer, Networking, I/O streams, Collections API packages

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Explain** the basics of Object-Oriented Programming Features.
CLO 2	**Develop** applications using programming language basics.
CLO 3	**Develop** Object-Oriented solutions for programming problems.

CLO 4	**Analyze** and **Debug** program.
CLO 5	**Create** applications using the language-specific library.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	**Corresponding PLOs (Appendix-1)**	**Bloom's taxonomy domain/level (Appendix-2)**	**Delivery methods and activities**	**Assessment Tools**
CLO1	1	1/Understand	Lecture, multimedia	Viva, Presentation, Written exam
CLO2	2	1/Apply	Lecture, Problem Analysis, and Implementation.	Quiz, Written exam
CLO3	2	1/Apply	Lecture, Problem Analysis, and Implementation.	Quiz, Written exam
CLO4	4	1/Analyze	Lecture, Problem Analysis, and Implementation.	Quiz, Written Exam
CLO5	2	1/Analyze	Lecture, Problem Analysis, and Implementation.	Problem Solving, Written Exam

<u>Part B – Content of the Course</u>

14. Course Content:

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Language Basic	CLO1, CLO2, CLO4
2	OOP Basics	CLO1, CLO3, CLO4
3	OOP Principles: Inheritance, Encapsulation, Polymorphism, Abstraction	CLO1, CLO3, CLO4
4.	Language Specific library (Exception, Thread, IO, Collections	CLO1, CLO4, CLO5

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	**Specific Outcome(s)**	**Time Frame**	**Suggested Activities**	**Teaching Strategy(s)**	**Alignment with CLO**
Introduction to Java and Object Oriented Programming principles, Data types, Variables, Scoping and lifetime of		Week 1		Lecture, multimedia	CLO1, CLO2

variable					
Arrays: Single and Multidimensional Operators: Arithmetic, The Bitwise Operators, Boolean Logical Operators, Relational Operators, Precedence Control Statements		Week 2		Lecture, multimedia	CLO1, CLO2
Introduction to classes and objects, Constructors and methods. Reference type as parameter and return type. Package, Static keyword, String and String Tokenizer. Wrapper Class		Week 3-5		Lecture, Problem Solving	CLO1, CLO3, CLO4
OOP Features: Inheritance, Encapsulation, Method overloading, Polymorphism, method overriding, Final keyword		Week 6-7		Lecture, Problem Solving, Group discussion	CLO1, CLO3, CLO4
MID-TERM EXAMINATION		Week 7			
Abstraction: abstract class, Interface		Week 8		Lecture, multimedia	CLO1, CLO3, CLO4
Exception Handling		Week 9		Lecture, multimedia	CLO1, CLO4, CLO5
Nested class, Threading		Week 10-11		Lecture, multimedia	CLO1, CLO4, CLO5
Input/Output and Serialization		Week 12		Lecture, multimedia	CLO1, CLO4, CLO5
Collections and Generics		Week 13-14		Lecture, multimedia	CLO1, CLO4, CLO5
FINAL EXAMINATION		Week 15			

17. Teaching-Learning Strategies:

18. Assessment Techniques of each topic of the course:

<u>Part C – Assessment and Evaluation</u>

19. Assessment Strategy

Class Tests: Altogether 5 class tests may be taken during the semester,3 class tests will be taken for midterm and 2 class tests will be taken for final term. 3 out of 5 class tests will be considered. CT1, best of CT2 & CT3, and best of CT4 & CT5 will be considered. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: Assignments (Written and/or presentation.) will be given throughout the semester. Late submission will result in a 50% deduction in score. Students will have to do the presentation on the given topic as an assignment.

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 30)	Tests (20)	Assignments (10)
Remember		
Understand		
Apply	**20**	**10**
Analyze		
Evaluate		
Create		

SMEB- Semester Mid & End Exanimation (70 Marks)

Bloom's Category	Test
Remember	14
Understand	
Apply	42
Analyze	14
Evaluate	
Create	

19. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Assessment 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

20. Text Book

1. Herbert Schildt and Danny Coward, Java the Complete Reference, 12th edition (2021), McGraw Hill

Reference Books & Materials

1. Paul Deitel and Harvey M. Deitel,Java: How to Program, 9th Edition (2011),Pearson College Div
2. Kathy Sierra and Bert Bates, Head First Java, 2nd Edition (2005), O'Reilly Media
3. Others

Course Outline – Object-Oriented Programming I Lab

Part A – Introduction

1.	**Course No. / Course Code**	**:** CSE 202
2.	**Course Title**	**:** Object-Oriented Programming I Lab
3.	**Course Type**	**:** Core course
4.	**Level/Term and Section**	**:** 3rd Semester (2nd Year/1st Semester)
5.	**Academic Session**	**:** Fall 23
6.	**Course Instructor**	**:** Tanjina Helaly
7.	**Prerequisite (If any)**	**:** None
8.	**Credit Value**	**:** 1.5
9.	**Contact Hours**	**:** 3.0
10.	**Total Marks**	**:** 100

11. Course Objectives and Course Summary:

The objectives of this course are to:

1. **Teach** OOP principles and features and how to apply them in solving real life problem using java.
2. **Demonstrate** how to use a modern IDE to develop java application.
3. **Show** how to use Java library effectively.

This course will cover the main aspects of the Java programming language. Students will learn how to use Java according to proper Object-Oriented Programming principles. This course covers the Java language syntax, and then moves into the object-oriented features of the language. Students will then learn the OOP principles, Data types, Variables, Scoping and life time of variable, Operators, classes and objects, Inheritance, Abstraction, Exception Handling, Threading, File and StringTokenizer, Networking, I/O streams, Collections API packages

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Develop** applications using programming language basics.
CLO 2	**Develop** well-designed applications using the OOP features.
CLO 3	**Use** a modern/popular IDE to develop the java application.
CLO 4	**Use** the Library effectively.
CLO 5	Independently **learn** and **apply** new knowledge or techniques to solve a problem.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Correspondin g PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	2	1/Apply	Lecture, Problem Solving	Class work, Problem-solving, Exam
CLO2	2	1/Analyze	Lecture, Problem Solving	Class work, Problem-solving, Exam, Project
CLO3	5	2/Manipulate	Lecture, Demonstration	Class work, Project
CLO4	2	1/Analyze	Lecture, Problem Solving	Class work, Problem-solving, Exam, Project
CLO5	12	1/Analyze	Lecture, Problem Solving	Class work, Project

CLO5:

- Independently find and interpret discipline related documentation.
- Able to analyze a given program and able to debug, extend, improve application behavior according to given instructions.
- Able to search and use the program library for some standard objects

<u>Part B – Content of the Course</u>

14. Course Content:

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Language Basic	CLO1, CLO3
2	OOP Basics	CLO2, CLO3
3	OOP Principles: Inheritance, Encapsulation, Polymorphism, Abstraction	CLO2, CLO3, CLO5
4.	Language Specific library (Exception, Thread, IO, Collections	CLO3, CLO4, CLO5

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	**Specific Outcome(s)**	**Time Frame**	**Suggested Activities**	**Teaching Strategy(s)**	**Alignment with CLO**
Introduction to Java, Object-Oriented Programming., Hello World program	CLO1, CLO3	Week 1		Lecture, multimedia	CLO1, CLO2
Tool Set up, **Develop** simple application covering Java basics and User input.	CLO1, CLO3	Week 2		Lecture, multimedia	CLO1, CLO2
Develop Simple application involving creating Object and accessing members of the class.	CLO2, CLO3	Week 3		Lecture, Problem Solving	CLO1, CLO3, CLO4
Continuation of Class and Object to make students get a good grasp in OOP basic concept class and Object.	CLO2, CLO3	Week 4		Lecture, Problem Solving, Group discussion	CLO1, CLO3, CLO4
Introduce Overloading. **Develop** a simple management system.	CLO2, CLO3	Week 5			

Introduce Inheritance and Overriding and **implement** those features in the management system.	CLO2, CLO3	Week 6		Lecture, multimedia	CLO1, CLO3, CLO4
Implement Abstraction and Subclass Polymorphism in the management system	CLO2, CLO3	Week 7		Lecture, multimedia	CLO1, CLO4, CLO5
Mid Exam – Provide the problem statement of a management system and Students have to design the classes and implement the system. (Week 8)					
Introduce Exception Handling and implement it into the Management system	CLO3, CLO4	Week 9			
Implement GUI and Event Handling into the management system. (Java FX)	CLO3, CLO4, CLO5	Week 10			
Continue GUI	CLO3, CLO4, CLO5	Week 11			
Implement Java IO and String manipulation into the management system	CLO3, CLO4, CLO5	Week 12			
Project Submission	CLO1-CLO5	Week 13		Lecture, multimedia	CLO1, CLO4, CLO5
Final Exam (Week 14)					

17. Teaching-Learning Strategies:

18. Assessment Techniques of each topic of the course:

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Performance: Students will be provided with some problems during each class and evaluated based on the number of solved problems and correctness.

Assignment: Unfinished work should be submitted as assignment.

Additional assignments may be given as needed. **Copied** home work will be graded as **zero**. **Late** submission will result a **50% deduction** in score.

Project: Students have to develop an application exercising the OOP features (Inheritance, Polymorphism, Abstraction), Programming language specific libraries (such as Exception, IO, etc.)

Mid Exam (on Problem solving**)**: The problem statement of a small management system will be provided and Students have to design the classes and implement the system.

Final Exam: A tests covering the basic knowledge of CLO1-CLO5.

CIE- Continuous Internal Evaluation (55 Marks)

Bloom's Category Marks (out of 30)	**Class Performance (20)**	**Assignments (10)**	**Project (20)**
Remember			
Understand			
Apply	**20**	**10**	**15**
Analyze			**5**
Evaluate			
Create			

SMEB- Semester Mid & End Exanimation (45 Marks)

Bloom's Category	**Test**
Remember	5
Understand	5
Apply	30
Analyze	5
Evaluate	
Create	

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Assessment 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25

40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Herbert Schildt and Danny Coward, Java the Complete Reference, 12th edition (2021), McGraw Hill

Reference Books & Materials

1. Paul Deitel and Harvey M. Deitel,Java: How to Program, 9th Edition (2011),Pearson College Div
2. Kathy Sierra and Bert Bates, Head First Java, 2nd Edition (2005), O'Reilly Media
3. Others

Course Outline – Data Structures and Algorithms I

Part A – Introduction

1. **Course No. / Course Code** : CSE 203
2. **Course Title** : Data Structures and Algorithms I
3. **Course Type** : Core
4. **Level/Term and Section** : 2^{nd} Year 1^{st} Semester
5. **Academic Session** : Fall 2023
6. **Course Instructor** : Nayeema Sultana
7. **Pre-requisite (If any)** : N/A
8. **Credit Value** : 3.0
9. **Contact Hours** : 3.0
10. **Total Marks** : 100
11. **Course Objectives and Course Summary:**

Data structure and algorithms are two of the most important aspects of computer programming and software development. Data structures allow students to organize and store data, while algorithms allow us to process that data in a meaningful way. Learning data structure and algorithms will help students become a better programmer in future.

12. **Course Learning Outcomes: at the end of the Course, the Student will be able to –**

CLO 1	Understand fundamentals of data structures, algorithms, and complexity of algorithms.
CLO 2	Classify a problem into its supporting data structures and simulate the process to

	solve the problem.
CLO 3	Applying data structures and algorithms to solve a practical problem or developing a solution using pseudo-code or any high-level programming language.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	1	1/Understand	Lecture, multimedia	Quiz, Written Examination
CLO2	2	1/Analyze	Lecture, Problem Solving, Group Discussion	Quiz, Written Examination
CLO3	2	1/Apply	Lecture, Problem Solving	Quiz, Written Examination

<u>Part B – Content of the Course</u>

14. **Course Content: Introduction to Data Structures**, Purposes of data structure, Basic operations (Insertion, Deletion, Searching, and Traverse). **Complexity of Algorithms:** Basic Asymptotic Notation and Runtime Analysis of Algorithms, **Array:** Insertion, Deletion, Matrix representation of arrays, Multidimensional arrays, Pointers arrays **Linked List:** Singly Linked Lists, Doubly Linked Lists and Circular Linked Lists. Basic Operations on Linked List. **Recursion:** Direct and indirect recursion, Simulation of recursion, Depth of recursion, Removal of recursion. **Stack:** Basic Stack Operations, Infix, Postfix and Prefix Notation of Arithmetic Expressions, Conversions and Evaluations of Arithmetic Expressions Using Stack, **Queue:** Basic Queue Operations, types of Queue, Linear Queue, Priority Queue, Circular Queue and Double-ended Queue, **Searching :** Sequential Searching, Binary Searching, Interpolation Search, **Basic Sorting:** Quick Sort, Merge Sort, Selection Sort, Insertion Sort, etc., **Trees:** Basic terminology, Binary Tree: Binary tree representation, Traversal of Binary Tree (Inorder, Preorder and Postorder), Application of Binary Trees, Counting Binary Trees, Binary Search Tree BST representation, Basic Operations, Huffman Codes, Heap **Graphs:** Graph Representation (Using Adjacency Matrix and Adjacency List), Basic Operations on Graph (Node/ Edge Insertion and Deletion), Traversing a Graph: Breadth-first Search, Depth-first Search. **Hashing:** Hash Function and Overflow Handling, theoretical evaluation of overflow techniques. Open Hashing and Closed Hashing, Linear Probing, Quadratic Probing, Double Hashing, randomize hash.

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)

1	Linear Data Structures (Array, Stack, Queue, Linked List)	CLO1, CLO2, CLO3
2	Nonlinear Data Structures (Graph, Tree)	CLO1, CLO2, CLO3
3	Asymptotic Notations	CLO1, CLO2, CLO3

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	**Specific Outcome(s)**	**Time Frame**	**Suggested Activities**	**Teaching Strategy(s)**	**Alignment with CLO**
Introductory concepts: Data Structures and Algorithm basics, Array: Memory representation, Basic algorithm on array: insert, delete, and search.	CLO1	Week 1	Problem Solving	Lecture, Multimedia	CLO1
Asymptotic Notations: Time and space complexity, best, worst, average case, Big O notation.	CLO1	Week 2	Problem Solving	Lecture, Multimedia	CLO1, CLO2
Basic Sorting Algorithms: Bubble Sort, Insertion Sort, Selection sort	CLO2, CLO3	Week 3	Problem Solving	Lecture, Multimedia	CLO1, CLO2, CLO3
Searching Algorithms: Linear Search, Binary Search, Interpolation Search.	CLO2, CLO3	Week 4	Problem Solving	Lecture, Multimedia	CLO1, CLO2, CLO3
Stacks: Definition, Stack representation, Primitive operations on stack, array representation of stacks, Application of stack: Infix, prefix, postfix, their conversion and evaluation	CLO1, CLO2, CLO3	Week 5	Problem Solving	Lecture, Multimedia	CLO1, CLO2, CLO3
Queues: Definition, Queue representation, Primitive operations on queue, array representation of queues, Circular queue, Applications of queues	CLO1, CLO2, CLO3	Week 6	Problem Solving	Lecture, Multimedia	CLO1, CLO2, CLO3
Recursion: Factorial calculation, Fibonacci series, Tower of Hanoi, Greatest Common Divisor, Iterative vs recursive approach	CLO1, CLO2, CLO3	Week 7	Problem Solving	Lecture, Multimedia	CLO1, CLO2, CLO3
MID-TERM EXAMINATION		Week 8			
Linked Lists: Dynamic memory allocation, Introduction to linked list, Representation of linked list in memory,		Week 9 & 10			CLO1, CLO2, CLO3

primitive operations on linked list, searching a linked list, circular linked list, doubly linked list					
Trees: Introduction, Binary tree – complete binary tree, weighted 2-tree, representing binary tree in memory, traversing a binary tree, binary Search tree, insertion and deletion in binary search tree. Heap tree, creation of heap tree (heapify), insertion in heap, Deletion from heap, Heapsort, Huffman's Algorithm		Week 11 &12			CLO1, CLO2, CLO3
Graphs: Introduction to Graph, Graph theory terminologies, adjacency matrix and path matrix, Linked representation of a graph, Operations on a graph, Traversing a graph, Topological sorting		Week 13			CLO1, CLO2, CLO3
Hashing: Hash Function and Overflow Handling, theoretical evaluation of overflow techniques. Open Hashing and Close Hashing, Linear Probing, Quadratic Probing, Double Hashing, randomize hash.		Week 14			CLO1, CLO2, CLO3
FINAL EXAMINATION		Week 15			

17. Teaching-Learning Strategies:

18. Assessment Techniques of each topic of the course:

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester, 2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 30)	**Tests (30)**
Remember	
Understand	10

Apply	20
Analyze	
Evaluate	
Create	

SMEB- Semester Mid & End Examination (70 Marks)

Bloom's Category	**Mid**	**Final**
Remember		
Understand	6	10
Apply	14	30
Analyze		10
Evaluate		
Create		

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual students will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25

40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Data Structures using C, Aaron M. Tanenbaum, Yedidy Seymour Lipschutz, Schaum's outline Series.
2. Introduction to Algorithms, T.H. Cormen, C.E.Leiserson, R. L. Rivest, C. Stein: HI Learning Pvt. Ltd

Reference Books & Materials

1. Data Structures and Program Design, Robert L. Kruse, Prentice Hall.
2. Data structures and problem solving using C++, Mark Allen Weiss, Pearson Addition Wesley Education.
3. Data Structures Using C and C++, Yedidyah Langsam, Moshe J. Augenstein, and Aaron M. Tenenbaum, Prentice Hall.
4. Data Structures, Edward M. Reigngold. Wilfred J. Hansen, Addison,Wesley Publishing Company

Course Outline – Data Structures and Algorithms Lab I

Part A – Introduction

1.	**Course No. / Course Code**	**:** CSE 204
2.	**Course Title**	**:** Data Structures and Algorithms Lab I
3.	**Course Type**	**:** Core
4.	**Level/Term and Section**	**:** 2nd Year 1st Semester
5.	**Academic Session**	**:** Fall 2023
6.	**Course Instructor**	**:** Nayeema Sultana
7.	**Pre-requisite (If any)**	**:** N/A
8.	**Credit Value**	**:** 1.50
9.	**Contact Hours**	**:** 3.00
10.	**Total Marks**	**:** 100

11. Course Objectives and Course Summary:

Mastering the implementation of fundamental data structures and algorithms in a programming language. This includes arrays, linked lists, stacks, queues, trees, graphs, sorting algorithms (such as bubble sort, insertion sort, merge sort), searching algorithms (like linear search, binary search), etc. Enhancing problem-solving skills by applying various data structures and algorithms to solve real-world problems. Understanding the efficiency and performance of algorithms through empirical analysis using time complexity and space complexity of algorithms and comparing them to theoretical expectations. Developing debugging skills by identifying and fixing errors in code implementations.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO1	**Classify** a problem into its supporting data structures and algorithms.
CLO2	**Solve** practical problems applying the algorithm techniques and appropriate data structures.
CLO3	**Analyze** problems using different algorithmic paradigms and choose the best one for solving a problem.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	1	1/Understand	Lecture, multimedia, Lab worksheets, Problem Solving, Group Discussion	Assignments, Offline lab tasks, Lab tests
CLO2	3	1/Apply	Lecture, Lab worksheets, Problem Solving, Group Discussion	Assignments, Offline and online coding tasks, Lab tests
CLO3	4	1/Analyze	Lecture, Lab worksheets, Problem Solving	Assignments, Offline lab tasks, Lab tests

Part B – Content of the Course

14. Course Content: Laboratory work based on Data Structures and Algorithms I (CSE 203)

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
		Week 1			
		Week 2			
		Week 3			
		Week 4			
		Week 5			
		Week 6			
		Week 7			
MID-TERM EXAMINATION					
		Week 8			
		Week 9			
		Week 10			
		Week 11			
		Week 12			
		Week 13			
		Week 14			
FINAL EXAMINATION					

17. Teaching-Learning Strategies:

18. Assessment Techniques of each topic of the course:

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignment in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category Marks (out of 50)	Tests (25)	Assignments (10)	Quizzes (5)	External Participation in Curricular/ Co-Curricular Activities (10)
Remember				
Understand				
Apply				
Analyze				
Evaluate				
Create				

SMEB- Semester Mid & End Exanimation (50 Marks)

Bloom's Category	Mid	Final
Remember		
Understand		
Apply		
Analyze		
Evaluate		
Create		

19. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00

55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

20. Text Book

1. Arora, Renu and Sood S.K, Fundamentals of Entrepreneurship and Small Business, 1't Edition (2003), Kalyani Publishers, New 'Delhi, India'.

Reference Books & Materials

2. Barringer, Bruce R. and Ireland Duane R., Entrepreneurship Successfully Lunching New Ventures. 3'd Edition (2010) Pearson Education Inc., New Delhi, India
3. Others

Course Outline – ICT Law, Policy, and Ethics

Part A – Introduction

1. **Course No. / Course Code** : CSE 205
2. **Course Title** : ICT Law, Policy, and Ethics
3. **Course Type:**
4. **Level/Term and Section** : 2nd Year 2nd Semester
5. **Academic Session** : Fall 2023
6. **Course Instructor** **:**
7. **Pre-requisite (If any)** **:**
8. **Credit Value** : 3.0
9. **Contact Hours** : 3.0
10. **Total Marks** : 100

11. Course Objectives and Course Summary:

The objectives of this course are to:

The primary objective of this Course is to equip students with the theoretical knowledge, practical skills, and ethical understanding necessary to effectively analyze, interpret, and communicate data-driven insights across a variety of domains. Upon successful completion of this course, students will be able to:

Understand the principles of ICT law and the policy

Apply Laws to solve real-world problems

Develop skills for effectively communicating complex data insights to both technical and non-technical audiences, and foster collaboration within diverse teams for successful project execution.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Understand** the concepts of ICT law, IP Law and professional ethics
CLO 2	**Identify** the standard of the legal law frameworks
CLO 3	**Apply** the ICT law in real life

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	**CLO Statements:** Upon successful completion of the course, students should be able to:	**Corresponding PLOs (Appendix-1)**	**Bloom's taxonomy domain/level (Appendix-2)**	**Delivery methods and activities**	**Assessment Tools**
CLO1	**Understand** the concepts of ICT law, IP Law and professional ethics	a	1/Understand	Lecture, Classwork, Assignments	Quiz, Written exam
CLO2	**Identify** the standard of the legal law frameworks	a	1/Understand	Lecture, Classwork, Assignments	Quiz, Written exam
CLO3	**Apply** the ICT law in real life	b	1/Apply	Lecture, Classwork, Assignments	Quiz, Written exam

Part B – Content of the Course

14. Course Content:

This course is designed for understanding the principles of ICT law and the policy with it. It also covers the ethical theories and principles, Ethics and critical reasoning in computer science.With projects and case studies in fields like finance, healthcare, marketing, and social sciences, the application component of the course focuses on developing practical problem-solving abilities.

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	National ICT Act, National ICT Policy, National e-services rules, National Information security policy guideline, National Copyright, patent, trademark related laws, Laws on document & records retention, UN conventions/Laws related to internet or cyber security, Rights to know, Freedom of Information.	**CLO1**
2	Case Study: Methods for case analysis, Analysis of Cases, Minutes of Annual Meetings of ITU, WTC, UN on ICT policy, Report/Presentation. Ethics: Introduction to ethical theories and principles, Ethics and critical reasoning in computer science, Privacy, personal information, and trust, Software piracy, Music and video piracy, Misuse of software, Viruses and hacking, Computer communication and freedom of expression	**CLO2**
3	Security and encryption, Content control and censorship, Computer crime, Professional issues and decision-making, Intellectual property and licensing, ACM Code of Ethics and Professional Conduct Software Engineering, Code of Ethics and Professional Practice as recommended by the ACM/IEEE-CS Joint Task Force.	**CLO3**

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Program Outcome (PO) (s)	Time Frame	Suggested Activities	Teaching Strategy (s)	Alignment with CLO
National ICT Act, National ICT Policy, National e-services rules, National Information security policy guideline, National Copyright, patent, trademark related laws, Laws on document & records retention	a	Week 1	Assignment on basic understanding	Lecture, Multimedia	CLO1
UN conventions/Laws related to internet or cyber security, Rights to know, Freedom of	**a**	Week 2		Lecture, Multimedia	CLO1

Information. Case Study: Methods for case analysis, Analysis of Cases, Minutes of Annual Meetings of ITU, WTC, UN on ICT policy, Report/Presentation.					
Ethics: Introduction to ethical theories and principles, Ethics and critical reasoning in computer science, Privacy **CT1: Class Test 1**	**a**	Week 3		Lecture, Multimedia	CLO1
personal information, and trust, Software piracy, Music and video piracy, Misuse of software, Viruses and hacking, Computer communication and freedom of expression, Security and encryption **CT1: Class Test 2**	**a**	Week 4,5,6	Practical session:	Lecture, Multimedia	CLO2
Review Class		Week 7			
MID-SEMESTER EXAMINATION					
Content control and censorship, Computer crime, Professional issues and decision-making	**c**	Week 8, 9	Practical session	Lecture, Multimedia	CLO4
Intellectual property and licensing, ACM Code of Ethics and Professional Conduct Software Engineering, Code of Ethics and Professional Practice as recommended by the ACM/IEEE-CS Joint Task Force. **CT3: Class Test 3**	**c**	Week 10, 11,	Case studies	Lecture, Multimedia	CLO4
National Copyright, patent, trademark related laws, Laws on document & records retention, UN conventions/Laws related to internet or cyber security, Rights to know, Freedom of Information **CT4: Class Test 4**	**c**	Week 12, 13		Lecture, Multimedia	CLO4
Review Class		Week 14		Lecture, Multimedia	

FINAL EXAMINATION

17. Teaching-Learning Strategies:

18.

SL. No	**Topics / Content**	Strategy
1.	National ICT Act, National ICT Policy, National e-services rules, National Information security policy guideline, National Copyright, patent, trademark related laws, Laws on document & records retention	Lecture, Slide, Presentation
2.	UN conventions/Laws related to internet or cyber security, Rights to know, Freedom of Information. Case Study: Methods for case analysis, Analysis of Cases, Minutes of Annual Meetings of ITU, WTC, UN on ICT policy, Report/Presentation.	Lecture, Slide, Presentation
3.	Introduction to ethical theories and principles, Ethics and critical reasoning in computer science, Privacy, personal information, and trust, Software piracy, Music and video piracy, Misuse of software, Viruses and hacking, Computer communication and freedom of expression, Security and encryption	Lecture, Slide, Presentation
4.	Content control and censorship, Computer crime, Professional issues and decision-making, Intellectual property and licensing, ACM Code of Ethics and Professional Conduct Software Engineering, Code of Ethics and Professional Practice as recommended by the ACM/IEEE-CS Joint Task Force	Lecture, Slide, Presentation

19. Assessment Techniques of each topic of the course:

SL. No	**Topics / Content**	**Assessment Technique**
1	National ICT Act, National ICT Policy, National e-services rules, National Information security policy guideline, National Copyright, patent, trademark related laws, Laws on document & records retention	Assignment, Quiz, Exam

2	UN conventions/Laws related to internet or cyber security, Rights to know, Freedom of Information. Case Study: Methods for case analysis, Analysis of Cases, Minutes of Annual Meetings of ITU, WTC, UN on ICT policy, Report/Presentation.	Assignment, Quiz, Exam
3.	Introduction to ethical theories and principles, Ethics and critical reasoning in computer science, Privacy, personal information, and trust, Software piracy, Music and video piracy, Misuse of software, Viruses and hacking, Computer communication and freedom of expression, Security and encryption	Assignment, Quiz, Exam
4.	Content control and censorship, Computer crime, Professional issues and decision-making, Intellectual property and licensing, ACM Code of Ethics and Professional Conduct Software Engineering, Code of Ethics and Professional Practice as recommended by the ACM/IEEE-CS Joint Task Force.	Assignment, Quiz, Exam

Part C – Assessment and Evaluation

20. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignment in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

21. CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 50)	**Tests (20)**	**Assignments (10)**
Remember		
Understand		
Apply	**20**	**10**
Analyze		

Evaluate		
Create		

22. SMEB- Semester Mid & End Exanimation (70 Marks)

Bloom's Category	**Mid**	**Final**
Remember	**14**	
Understand		
Apply	**42**	
Analyze	**14**	
Evaluate		
Create		

23. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

23. Text Book

1. Durga Das Bhagabati Prosad sarati, Vep P. Basu, Law of the Press (Wadhwa & Co. 2002).
2. Mr Anupa P Kumar, Cyber Law (Create Space Independent Publishing Platform, 2009).
3. Justice Yatindra Singh, Cyber Laws (Universal Law Publishing Co. ltd., 2nd ed., 2005).
4. M.K. Saxena, Information Technology Law: Concepts, Evolution and Enactments (Mangal Deep Publications, 2004).

5. Computer Ethics, Deborah G. Johnson. ISBN 0-13-111241-4, Pearson Publishers.

Course Outline – Vector Geometry and Linear Algebra

Part A – Introduction

1.	**Course No. / Course Code**	**:** MTH 201
2.	**Course Title**	**:** Math III: Vector Geometry and Linear Algebra
3.	**Course Type**	**:** Theory
4.	**Level/Term and Section**	**:** Second year First semester
5.	**Academic Session**	**:** Fall 2023
6.	**Course Instructor**	**:**
7.	**Pre-requisite (If any)**	**:**
8.	**Credit Value**	**: 3.00**
9.	**Contact Hours**	**: 3.00**
10.	**Total Marks**	**: 100**

11. Course Objectives and Course Summary:

The objectives of this course are to:

1. Provide clear concepts of different coordinate system in 2D and 3D, curves, geometrical bodies and vectors.
2. Analyze some common problems using vector calculus and coordinate geometry.
3. Demonstrate the ability to manipulate vectors.
4. Demonstrate the Eigen values and Eigen vectors to solve real-life problem
5. Analyze Linear Algebra and transformation to apply programming and Graphics.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to demonstrate competence with the basic ideas of vector geometry in 3D geometrical bodies and manipulate vectors, linear algebra including concepts of linear systems, independence, theory of matrices, linear transformations, basis and dimension, eigenvalues, eigenvectors and diagonalization**.**

CLOs	Statements
CLO1	**Understand** basic concepts of vector calculus, partial derivatives and multiple integrals
CLO2	**Solve** various problems using the basic concepts of vectors
CLO3	**Apply** multiple integrals and vector calculus to analyze common problems relating to engineering
CLO4	**Analyze** Eigen values and Eigen vectors to solve various real-life problems
CLO5	**Apply** Linear Algebra to analyze linear programming, statistics and computer graphics.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools

CLO1	PLO1	Cognitive-Understand	Lecture, multimedia	Open Book Exam, Quiz, Short Question, Written Examination
CLO2	PLO1	Cognitive-Apply	Lecture, Problem Solving	Open Book Exam, Assignment, Written Examination
CLO3	PLO1	Cognitive-Analyze	Lecture, Problem Solving	Quiz, Short Question, Written Examination
CLO4	PLO2	Cognitive-Analyze	Lecture, Problem Solving	Open Book Exam, Quiz, Short Question, Written Examination
CLO5	PLO2	Cognitive-Apply	Lecture, Problem Solving	Group Assignment, Open Book Exam, Written Examination

Part B – Content of the Course

14. Course Content:

Three dimensional geometry: Coordinates in three dimensions, direction cosines and direction ratios, planes, sphere, straight line and conicoids (basic definition and properties only) **Geometry of space:** Equations for lines, planes, cylinders and quadric surfaces, **Introduction to Vectors:** Vectors and Linear Combinations, Lengths and Dot Products. **Orthogonality:** Orthogonality of the Four Subspaces, Projections, Least Squares Approximations, Orthogonal Bases and Gram-Schmidt. **Determinants:** The Properties of Determinants, Permutations and Cofactors, Cramer's Rule, Inverses, and Volumes. **Eigenvalues and Eigenvectors:** Introduction to Eigenvalues, Diagonalizing a Matrix, Applications to Differential Equations, Symmetric Matrices, Positive Definite Matrices, Similar Matrices, Singular Value Decomposition (SVD). **Linear Transformations:** The Idea of a Linear Transformation, The Matrix of a Linear Transformation, Diagonalization and the Pseudoinverse. **Applications:** Matrices in Engineering, Graphs and Networks, Markov Matrices, Population, and Economics, Linear Programming, Fourier Series: Linear Algebra for Functions, Linear Algebra for Statistics and Probability, Computer Graphics."

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	**Three-dimensional geometry**	**CLO1**
2	**Geometry of space**	**CLO2**
3	**Introduction to vectors, orthogonality and determinants**	**CLO3**
4	**Eigenvalues and Eigenvectors**	**CLO4**
5	**Linear Transformations and Applications**	**CLO5**

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	**Specific Outcome(s)**	**Time Frame**	**Suggested Activities**	**Teaching Strategy(s)**	**Alignment with CLO**
Coordinates in three dimensions, direction cosines and direction ratios.		Week 1		Multimedia or, Lecture	**CLO1**
planes, sphere, straight line and conicoids		Week 2		Multimedia or,Lecture	**CLO1**
Vectors and Linear Combinations, Lengths and Dot Products		Week 3		Multimedia or, Lecture	**CLO1**
Geometry of space: Equations for lines, planes, cylinders and quadric surfaces		Week 4		Multimedia or, Lecture	**CLO2**
Vectors and Linear Combinations, Lengths and Dot Products		Week 5		Multimedia or, Lecture	**CLO2**
MID-TERM EXAMINATION		Week 7			
Orthogonality of the Four Subspaces		Week 7		Multimedia or, Lecture	**CLO3**
Introduction to Eigenvalues, Diagonalizing a Matrix		Week 8		Multimedia or, Lecture	**CLO4**
Applications to Differential Equations, Symmetric Matrices, Positive Definite Matrices,		Week 9		Multimedia or, Lecture	**CLO4**
Singular Value Decomposition (SVD)		Week 10		Multimedia or, Lecture	**CLO4**
The Idea of a Linear Transformation, The Matrix of a Linear Transformation, Diagonalization and the Pseudoinverse		Week 11		Multimedia or, Lecture	**CLO5**
Matrices in Engineering, Graphs and Networks		Week 12		Multimedia or, Lecture	**CLO5**
Linear Programming, Fourier Series: Linear Algebra for Functions		Week 13		Multimedia or, Lecture	**CLO5**
Linear Algebra for Statistics and Probability, Computer Graphics		Week 14		Multimedia or, Lecture	**CLO5**

FINAL EXAMINATION		Week 15			

17. Teaching-Learning Strategies:

18. Assessment Techniques of each topic of the course:

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignment in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 50)	Tests (15)	Assignments (5)	Quizzes (5)	External Participation in Curricular/Co-Curricular Activities (5)
Remember			**3**	
Understand	**2**		**2**	
Apply	**3**			
Analyze	**5**			
Evaluate	**5**			
Create		**5**		**5**

SMEB- Semester Mid & End Exanimation (70 Marks)

Bloom's Category	Test
Remember	**5**
Understand	**10**
Apply	**15**
Analyze	**15**

Evaluate	**15**
Create	**10**

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

10. Class Tests 30%
11. Term Examination 50%
12. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

<u>Part D – Learning Resources</u>

21. Text Book:

1. A. F. M. A. Rahman and P. K. Bhattacharjee, Analytic Geometry and Vector Analysis.
2. K. Mohammad, Analytic Geometry and Vector Analysis
3. Gilbert Strang, Introduction to Linear Algebra, Wellesley-Cambridge Press and SIAM.

Reference Books:

1. L. Seymour, Linear algebra, New Delhi: Mc-Graw Hill.
2. M. A. Rahman, Linear Algebra, Dhaka: Nahar Book.

Course Outline –Electronic Devices and Circuits

Part A – Introduction

1.	**Course No. / Course Code**	: EEE 201
2.	**Course Title**	: Electronic Devices and Circuits
3.	**Course Type**	: Core
4.	**Level/Term and Section**	: 2th Year 2nd Semester
5.	**Academic Session**	: Fall 2023
6.	**Course Instructor**	:
7.	**Pre-requisite (If any)**	:
8.	**Credit Value**	: 3.0
9.	**Contact Hours**	: 3.0
10.	**Total Marks**	: 100

11. Course Objectives and Course Summary:

The objectives of this course are to:

The primary objective of this Course is to equip students with the theoretical knowledge, practical skills, and ethical understanding necessary to effectively analyze, interpret, and communicate data-driven insights across a variety of domains. Upon successful completion of this course, students will be able to:

Understand the principle of electro-machanical devices that is widely used in computers

Apply electronic circuit switching operations

Develop the analog to digital data conversion and vice versa using different techniques.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Understand** the principle of electro-machanical devices that is widely used in computers
CLO 2	**Explain** electronic circuit switching operations
CLO 3	**Analyze** the analog to digital data conversion and vice versa using different techniques.

CLO 4	**Use** computer memory and modules

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	**CLO Statements:** Upon successful completion of the course, students should be able to:	**Corresponding PLOs (Appendix-1)**	**Bloom's taxonomy domain/level (Appendix-2)**	**Delivery methods and activities**	**Assessment Tools**
CLO1	**Understand** the principle of electro-machanical devices that is widely used in computers	a	1/Understand	Lecture, Classwork, Assignments	Quiz, Written exam
CLO2	**Explain** electronic circuit switching operations	a	1/Understand	Lecture, Classwork, Assignments	Quiz, Written exam
CLO3	**Analyze** the analog to digital data conversion and vice versa using different techniques.	b	1/Apply	Lecture, Classwork, Assignments	Quiz, Written exam
CLO4	**Use** computer memory and modules	c	1/Apply	Lecture, Classwork, Assignments	Quiz, Written exam

<u>Part B – Content of the Course</u>

14. Course Content:

This course introduces the functionalities of electro-machanical devices along with their working principles. It also covers the mechanism of frequency generations and computer memory modules.

15. Alignment of topics of the courses with CLOs:

SL. No	**Topics / Content**	**Course Learning Outcome (CLO)**
1	DC Generator: Principles, operations and characteristics study; DC Motor: Principles, operations and characteristics study, Transformer: Principles, operations and characteristics study, 3-ϕ induction motor: Principles, operations and characteristics study, Stepper motor: Principles, operations and characteristics study.	**CLO1**

2	Instrumentation: Transducers, Solenoids, Relay, Digital-Multimeter, Digital-Watt-meter, Digital Electronics: Introduction to MOSFET, Basic terminology; TTL, NMOS and CMOS logic; Converter: specifications, weighted and R-2R ladder, Flash, Successive Approximation, Dual-slope converters, etc.;	**CLO2**
3	Memory elements: ROM, static RAM and dynamic RAM, memory expansion, Pulse Techniques: Operational amplifier:	**CLO3**
4	linear applications, dc performance, ac performance; Design of Active filters: low pass, high pass and band pass; Square, triangular and sawtooth wave generation techniques, 555 timers and their applications, application of Schmitt triggers in wave shaping, application of diodes in clipping and clamping, application of inverter, chopper, rectifier, and switch mode power supply.	**CLO4**

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	**Specific Program Outcome (PO) (s)**	**Time Frame**	**Suggested Activities**	**Teaching Strategy (s)**	**Alignment with CLO**
DC Generator: Principles, operations and characteristics study; DC Motor: Principles, operations and characteristics study,	a	Week 1	Assignment on basic understanding	Lecture, Multimedia	CLO1
Transformer: Principles, operations and characteristics study, 3-ϕ induction motor: Principles, operations and characteristics study, Stepper motor: Principles, operations and characteristics study. Instrumentation: Transducers, Solenoids, Relay, Digital-Multimeter, Digital-Watt-meter,	**a**	Week 2, 3		Lecture, Multimedia	CLO1
Digital Electronics: Introduction to MOSFET, Basic terminology; TTL, NMOS and CMOS logic; Converter: specifications, weighted and R-2R	**a**	Week 4,5,6	Practical session	Lecture, Multimedia	CLO2

ladder, Flash, Successive Approximation, Dual-slope converters, etc.					
Review Class		Week 7			
MID-SEMESTER EXAMINATION					
Memory elements: ROM, static RAM and dynamic RAM, memory expansion, Pulse Techniques: Operational amplifier	**c**	Week 8, 9	Practical session	Lecture, Multimedia	CLO4
linear applications, dc performance, ac performance; Design of Active filters: low pass, high pass and band pass; Square, triangular and sawtooth wave generation techniques,, application of inverter, chopper, rectifier, and switch mode power supply. **CT3: Class Test 3**	**c**	Week 10, 11,	Case studies	Lecture, Multimedia	CLO4
555 timers and their applications, application of Schmitt triggers in wave shaping, application of diodes in clipping and clamping. **CT4: Class Test 4**	**c**	Week 12, 13		Lecture, Multimedia	CLO4
Review Class		Week 14		Lecture, Multimedia	
FINAL EXAMINATION					

17. Teaching-Learning Strategies:

SL. No	Topics / Content	Strategy
1	DC Generator: Principles, operations and characteristics study; DC Motor: Principles, operations and characteristics study, Transformer: Principles, operations and characteristics study, 3-ϕ induction motor: Principles, operations and characteristics study, Stepper motor: Principles, operations and characteristics study.	Lecture, Slide, Presentation
2	Instrumentation: Transducers, Solenoids, Relay, Digital-Multimeter, Digital-Watt-meter, Digital Electronics: Introduction to MOSFET, Basic terminology; TTL, NMOS and CMOS logic; Converter: specifications, weighted and R-2R ladder, Flash, Successive	Lecture, Slide, Presentation

	Approximation, Dual-slope converters, etc.	
3.	Memory elements: ROM, static RAM and dynamic RAM, memory expansion, Pulse Techniques: Operational amplifier: linear applications, dc performance, ac performance; Design of Active filters: low pass, high pass and band pass	Lecture, Slide, Presentation
4.	Square, triangular and sawtooth wave generation techniques, 555 timers and their applications, application of Schmitt triggers in wave shaping, application of diodes in clipping and clamping, application of inverter, chopper, rectifier, and switch mode power supply.	Lecture, Slide, Presentation

18. Assessment Techniques of each topic of the course:

SL. No	Topics / Content	Assessment Technique
1	DC Generator: Principles, operations and characteristics study; DC Motor: Principles, operations and characteristics study, Transformer: Principles, operations and characteristics study, 3-ϕ induction motor: Principles, operations and characteristics study, Stepper motor: Principles, operations and characteristics study.	Assignment, Quiz, Exam
2	Instrumentation: Transducers, Solenoids, Relay, Digital-Multimeter, Digital-Watt-meter, Digital Electronics: Introduction to MOSFET, Basic terminology; TTL, NMOS and CMOS logic; Converter: specifications, weighted and R-2R ladder, Flash, Successive Approximation, Dual-slope converters, etc.	Assignment, Quiz, Exam
3.	Memory elements: ROM, static RAM and dynamic RAM, memory expansion, Pulse Techniques: Operational amplifier: linear applications, dc performance, ac performance; Design of Active filters: low pass, high pass and band pass	Assignment, Quiz, Exam
4.	Square, triangular and sawtooth wave generation techniques, 555 timers and their applications, application of Schmitt triggers in wave shaping, application of diodes in clipping and clamping, application of inverter, chopper, rectifier, and switch mode power supply.	Assignment, Quiz, Exam

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignment in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 50)	Tests (20)	Assignments (10)
Remember		
Understand		
Apply	**20**	**10**
Analyze		
Evaluate		
Create		

SMEB- Semester Mid & End Exanimation (70 Marks)

Bloom's Category	Mid	Final
Remember	**14**	
Understand		
Apply	**42**	
Analyze	**14**	
Evaluate		
Create		

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75

70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. A TextBook of Electrical Technology II – B L Thereja, Chand (S) & Co Ltd,India.
2. Power Electronics, Daniel Hart, McGraw-Hill.
3. Digital System Principles and Applications – Ronald j Tocci, Neal Widmer Greq Moss, Prentice Hall.

Course Outline – Electronic Devices and Circuits Lab

Part A – Introduction

1. **Course No. / Course Code** : EEE 202
2. **Course Title** : Electronic Devices and Circuits Lab
3. **Course Type** : Core
4. **Level/Term and Section** : 2nd Year 2nd Semester
5. **Academic Session** : Fall 2023
6. **Course Instructor** :
7. **Pre-requisite (If any)** :
8. **Credit Value** : 1.5
9. **Contact Hours** : 3.0
10. **Total Marks** : 100

11. **Course Objectives and Course Summary:**
The main objective of this course is to enhance the student's learning experience in topics encountered in EEE 201. In this lab, students are expected to gain experience using the basic electro-mechanical devices used in computer engineering and interpreting the results of logical operations in terms of the concepts introduced in the second electrical circuits course.

12. **Course Learning Outcomes: at the end of the Course, the Student will be able to –**

CLO 1	**Design** internal circuits of different logic gates and verify their truth table.
CLO 2	**Design** 2^n bits ADC & DAC circuits.

CLO 3	**Construct** different types of signal-generating circuits and assess their frequency and voltage.
CLO 4	**Implement** the basic characteristics of a single-phase transformer.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	b	1/Apply	Lecture, Lab Demonstration	Quiz, Lab Performance, Viva, Report.
CLO2	b	1/Apply	Lecture, Lab Demonstration	Quiz, Lab Performance, Viva, Report.
CLO3	b	1/Apply	Lecture, Lab Demonstration	Quiz, Lab Performance, Viva, Report.
CLO4	c	1/Apply	Lecture, Lab Demonstration	Quiz, Lab Performance, Viva, Report.

Part B – Content of the Course

14. Course Content:

This course introduces the practice of implementation of functionalities of electro-mechanical devices along with their working principles. It also covers the mechanism of frequency generation and computer memory modules.

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	**Design** internal circuits of different logic gates and verify their truth table.	**CLO 1**
2	**Design** 2^n bits ADC & DAC circuits.	**CLO 2**
3	**Construct** different types of signal-generating circuits and assess their frequency and voltage.	**CLO 3**
4	**Implement** the basic characteristics of a single-phase transformer.	**CLO 4**

16. Class Schedule/Lesson Plan/Weekly Plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Basic Logic Gates	Design internal circuits of basic logic gates (AND, OR, NOT) and verify their truth tables.	Week 1	Assignment on basic understanding	Lecture, Multimedia	CLO1

Combinational Logic Circuits	Design and test combinational logic circuits such as adders and multiplexers.	Week 2	Practice problems	Lecture, Multimedia	CLO1
Sequential Logic Circuits	Implement and verify sequential logic circuits like flip-flops and counters.	Week 3	Practice problems	Lecture, Multimedia	CLO1
Introduction to ADC and DAC	Understand the principles of ADC and DAC; design simple conversion circuits.	Week 4	Practical session	Lecture, Multimedia	CLO2
Designing 2^n bit ADC Circuits	Design and implement 2^n bit ADC circuits; analyze their performance.	Week 5	Practical session	Lecture, Multimedia	CLO2
Designing 2^n bit DAC Circuits	Design and implement 2^n bit DAC circuits; analyze their performance.	Week 6	Practical session	Lecture, Multimedia	CLO2
Week 7: MID-TERM EXAMINATION					
Oscillators and Waveform Generators	Design and implement oscillator circuits; generate different waveforms.	Week 8	Practical session	Lecture, Multimedia	CLO3
Filters and Frequency Response	Construct and evaluate different filter circuits; understand frequency response.	Week 9	Case studies	Lecture, Multimedia	CLO3
Signal Modulation Techniques	Design and implement circuits for AM, FM, and PWM signal modulation; assess their frequency and voltage.	Week 10	Assignment on basic understanding	Lecture, Multimedia	CLO3
Single-Phase Transformer Basics	Understand the basic characteristics and operation of single-phase transformers.	Week 11	Practice problems	Lecture, Multimedia	CLO4
Transformer Equivalent	Implement the equivalent circuit of a	Week 12	Practice problems	Lecture, Multimedia	CLO4

Circuit	transformer and analyze its parameters.				
Transformer Testing and Efficiency	Perform tests on transformers to determine efficiency and voltage regulation.	Week 13	Practical session	Lecture, Multimedia	CLO4
Week 14: FINAL EXAMINATION					

17. Teaching-Learning Strategies:

Practical examples will be incorporated with each of the lab classes from the beginning. The class lectures will be broken down into interactive examples where students will be encouraged to ask questions to create an open atmosphere for exploration and relate the concepts to real-world examples and applications. Progressively challenging assignments will be built and assigned to the students to reinforce learning, evaluate understanding, and adjust teaching accordingly. Feedback will be provided on students' work to guide their progress and address misconceptions. It will be discussed throughout the weekly lab classes on how programming is used in various industries from game development to scientific research, to make the subject matter more relevant and engaging.

18. Assessment Techniques of each topic of the course:

Part C – Assessment and Evaluation

19. Assessment Strategy

Lab exams: Altogether 4 to 6 lab exams may be taken during the semester. 3 out of 4/4 out of 5/5 out of 6 lab exams may be considered depending on the number of lab exams taken. No makeup lab exam will be taken. Students are strongly recommended not to miss any lab exams.

Assignment: Assignments (Written and/or presentation) will be given throughout the semester. Late submission will result in a 50% deduction in the score. Students will have to do the presentation on the given topic as an assignment.

CIE- Continuous Internal Evaluation (60 Marks)

Bloom's Category Marks (out of 50)	**Tests (40)**	**Assignments (20)**
Remember		
Understand		
Apply	**40**	**20**
Analyze		
Evaluate		
Create		

SMEB- Semester Mid & End Exanimation (40 Marks)

Bloom's Category	Mid	Final
Remember		
Understand		
Apply	**40**	
Analyze		
Evaluate		
Create		

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual students will be evaluated based on the following criteria with respective weights.

1. Lab Tests 40%
2. Term Examination 40%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

<u>Part D – Learning Resources</u>

21. Text Book:

1. Ramakant A. Gayakwad, Op-Amps and Linear Integrated Circuits (4th edition), Published by: Pearson.

2. Robert F. Coughlin, Frederick F. Driscoll Operational Amplifiers & Linear Integrated Circuits (6th or 7th edition).
3. Douglas A. Pucknell, Kamran Eshraghian, Basic VLSI Design (3rd edition).

Reference Books:

1. B. L. Theraja, A. K. Theraja, A TextBook of Electrical Technology (Volume II), S.Chand.
2. A K. Sawhney A Course in Electrical and Electronic Measurements and Instrumentation.

Second Year Second Semester

Course Outline – Data Structures and Algorithms II

Part A – Introduction

1.	**Course No. / Course Code**	**:** CSE 207
2.	**Course Title**	**:** Data Structures and Algorithms II
3.	**Course Type**	**:** Core Course
4.	**Level/Term and Section**	**:** 2^{nd} year 2^{nd} semester
5.	**Academic Session**	**:** Fall 2023
6.	**Course Instructor**	**:** Md. Shahidul Islam
7.	**Pre-requisite (If any)**	**:** CSE 203
8.	**Credit Value**	**:** 3.00
9.	**Contact Hours**	**:** 3.00
10.	**Total Marks**	**:** 100

11. Course Objectives and Course Summary:

Data structures and algorithms are essential for the students to be able to design, develop efficient algorithms using different data structures. This course is designed to help the students learn the skills to design and implement efficient algorithms using appropriate data structures. This is a required course and a pre-requisite of Operating System, and Artificial Intelligence and Expert System in the CSE program.

The prime objective of this course is to provide students with an in-depth knowledge of applying data structures and algorithms to solve different types of problems.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Explain** terms related to important data structures, algorithm analysis, design techniques, and basic algorithms.
CLO 2	**Apply** techniques and appropriate data structures to design and implement algorithms to solve a practical problem.
CLO 3	**Analyze** the performance or resource requirements of various algorithms.
CLO 4	**Apply** algorithmic techniques and data structures through interactive calculation and visualization.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	1	1/Remember	Lecture, Multimedia	Quiz, Assignment, Written Examination
CLO2	3	1/Apply	Lecture, Multimedia	Quiz, Viva, Assignment, Written Examination
CLO3	2	1/Analyze	Lecture, Multimedia	Quiz, Assignment, Written Examination
CLO4	3	1/ Apply	Lecture, Multimedia, Illustrations	Quiz, Assignment, Written Examination

Part B – Content of the Course

14. Course Content:

Introduction: The role of algorithms in computing. **Complexity analysis**: Growth of function, asymptotic notations, orders, designing worst case and average-case. **Recurrence relations**: Substitution method, iteration method, master method. **Divide and Conquer**: Basic idea, control structure properties of D & C, applications of D & C. **Dynamic Programming**: Elements of Dynamic Programming, Comparison with D & C. Application of Dynamic programming in: Optimal binary search tree, 0/1 Knapsack problem. **Greedy Method**: Elements of greedy method, basic control structure, **Application of Greedy method in**: Minimum cost spanning tree, Huffman code, Job sequencing with deadline. **Backtracking**: Basic idea behind backtracking, control structure. **Application of backtracking in**: graph coloring problem, n -queens' problems. **Branch and Bound**: Basic idea and control structure of Branch and Bound. FIFO branch and Bound, LC Branch and Bound, the l5-puzzle problem. **Graph related algorithms**: Breadth First search, Depth First search, Topological sort, Dijkstra's shortest path algorithm, The Bellman-Ford algorithm for single source shortest path, The Floyd-War shall algorithm for all pair shortest path, Johnson's algorithm for sparse graph, Flow networks, the Ford-Fulkerson method. **String Matching**: Naïve string-matching algorithm, the Rabin-Karp algorithm. **Completeness**: Polynomial time, polynomial time verification, NP-completeness and reducibility, NP completeness proofs, NP complete problems. **Approximation Algorithms**: Introduction, the vertex-cover problem, the traveling salesman problem, the subset-sum problem.

15. Alignment of topics of the courses with CLOs:

SL. NO	Topics / Content	Course Learning Outcome (CLO)
1	Introduction to algorithms	CLO1
2	Algorithm Implementation: Divide and Conquer, Dynamic Programming, Greedy algorithms, Graph Algorithms, Backtracking, String Matching, Approximation Algorithms	CLO2
3	Complexity Analysis, Analysis of Algorithms: Divide and Conquer, Dynamic Programming, Greedy algorithms, Graph Algorithms, Backtracking, String Matching, Approximation Algorithms	CLO3
4	Numerical Calculation and visualization: Divide and Conquer, Dynamic Programming, Greedy algorithms, Graph Algorithms, Backtracking, String Matching, Approximation Algorithms	CLO4

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Introduction, Complexity Analysis: Worst-Case and Best-Case Analysis, Asymptotic notation.	- To analyze the time complexity of algorithms	Week 1	Course outline will be discussing in details	Lecture, multimedia	CLO1, CLO3
The Divide-and-Conquer (DC) Approach: Binary Search, Ternary Search, Merge Sort, Quick Sort, Analyzing DC Algorithms, Recurrence Relations, Master Method.	- To apply DC algorithms for real life problems - To analyze time complexity of DC using different methods	Week 2 – Week 4	Report on “Visual Representation of DC algorithms”	Lecture, multimedia	CLO2, CLO3, CLO4
Dynamic Programming: Longest Common Subsequence, Coin changing problem,	- To apply DP and memoization - To identify overlapping	Week 5 – Week 6	Report on “Time Complexity analysis of DC and DP	Lecture, multimedia, Problem Solving	CLO2, CLO3, CLO4

0/1 Knapsack Problem	subproblems		algorithms”		
Greedy algorithms: Coin change, fractional Knapsack, Job Sequencing	- To apply greedy algorithms - To minimize time complexity using Greedy approach	Week 7	Discuss and list other problems which can be solved using greedy method.	Lecture, multimedia, Group discussion	CLO2, CLO4
MID-TERM EXAMINATION					
Graph Related Algorithms: DFS, BFS, Single Source Shortest Path, Dijkstra's Algorithm, MST	- To understand graph representation and traversal	Week 8 – Week 9	Visualize graph related problems	Lecture, multimedia, homework	CLO2, CLO4
Backtracking: Graph Coloring, N-Queen problem	- To apply backtracking idea	Week 10	Backtrack using chess board	Lecture, multimedia, homework	CLO2, CLO4
Branch and Bound: FIFO branch and Bound, LC Branch and Bound, the l5-puzzle problem.	- To understand branch and bound concept	Week 11	Solve 15 puzzle by hand and note the moves	Lecture, multimedia	CLO2, CLO4
String Algorithms: The Naive String-Matching Algorithm, The Rabin-Karp Algorithm	- To develop efficient string-matching algorithms	Week 12 – Week 13	Make a hash function and use it in Rabin Karp algorithm	Lecture, multimedia	CLO2, CLO3, CLO4
Approximation Algorithms: the vertex-cover problem, the traveling-salesman problem, the subset-sum problem	- To develop approximation algorithms - To find the approximation ratio	Week 14	Compare approximate and optimal solution for small graph to find the ratio	Lecture, multimedia	CLO2, CLO3, CLO4
FINAL EXAMINATION					

17. Teaching-Learning Strategies:

18. Assessment Techniques of each topic of the course:

Assessment Type	% weight	CO1	CO2	CO3	CO4
Final Exam	50%	5	20	5	20
Mid Term Exam	20%	2	10	3	5
Class performance (Class Test, Assignment, Problem solving session)	30%	3	15	2	10
Total	100%	10	45	10	35

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests will be taken during the semester, 2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests on same CLO, best 1 class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignment in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment.

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category	Class Tests (30)
Remember	3
Understand	
Apply	15
Analyze	2
Evaluate	
Create	10

SMEB- Semester Mid & End Exanimation (70 Marks)

Bloom's Category	Mid (20)	Final (50)
Remember	2	5
Understand		
Apply	10	20
Analyze	3	5
Evaluate		
Create	5	20

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Ellis Horowitz, S. Rajasekaran, Sartaj Sahni: Fundamental of Computer Algorithms, Second Edition, 2008, Universities Press.

Reference Books & Materials

2. T.H. Cormen, C.E.Leiserson, R. L. Rivest, C. Stein: Introduction to Algorithms, Third Edition, 2009, PHI Learning Pvt. Ltd

Course Outline – Data Structures and Algorithms II Lab

Part A – Introduction

1.	**Course No. / Course Code**	**:** CSE 208
2.	**Course Title**	**:** Data Structures and Algorithms II Lab
3.	**Course Type**	**:** Core Course
4.	**Level/Term and Section**	**:** 2nd year 2nd semester
5.	**Academic Session**	**:** Fall 2023
6.	**Course Instructor**	**:** Md. Shahidul Islam
7.	**Pre-requisite (If any)**	**:** Nil
8.	**Credit Value**	**:** 1.50
9.	**Contact Hours**	**:** 3.00
10.	**Total Marks**	**:** 100

11. Course Objectives and Course Summary:

Data structures and algorithms are essential for the students to be able to design, develop efficient algorithms using different data structures. This course is designed to help the students learn the skills to design and implement efficient algorithms using appropriate data structures. This is a required course and a pre-requisite of Operating System, and Artificial Intelligence and Expert System in the CSE program.

The prime objective of this course is to provide students with an in-depth knowledge of applying data structures and algorithms to solve different types of problems.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Explain** terms related to important data structures, algorithm analysis, design techniques, and basic algorithms.
CLO 2	**Apply** techniques and appropriate data structures to design and implement algorithms to solve a practical problem.
CLO 3	**Analyze** the performance or resource requirements of various algorithms.
CLO 4	**Apply** algorithmic techniques and data structures through interactive calculation and visualization.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	1	1/Remember	Coding, Multimedia	Quiz, Assignment, Lab Test
CLO2	3	1/Apply	Coding, Multimedia, Problem solving session	Quiz, Viva, Assignment, Lab Test
CLO3	2	1/Analyze	Coding, Multimedia	Quiz, Assignment, Lab Test
CLO4	3	1/ Apply	Coding, Multimedia, Illustrations	Quiz, Assignment, Lab Test

Part B – Content of the Course

14. Course Content:

Introduction: The role of algorithms in computing. **Complexity analysis**: Growth of function, asymptotic notations, orders, designing worst case and average-case. **Recurrence relations**: Substitution method, iteration method, master method. **Divide and Conquer**: Basic idea, control structure properties of D & C, applications of D & C. **Dynamic Programming**: Elements of Dynamic Programming, Comparison with D & C. Application of Dynamic programming in: Optimal binary search tree, 0/1 Knapsack problem. **Greedy Method**: Elements of greedy method, basic control structure, **Application of Greedy method in**: Minimum cost spanning tree, Huffman code, Job sequencing with deadline. **Backtracking**: Basic idea behind backtracking, control structure. **Application of backtracking in**: graph coloring problem, n -queens' problems. **Branch**

and Bound: Basic idea and control structure of Branch and Bound. FIFO branch and Bound, LC Branch and Bound, the l5-puzzle problem. **Graph related algorithms**: Breadth First search, Depth First search, Topological sort, Dijkstra's shortest path algorithm, The Bellman-Ford algorithm for single source shortest path, The Floyd-War shall algorithm for all pair shortest path, Johnson's algorithm for sparse graph, Flow networks, the Ford-Fulkerson method. **String Matching**: Naïve string-matching algorithm, the Rabin-Karp algorithm. **Completeness**: Polynomial time, polynomial time verification, NP-completeness and reducibility, NP completeness proofs, NP complete problems. **Approximation Algorithms**: Introduction, the vertex-cover problem, the traveling salesman problem, the subset-sum problem.

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Introduction to algorithms	CLO1
2	Algorithm Implementation: Divide and Conquer, Dynamic Programming, Greedy algorithms, Graph Algorithms, Backtracking, String Matching, Approximation Algorithms	CLO2
3	Complexity Analysis, Analysis of Algorithms: Divide and Conquer, Dynamic Programming, Greedy algorithms, Graph Algorithms, Backtracking, String Matching, Approximation Algorithms	CLO3
4	Numerical Calculation and visualization: Divide and Conquer, Dynamic Programming, Greedy algorithms, Graph Algorithms, Backtracking, String Matching, Approximation Algorithms	CLO4

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Introduction, Complexity Analysis: Worst-Case and Best-Case Analysis, Asymptotic notation.	1. To analyze the time complexity of algorithms	Week 1	Visualization of different functions, numerical analysis of functions	Practice session	CLO1, CLO3
The Divide-and-Conquer (DC) Approach: Binary Search, Ternary Search, Merge Sort, Quick Sort, Analyzing DC Algorithms, Recurrence	2. To apply DC algorithms for real life problems 3. To analyze time complexity of DC using different	Week 2 – Week 4	Implementing DC algorithms and complexity analysis	Practice session, Coding	CLO2, CLO3, CLO4

Relations, Master Method.	methods				
Dynamic Programming: Longest Common Subsequence, Coin changing problem, 0/1 Knapsack Problem	4. To apply DP and memoization 5. To identify overlapping subproblems	Week 5 – Week 6	Implementation and Time Complexity analysis DP algorithms	Practice session, Coding	CLO2, CLO3, CLO4
Greedy algorithms: Coin change, fractional Knapsack, Job Sequencing	6. To apply greedy algorithms 7. To minimize time complexity using Greedy approach	Week 7	Code implementation of problems which can be solved using greedy method	Lecture, multimedia, Group discussion	CLO2, CLO4
Graph Related Algorithms: DFS, BFS, Single Source Shortest Path, Dijkstra's Algorithm, MST	8. To understand graph representation and traversal	Week 8 – Week 9	Solve graph related problems	Practice session, Coding, Homework	CLO2, CLO4
Backtracking: Graph Coloring, N-Queen problem	9. To apply backtracking idea	Week 10	Implement Backtracking for N-Queen problem	Practice session, Coding, Homework	CLO2, CLO4
Branch and Bound: FIFO branch and Bound, LC Branch and Bound, the l5-puzzle problem.	10. To understand branch and bound concept	Week 11	Solve 15 puzzle by hand and note the moves then implement the algorithm	Practice session, Coding	CLO2, CLO4
String Algorithms: The Naive String-Matching Algorithm, The Rabin-Karp Algorithm	11. To develop efficient string-matching algorithms	Week 12 – Week 13	Make a hash function and use it in implementing Rabin Karp algorithm	Practice session, Coding	CLO2, CLO3, CLO4
Approximation Algorithms: the vertex-cover problem, the traveling-salesman problem, the subset-sum	12. To develop approximation algorithms 13. To find the approximation ratio	Week 14	Implement Approximation algorithms	Practice session, Coding	CLO2, CLO3, CLO4

problem					
FINAL LAB TEST					

17. Teaching-Learning Strategies:

18. Assessment Techniques of each topic of the course:

Assessment Type	**% weight**	**CO1**	**CO2**	**CO3**	**CO4**
Final Lab Test	40%	5	10	5	20
Lab Assessment (Lab Test, Assignment, Problem solving, Quiz)	60%	10	20	10	20
Total	**100%**	**15**	**30**	**15**	**40**

Part C – Assessment and Evaluation

19. Assessment Strategy

Lab Tests: Altogether 4 lab tests will be taken during the semester, 4 tests will be taken before midterm and 2 class tests will be taken before final term. No makeup lab tests will be taken. Students are strongly recommended not to miss any lab tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignment in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category	**Lab Tests (40)**	**Assignments (20)**
Remember		2
Understand		
Apply		5
Analyze		3
Evaluate		5
Create	40	5

SMEB- Semester Mid & End Exanimation (70 Marks)

Bloom's Category	**Lab Final (40)**
Remember	5
Understand	
Apply	10
Analyze	5

Evaluate	
Create	10

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Lab Assessment 60%
2. Lab Final Examination 40%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Ellis Horowitz, S. Rajasekaran, Sartaj Sahni: Fundamental of Computer Algorithms, Second Edition, 2008, Universities Press.

Reference Books & Materials

2. T.H. Cormen, C.E.Leiserson, R. L. Rivest, C. Stein: Introduction to Algorithms, Third Edition, 2009, PHI Learning Pvt. Ltd

<u>**Course Outline – Digital Logic Design**</u>

<u>**Part A – Introduction**</u>

1.	**Course No. / Course Code**	: CSE 209
2.	**Course Title**	: Digital Logic Design
3.	**Course Type**	: Core Course
4.	**Level/Term and Section**	: 2nd Year 2nd Semester
5.	**Academic Session**	: Fall 2023
6.	**Course Instructor**	: Prof. Dr. Aloke Kumar Saha
7.	**Pre-requisite (If any)**	: Nil
8.	**Credit Value**	: 3.00
9.	**Contact Hours**	: 3.00
10.	**Total Marks**	: 100

Course Objectives and Course Summary: The objectives of this course are to:

- **a) Provide** knowledge and understanding on principles of digital logic operation and different types of logic gates.
- **b) Introduce** the concept of different types of combinational logic, sequential circuits, registers and counters.
- **c) Learn** the operation of different types of combinational logic, sequential circuits, registers and counters.
- **d) Enable** the student to gain Application of different types of logic gates and flip flops.
- **e) Emphasize** the Design and Implement of different types of combinational & sequential logic circuits and counters.

11. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Describe** the concept of digital logic operation and different types of logic gates.
CLO 2	**Recognize** the concept of different types of combinational logic, sequential circuits, registers and counters.
CLO 3	**Understand** the operation of different types of combinational logic, sequential circuits, registers and counters.
CLO 4	**Apply** different types of logic gates and flip flops.
CLO 5	**Design** different types of combinational & sequential logic circuits and counters.

12. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	1	1/Remember	Lecture, multimedia,	Written Examination, Assignment
CLO2	1	1/Analyze	Lecture, Group discussion	Quiz, Written Examination
CLO3	4	1/Understand	Lecture, Problem Solving, Group discussion	Quiz, Presentation, Viva, Written Examination
CLO4	5	1/Apply	Problem Solving	Quiz, Assignment, Written Examination
CLO5	5	1/Create	multimedia	Quiz, Written Examination

Part B – Content of the Course

13. Course Content:

Logic gates: Basic logic gates, compound logic gates, universal logic gates; **Boolean Algebra:** Truth tables, canonical and standard forms of functions, logic operations; **Simplification of functions:** Karnaugh map, SOP and POS methods, don't care conditions, tabulation method; **Combinational logic:** Half and full adder and subtractor, binary parallel adder, BCD adder, encoder and decoder, multiplexer and demultiplexer, Boolean function implementation using decoder and multiplexer; design and implementation of logic circuits; **Sequential logic:** Latches, flip flops, flip flop timing consideration, flip flop excitation table; **Complex sequential logic:** Frequency division and counting, asynchronous ripple up and down counters, counters with any MOD numbers, asynchronous IC counters, propagation delay, parallel up and down counters, up/down counters, presentable counters, decoding a counter, cascading counters, shift counters; **Sequential circuits and registers:** State diagrams, state tables, state equations, flag registers, shift and parallel registers.

14. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Logic gates and Boolean Algebra	CLO 1
2	Combinational Logic Circuits, Digital Arithmetic: Operations and	CLO 2

	Circuits	
3	Flip Flops and their applications, Design the various Components of Computer	CLO 3
4	Synchronous sequential Circuits, Asynchronous sequential Circuits	CLO 4
5	Counters and Registers, MSI Logic Circuits	CLO 5

15. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Logic gates and Boolean Algebra		Week 1		Lecture	CLO 1
Combinational Logic Circuits		Week 2		Lecture	CLO 2
Digital Arithmetic: Operations and Circuits		Week 3		Lecture, Problem Solving	CLO 2
Flip Flops and their applications		Week 4 & 5		Lecture, Problem Solving	CLO 3
Counters and Registers		Week 6 & 7		Lecture, Group discussion	CLO 5
MID-TERM EXAMINATION					
Counters and Registers		Week 8		Lecture, Group discussion	CLO 5
MSI Logic Circuits		Week 9 & 10		Lecture, Group discussion	CLO 5
Synchronous sequential Circuits		Week 11 & 12		Lecture, Problem Solving	CLO 4
Asynchronous sequential Circuits		Week 13 & 14		Lecture, Group discussion	CLO 4
FINAL EXAMINATION					

16. Teaching-Learning Strategies:

17. Assessment Techniques of each topic of the course:

Part C – Assessment and Evaluation

18. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignment in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category Marks (out of 50)	**Tests (20)**	**Assignments (10)**
Remember		
Understand	5	
Apply	10	5
Analyze	5	5
Evaluate		
Create		

SMEB- Semester Mid & End Exanimation (50 Marks)

Bloom's Category	**Mid (20)**	**Final (50)**
Remember	5	
Understand	5	15
Apply	10	20
Analyze		
Evaluate		15
Create		

19. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Assessment 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

20. Text Book

Digital Systems: Principles and Applications – Ronald J. Tocci & Neal S. Widmer

Reference Books & Materials

Digital Logic and Computer Design – M. Morris Mano
Digital Fundamentals – Thomas L. Floyd

Course Outline – Digital Logic Design Lab

Part A – Introduction

1. **Course No. / Course Code** : CSE 210
2. **Course Title** : Digital Logic Design Lab
3. **Course Type** : Core Course
4. **Level/Term and Section** : 2nd Year 2nd Semester
5. **Academic Session** : Fall 2023
6. **Course Instructor** : Fabliha Haque
7. **Pre-requisite (If any)** : Nil
8. **Credit Value** : 1.50
9. **Contact Hours** : 3.00
10. **Total Marks** : 100

Course Objectives and Course Summary: The objectives of this course are to:

a) **Provide** knowledge and understanding on principles of digital logic operation and different types of logic gates.

b) **Introduce** the concept of different types of combinational logic, sequential circuits, registers and counters.
c) **Learn** the operation of different types of combinational logic, sequential circuits, registers and counters.
d) **Enable** the student to gain Application of different types of logic gates and flip flops.
e) **Emphasize** the Design and Implement of different types of combinational & sequential logic circuits and counters.

11. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Describe** the concept of digital logic operation and different types of logic gates.
CLO 2	**Recognize** the concept of different types of combinational logic, sequential circuits, registers and counters.
CLO 3	**Understand** the operation of different types of combinational logic, sequential circuits, registers and counters.
CLO 4	**Apply** different types of logic gates and flip flops.
CLO 5	**Design** different types of combinational & sequential logic circuits and counters.

12. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	1	1/Remember	Lecture, multimedia,	Written Examination, Assignment
CLO2	1	1/Analyze	Lecture, Group discussion	Quiz, Written Examination
CLO3	4	1/Understand	Lecture, Problem Solving, Group discussion	Quiz, Presentation, Viva, Written Examination
CLO4	5	1/Apply	Problem Solving	Quiz, Assignment, Written Examination
CLO5	5	1/Create	multimedia	Quiz, Written Examination

Part B – Content of the Course

13. Course Content:

Logic gates: Basic logic gates, compound logic gates, universal logic gates; **Boolean Algebra:** Truth tables, canonical and standard forms of functions, logic operations; **Simplification of functions:** Karnaugh map, SOP and POS methods, don‘t care conditions, tabulation method; **Combinational logic:** Half and full adder and subtractor, binary parallel adder, BCD adder, encoder and decoder, multiplexer and demultiplexer, Boolean function implementation using decoder and multiplexer; design and implementation of logic circuits; **Sequential logic:** Latches, flip flops, flip flop timing consideration, flip flop excitation table; **Complex sequential logic:** Frequency division and counting, asynchronous ripple up and down counters, counters with any MOD numbers, asynchronous IC counters, propagation delay, parallel up and down counters, up/down counters, presentable counters, decoding a counter, cascading counters, shift counters; **Sequential circuits and registers:** State diagrams, state tables, state equations, flag registers, shift and parallel registers.

14. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Logic gates and Boolean Algebra	CLO 1
2	Combinational Logic Circuits, Digital Arithmetic: Operations and Circuits	CLO 2
3	Flip Flops and their applications, Design the various Components of Computer	CLO 3
4	Synchronous sequential Circuits, Asynchronous sequential Circuits	CLO 4
5	Counters and Registers, MSI Logic Circuits	CLO 5

15. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Logic gates and Boolean Algebra		Week 1		Lecture	CLO 1
Combinational Logic Circuits		Week 2		Lecture	CLO 2
Digital Arithmetic: Operations and		Week 3		Lecture, Problem Solving	CLO 2

Circuits					
Flip Flops and their applications		Week 4 & 5		Lecture, Problem Solving	CLO 3
Counters and Registers		Week 6 & 7		Lecture, Group discussion	CLO 5
MID-TERM EXAMINATION					
Counters and Registers		Week 8		Lecture, Group discussion	CLO 5
MSI Logic Circuits		Week 9 & 10		Lecture, Group discussion	CLO 5
Synchronous sequential Circuits		Week 11 & 12		Lecture, Problem Solving	CLO 4
Asynchronous sequential Circuits		Week 13 & 14		Lecture, Group discussion	CLO 4
FINAL EXAMINATION					

16. Teaching-Learning Strategies:

17. Assessment Techniques of each topic of the course:

Part C – Assessment and Evaluation

18. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignment in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category Marks (out of 50)	Tests (20)	Assignments (10)
Remember		
Understand	**5**	
Apply	**10**	**5**
Analyze	**5**	**5**
Evaluate		
Create		

SMEB- Semester Mid & End Exanimation (50 Marks)

Bloom's Category	Mid (20)	Final (50)
Remember	5	
Understand	5	15
Apply	10	20
Analyze		
Evaluate		15
Create		

19. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Assessment 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

Text Book

Digital Systems: Principles and Applications – Ronald J. Tocci & Neal S. Widmer

Reference Books & Materials

Digital Logic and Computer Design – M. Morris Mano

Digital Fundamentals – Thomas L. Floyd

Course Outline – Database Systems

Part A – Introduction

1. **Course No. / Course Code** : CSE 211
2. **Course Title** : Database Systems
3. **Course Type** : Core Course

4. **Level/Term and Section** : 4^{th} Semester (2^{nd} Year/2^{nd} Semester)

5. **Academic Session** : Fall 2023

6. **Course Instructor** : Molla Rashied Hussein, and Nadeem Ahmed

7. **Pre-requisite (If any)** : N/A

8. **Credit Value** : 3.00

9. **Contact Hours** : 3.00

10. **Total Marks** : 100

11. **Course Objectives and Course Summary:**

The objectives of this course are to:

1. Provide knowledge and understanding on principles of database management system, database technology, and applications.
2. Introduce how to represent data in a database and how to manage for an organization.
3. Learn conceptual database modeling, professional relational database design, and database language (SQL).
4. Enable the student to acquire skills in solving business problem using the fundamentals of database modeling, enterprise analysis and design.
5. Emphasize on efficient database modeling, quality enhancement of database transaction, concurrency control and security.

Required course and a pre-requisite to System Analysis and Design, and Visual and Web Programming in the CSE program. This knowledge is very important for the field of software development.

12. **Course Learning Outcomes: at the end of the Course, the Student will be able to –**

CLO 1	Explain the objectives, concept, structure, storage, transaction management, administration, and related terms of DBMS.
CLO 2	Apply the database language (SQL, relational algebra) for querying the database.
CLO 3	Apply the principles of functional dependencies, normalization and indexing techniques to improve overall database design.
CLO 4	Analyze and model the database system design for corporate, industrial and business process.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	1	1/Understand	Lecture, Multimedia	Quiz, Written exam
CLO2	2	1/Apply	Lecture, Problem Solving	Written exam
CLO3	4	1/Apply	Lecture, Problem Solving	Written exam
CLO4	3	1/Analyze	Lecture Problem Solving	Quiz, Written exam

Part B – Content of the Course

14. Course Content:

Introduction: Purpose of DBMS, Uses of DBMS, Relational Model, Integrity Constraints: Primary Referential Integrity, Details of Structured Query Language (SQL) and DBMS tools, Database design approach, Concepts of Entity, Entity-Relationship Model, Relational Database Design, Design Anomaly, Application of Normalization, Functional Dependency, Storage and File Structure: Database Backup and Recovery in Disaster, Indexing and Hashing, RAID Architecture: Different types of RAID, Database Transaction Management, ACID properties.

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	The Need for Databases, Data Models, Concepts of Storage Manager, Query Processing, Transaction Manager, Instance, Schema, Concept of Keys, Database administration, Roles, Authorization, Overview of Physical Storage Media, File Organization, RAID, Transaction Management, ACID properties	CLO1
2	Relational Query Languages, Relational Algebra Operators, Query Languages (SQL), Intermediate SQL, View	CLO2
3	Database normalization and its Objectives, Indexing and Hashing	CLO3

4	Design Process, E-R Diagram Design Issues, Weak Entity Sets, Extended E-R Features, Design of the Bank Database, Reduction to Relation Schemas	CLO4

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
The Need for Databases, Data Models, Concepts of Storage Manager, Query Processing Transaction Manager	Explain the objectives, concept, structure, storage, transaction management, and related terms of DBMS.	Week 1-2	Lecture, multimedia	Lecture, multimedia	CLO1
Instance, Schema, Concept of Keys		Week 2			
Relational Query Languages, Relational Algebra Operators	Apply the database language (SQL, relational algebra) for querying the database.	Week 3-4	Lecture, multimedia	Lecture, multimedia	CLO2
Query Languages (SQL)		Week 5-6	Lecture, Coding, Group Project	Lecture, Coding, Group Project	
Intermediate SQL, View		Week 7	Lecture, multimedia	Lecture, multimedia	
MID-TERM EXAMINATION					
Database administration, Roles, Authorization	Explain the administration, and related terms of DBMS.	Week 8	Lecture, multimedia	Lecture, multimedia	CLO1
Design Process, E-R Diagram, Design Issues, Weak Entity Sets, Extended E-R Features, Design of the Bank Database, Reduction to Relation Schemas	Analyze and model the database system design for corporate, industrial and business process.	Week 9-10	Lecture, multimedia	Lecture, multimedia	CLO4
Database normalization and	Apply the principles of	Week 11	Lecture, multimedia	Lecture, multimedia	CLO3

its Objectives	functional dependencies, normalization and indexing techniques to improve overall database design.				
Indexing and Hashing		Week 12			
Overview of Physical Storage Media, File Organization, RAID, Transaction Management, ACID properties	Explain the administration, and related terms of DBMS.	Week 13-14	Lecture, multimedia	Lecture, multimedia	CLO1
FINAL EXAMINATION					

17. Teaching-Learning Strategies:

Active Learning: Encourage students to actively participate in the course material through rigorous problem-solving, fruitful discussions, and engaging group activities.

18. Assessment Techniques of each topic of the course:

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category **Marks (out of 30)**	**Class Tests (30)**
Remember	
Understand	10
Apply	10
Analyze	10
Evaluate	
Create	

SMEB- Semester Mid & End Exanimation (70 Marks)

Bloom's Category	**Mid**	**Final**
Remember		
Understand	5	10
Apply	15	30
Analyze		10
Evaluate		
Create		

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Database System Concept (7th Edition), - Silberschatz, Korth, Sudarshan.

Reference Books & Materials

2. Database Management System (4th Ed.) – R. Ramakrishna, J. Gehrke

Course Outline – Database Systems Lab

Part A – Introduction

1.	**Course No. / Course Code**	**:** CSE 212
2.	**Course Title**	**:** Database Systems Lab
3.	**Course Type**	**:** Core Course
4.	**Level/Term and Section**	**:** 4th Semester (2nd Year/2nd Semester)
5.	**Academic Session**	**:** Fall 2023
6.	**Course Instructor**	**:** Molla Rashied Hussein, Nadeem Ahmed, and Fabliha Haque
7.	**Pre-requisite (If any)**	**:** N/A
8.	**Credit Value**	**:** 1.50
9.	**Contact Hours**	**:** 3.00
10.	**Total Marks**	**:** 100

11. **Course Objectives and Course Summary:**

The objectives of this course are to:

1. Summarize the basic concepts, applications, data models, schemas, and instances of database.
2. Demonstrate the use of different constraints, DDL and DML operations.
3. Solve the basics of SQL and construct queries using SQL.
4. Analyze the normalization process in the database model.
5. Create expertise in Database design

The course focuses on the principles of development of a database in a real-life scenario. Therefore, this lab emphasizes on the database design, model, which the students will be learning lab by lab.

12. **Course Learning Outcomes: at the end of the Course, the Student will be able to –**

CLO1	Use a modern/popular IDE (database software/tool) to manage database systems.
CLO2	Construct standard queries using Structured Query Languages (SQL) to store, retrieve and manipulate data.
CLO3	Design a database system for a complex engineering problem.
CLO4	Identify the relationship sets from the problem specification to model the E-R diagram.
CLO5	Implement an executable solution for the proposed database system. Verify and validate the solution by Project description, Entity Relationship model, backend database design, and Query implementation.
CLO6	Assess societal, health, safety, legal and cultural issues related to the project.

CLO7	Recognize ethical and professional responsibilities in engineering situations.
CLO8	Work effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
CLO9	Communicate effectively through presentation and write effective reports and documentation on the project.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	**Corresponding PLOs (Appendix-1)**	**Bloom's taxonomy domain/level (Appendix-2)**	**Delivery methods and activities**	**Assessment Tools**
CLO1	5	1/Apply	Lecture, Problem Solving	Lab Task (1)[1], Lab Exam with Viva (2)[1]
CLO2	2	1/Apply	Lecture, Problem Solving	Lab Task (1)[2], Lab Exam with Viva (2)[2]
CLO3	1	1/Create	Lecture	Report (4)[1], Project Viva (5)[1]
CLO4	2	1/Analyze	Lecture	Report (4)[2] +Project idea Presentation (3)[1]
CLO5	3	1/Analyze	Lecture, Practice	Continuous Project Evaluation project demonstration (6)[1], Presentation (3)[2], Report (4)[3]
CLO6	6	1/Understand	Lecture	Report (4)[4]
CLO7	8	3/Valuing	Lecture	Project Viva (5)[2]
CLO8	9	3/Characterizing	Lecture	Continuous Project Evaluation (6)[2], Project Viva (5)[3]
CLO9	10	1/Apply	Lecture	Report (4)[5], Project Viva (5)[4]

<u>Part B – Content of the Course</u>

14. Course Content:

Basic concept of SQL server and relational database and SQL Server connection establishment. Create Database and backup of database. Understanding the basic concept of creating tables on SQL server and how to create tables from schema diagrams. Understanding the data types and basic syntax of inserting data into the database. Understanding the basic syntax of database query and applying it on the created database.

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Basic concept of SQL server and relational database and SQL Server connection establishment. Understanding the basic concept of creating tables on SQL server and how to create tables from schema diagrams. Understanding the data types and basic syntax of inserting data into the database.	CLO1
2	Create Database and backup of database. Understanding the basic syntax of database query and applying it on the created database.	CLO2

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	**Specific Outcome(s)**	**Time Frame**	**Suggested Activities**	**Teaching Strategy(s)**	**Alignment with CLO**
Basic concept of SQL server and relational database and SQL Server connection establishment.	Use a modern/popular IDE (database software/tool) to manage database systems.	1	Lectures, Individual Tasks	Lectures, Individual Tasks	CLO1, CLO2
Database create and create the backup of database.		2	Lectures, Individual Tasks	Lectures, Individual Tasks	CLO1, CLO2
Understanding the basic concept of creating tables on SQL server and how to create tables from schema diagrams.	Construct standard queries using Structured Query Languages (SQL) to store, retrieve and manipulate data.	3	Lectures, Individual Tasks	Lectures, Individual Tasks	CLO1, CLO2
Understanding the data types and basic syntax of inserting data into the database.		4	Lecture, Individual Tasks	Lecture, Individual Tasks	CLO1, CLO2
Understanding the basic syntax of database query and applying it on the created database.		5	Lecture, Individual Tasks	Lecture, Individual Tasks	CLO1, CLO2
Understanding the basic syntax of database query and applying it on the		6	Lecture, Individual Tasks	Lecture, Individual Tasks	CLO1, CLO2

created database.					
Understanding the basic syntax of database query and applying it on the created database.		7	Lecture, Individual Tasks	Lecture, Individual Tasks	CLO1, CLO2
Project Group Formation ()	Implement an executable solution for the proposed database system. Verify and validate the solution by Project description, Entity Relationship model, backend database design, and Query implementation.	8	Lectures, Group Tasks	Lectures, Group Tasks	CLO8
Project Proposal: Define project objectives and scope, identify key stakeholders, conduct a quick analysis of high-level requirements.		9	Lectures, Group Tasks	Lectures, Group Tasks	CLO6
Refine project requirements, develop a preliminary database schema, identify major entities and relationships. Ensure Database Design Principles, Normalization, and Entity-Relationship (ER) Modeling.		10	Demonstration Group Tasks	Demonstration Group Tasks	CLO3, CLO4
Complete database schema design. Review design with stakeholders for quick feedback, set up the initial database environment. Implementation of Database Solutions, Backend Design, and Data Validation (**Project Update – 01)**		11	Demonstration Group Tasks	Demonstration Group Tasks	CLO3, CLO4
Project Update - 02		12	Demonstration	Demonstration	CLO8
Project Update - 03		13	Demonstration, Group Tasks	Demonstration, Group Tasks	CLO5, CLO8

Final Project Demonstration, Report submission and Viva	Work effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.	14	Demonstration, Viva Group Tasks	Demonstration, Viva Group Tasks	CLO1-3, CLO5-9
	Communicate effectively through presentation and write effective reports and documentation on the project.				

17. Teaching-Learning Strategies:

Active Learning: Encourage students to actively participate in the course material through rigorous problem-solving, fruitful discussions, and engaging group activities.

18. Assessment Techniques of each topic of the course:

Part C – Assessment and Evaluation

19. Assessment Strategy

Lab Tasks, Lab Exam, Project (Continuous Evaluation, Presentation, Report, and Viva)

Lab Tasks and Lab Exam (40 Marks)

Bloom's Category Marks (out of 40)	Lab Tasks (10)	Lab Exam (30)
Remember		
Understand		
Apply	10	20
Analyze		
Evaluate		
Create		

Project (60 Marks)

Bloom's Category	Continuous Evaluation	Presentation	Report	Viva
Remember				
Understand			3	
Apply			3	3
Analyze	8	3	18	
Evaluate				
Create		3	6	3
Valuing				3
Characterizing	4			3

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Lab Tasks and Lab Exam 40%
2. Project 60%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Database System Concept (7th Edition), - Silberschatz, Korth, Sudarshan.

Reference Books & Materials

2. Database Management System (4th Ed.) – R. Ramakrishna, J. Gehrke

Course Outline – Probability and Statistics

Part A – Introduction

1.	**Course No. / Course Code**	**:** MTH 203
2.	**Course Title**	**:** Probability and Statistics
3.	**Course Type**	**:** Theory
4.	**Level/Term and Section**	**:** second year second semester
5.	**Academic Session**	**:** Fall 2023
6.	**Course Instructor**	**:**
7.	**Pre-requisite (If any)**	**:**
8.	**Credit Value**	: 3
9.	**Contact Hours**	: 3
10.	**Total Marks**	:100

Course Objectives and Course Summary: Probability and Statistics deals with predicting the likelihood of future events, while statistics involves the analysis of the frequency of past events. Probability is primarily a theoretical branch of mathematics, which studies the consequences of mathematical definitions.

11. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Understand** the concepts of different types probability, and population
CLO 2	**Explain** the concepts of random variables and distributions
CLO 3	**Analyze** theorems about the concept of probability and Distribution.
CLO 4	**Evaluate** the Probabilities using Conditional Probability and Bayes Theorem
CLO 5	**Solve** the engineering problems with various distributions using engineering tools.

12. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	PLO1	**Understand**	Lecture, Problem Solving, Group discussion	Written Examination
CLO2	PLO1	**Explain**	Lecture, Problem Solving, Group discussion	Quiz,Written Examination
CLO3	PLO1	**Analyze**	Lecture, Problem Solving, Group discussion	Quiz,Written Examination
CLO4	PLO2	**Evaluate**	Lecture, Problem Solving, Group discussion	Quiz,Written Examination
CLO5	PLO2	**Solve**	Lecture, Problem Solving, Group discussion	Quiz,Written Examination, Assignment

Part B – Content of the Course

14. Course Content:

Statistics: Types and Sources of Data, Descriptive and Inferential Statistics, Uses and Abuses of Statistics, **Presentation of Data and Exploratory Data Analysis Tools:** Stem and Leaf plots, Frequency Tables, Histograms, Skewness and Modes, Percentiles and Quartiles, Estimating Percentiles from Histograms, Extremes and Median, Hinges, Outliers and Box-and-Whisker plots **Characteristics of Data:** Measures of location - Mean, Median, Mode; Measures of Spread/Scale: Spread and Variability, Range, Standard Deviation; Measures of Location and Spread under Affine Transformations; Robust Measures of Location: Trimmed Mean, Winsorized Mean; Robust Measures of Spread: Interquartile Range, Median Absolute Deviation; **Multivariate Data:** Scatter Plots and Scatterplot Matrices, Describing Scatterplots: Linearity and Nonlinearity, Homoscedasticity and Heteroscedasticity, Outliers, **Correlation and Association:** Correlation and Causality, Correlation Coefficient, the Effect of Nonlinear Association, Homoscedasticity and Heteroscedasticity, and Outliers on the Correlation Coefficient; Rank Correlation, Experiments, **Probability Distribution:** Distribution Function, Expectation, Variance, Moments and Moment Generating Functions, Transformation of Variable, Bayes' theorem **Discrete Distributions** - Bernoulli, Binomial, Geometric, Multinomial, Hypergeometric, and Poisson **Continuous Distributions** - Uniform, Gamma, Exponential, and Beta.Special Continuous Distributions - Normal Distribution and its properties Q-Q plots and the Normal Probability Plot.

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	**Understand** the concepts of different types probability, and population	**CLO1**
2	**Explain** the concepts of random variables and distributions	**CLO2**
3	**Analyze** theorems about the concept of probability and Distribution.	**CLO3**
4	**Evaluate** the Probabilities using Conditional Probability and Bayes Theorem	**CLO4**
5	**Solve** the engineering problems with various distributions using engineering tools.	**CLO5**

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Statistics: Types and Sources of Data, Descriptive and Inferential Statistics, Uses and Abuses of Statistics		Week 1		Multimedia or lecture	CLO1
Presentation of Data and Exploratory Data Analysis Tools: Stem and Leaf plots, Frequency Tables, Histograms, Skewness and Modes		Week 2		Multimedia or lecture	CLO1
Percentiles and Quartiles, Estimating Percentiles from Histograms		Week 3		Multimedia or lecture	CLO1
Extremes and Median, Hinges, Outliers and Box-and-Whisker plots		Week 4		Multimedia or lecture	CLO2
Characteristics of Data: Measures of location - Mean, Median, Mode		Week 5		Multimedia or lecture	CLO2
Characteristics of Data: Measures of location - Mean, Median, Mode		Week 6		Multimedia or lecture	CLO2
Rivision		Week 7		Multimedia or lecture	
MID-TERM EXAMINATION					
Measures of Spread/Scale: Spread and Variability, Range, Standard Deviation		Week 8		Multimedia or lecture	CLO3
Measures of Location and Spread under Affine Transformations		Week 9		Multimedia or lecture	CLO3
Robust Measures of Location: Trimmed Mean, Winsorized Mean; Robust Measures of Spread: Interquartile Range, Median Absolute Deviation		Week 10		Multimedia or lecture	CLO3
Multivariate Data: Scatter Plots and Scatterplot Matrices, Describing Scatterplots: Linearity and Nonlinearity, Homoscedasticity and Heteroscedasticity, Outliers		Week 11		Multimedia or lecture	CLO3
Correlation and Association: Correlation and Causality, Correlation Coefficient, the Effect		Week 12		Multimedia or lecture	CLO3

of Nonlinear Association, Homoscedasticity and Heteroscedasticity, and Outliers on the Correlation Coefficient; Rank Correlation, Experiments					
Probability Distribution: Distribution Function, Expectation, Variance, Moments and Moment Generating Functions, Transformation of Variable, Bayes' theorem		Week 13		Multimedia or lecture	CLO4
Discrete Distributions - Bernoulli, Binomial, Geometric, Multinomial, Hypergeometric, and Poisson Continuous Distributions - Uniform, Gamma, Exponential, and Beta. Special Continuous Distributions - Normal Distribution and its properties Q-Q plots and the Normal Probability Plot.		Week 14		Multimedia or lecture	CLO5
FINAL EXAMINATION					

17. Teaching-Learning Strategies:

18. Assessment Techniques of each topic of the course:

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignment in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 30)	Tests (15)	Assignments (5)	Quizzes (5)	External Participation in Curricular / Co-Curricular Activities (5)
Remember	1			
Understand	3			5
Apply	3	5		

Analyze	3		5	
Evaluate	2			
Create	3			

SMEB- Semester Mid & End Exanimation (70 Marks)

Bloom's Category	Test
Remember	5
Understand	10
Apply	20
Analyze	20
Evaluate	15
Create	

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Walpole and Mayers, Probability and Statistics for Engineering and Scientists, Pearson.
2. R.V. Hogg and E. Tanis, Probability and Statistical Inference, Pearson.

Reference Books & Materials

1. W. Mendenhall, Statistics for Engineering and the Sciences, Pearson.

Course Outline – Engineering Economics

Part A – Introduction

1.	**Course No. / Course Code**	**:** ECN 201
2.	**Course Title**	**:** Engineering Economics
3.	**Course Type**	**:**
4.	**Level/Term and Section**	**:** 2nd Year 2nd Semester
5.	**Academic Session**	**:** Fall 2023
6.	**Course Instructor**	**:**
7.	**Pre-requisite (If any)**	**:**
8.	**Credit Value**	**:** 3.0
9.	**Contact Hours**	**:** 3.0
10.	**Total Marks**	**:** 100

11. Course Objectives and Course Summary:

The main objective of this course is to understand the fundamental process of Demand-supply chain, Elasticity, Indifference Curve, Marginal analysis, Market, Production, Cost, Savings, Investment, Monetary policy, Fiscal policy, Trade policy.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	to explain the importance of Engineering Economics for Computer Engineers and to perform economic analysis of different Computer Engineering projects.
CLO 2	to value economic analysis of different Computer Engineering projects.
CLO 3	to discuss and interpret Computer Engineering related demand and supply in the context of Economics.
CLO 4	to perform economic analysis for different engineering project using modern tools

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	a	1/Understand	Lecture, multimedia, Problem Solving	Written Examination, Assignment
CLO2	a	1/Understand	Lecture, multimedia, Problem Solving	Written Examination, Assignment
CLO3	a	1/Understand	Lecture, multimedia, Problem Solving	Written Examination, Assignment
CLO4	b	1/Apply	Lecture, multimedia, Problem Solving	Written Examination, Assignment

Part B – Content of the Course

14. Course Content:

Micro: Scope of economics, Basic concept and tools used in economics, Economic problems-scarcity and resources. **Demand, Supply and Market:** Concept of demand, supply and equilibrium, Determinants of demand and supply, Shifting of demand and supply curves, Applications of demand and supply, Elasticity of demand and supply. **Theory of Consumer Behavior:** Concepts of utility, Paradox of value, Law of diminishing marginal utility, Indifference curve, Budget constraint, Consumer 's equilibrium. **Theory of Firm:** Production function, Law of diminishing return, Stages of production, Law of variable proportion, short run and long run production and costs. **Market:** Taxonomy of markets, Characteristics of different types of markets. **Macro: Money and Banking:** Definition and functions of money, Different kinds of money, commercial bank and the money stocks, Functions of central bank, Money supply. **Inflation and Unemployment:** Types and costs of inflation and unemployment.

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1		
2		
3		

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
		Week 1			
		Week 2			
		Week 3			
		Week 4			
		Week 5			
		Week 6			
		Week 7			
MID-TERM EXAMINATION					
		Week 8			
		Week 9			
		Week 10			
		Week 11			
		Week 12			
		Week 13			
		Week 14			
FINAL EXAMINATION					

17. Teaching-Learning Strategies:

18. Assessment Techniques of each topic of the course:

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignment in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category Marks (out of 50)	Tests (25)	Assignments (10)	Quizzes (5)	External Participation in Curricular/Co-Curricular Activities (10)
Remember				
Understand				
Apply				
Analyze				
Evaluate				
Create				

SMEB- Semester Mid & End Exanimation (50 Marks)

Bloom's Category	**Mid**	**Final**
Remember		
Understand		
Apply		
Analyze		
Evaluate		
Create		

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Roger A. Arnold: Economics. West publishing company, 2018

Reference Books & Materials

1. P.A. Samuelson and WD. Nordhaus: Economics, McGraw-Hill, latest edition

Third Year First Semester

Course Outline – Object Oriented Programming II and Web Programming

Part A – Introduction

1.	**Course No. / Course Code**	**:** CSE 301
2.	**Course Title**	**:** Object Oriented Programming II and Web Programming
3.	**Course Type**	**:** Core Course
4.	**Level/Term and Section**	**:** 2nd year 2nd semester
5.	**Academic Session**	**:** Fall 2023
6.	**Course Instructor**	**:** Durjoy Mistry
7.	**Prerequisite (If any)**	**:** CSE 201, CSE 211
8.	**Credit Value**	**:** 3.00
9.	**Contact Hours**	**:** 3.00
10.	**Total Marks**	**:** 100

11. Course Objectives and Course Summary:

The Object-Oriented Programming II Visual and Web Programming course incorporates the Django framework to enhance students' understanding and proficiency in web development. By leveraging Django, students gain hands-on experience in building robust and scalable web applications, reinforcing their ability to apply advanced OOP principles within the context of web programming. This course sets the stage for students to excel in roles related to Django web development and equips them for diverse opportunities in the field of visual and web programming.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Understand** basic programing concept in python
CLO 2	**Apply** advanced concepts of object-oriented programming in python to solve practical problems.
CLO 3	**Analyze** the concept of web development with Django framework
CLO 4	**Create** real-life problem solutions with the knowledge of web framework Django.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	**Corresponding PLOs (Appendix-1)**	**Bloom's taxonomy domain/level (Appendix-2)**	**Delivery methods and activities**	**Assessment Tools**
CLO1	1	1/Understand	Lecture, Multimedia	Quiz, Assignment, Written Examination
CLO2	2	1/Apply	Lecture, Multimedia	Quiz, Viva, Assignment, Written Examination
CLO3	5	1/Analyze	Lecture,	Quiz, Assignment,

			Multimedia	Written Examination
CLO4	3	1/ Create	Lecture, Multimedia, Illustrations	Quiz, Assignment, Written Examination

Part B – Content of the Course

14. Course Content:

Introduction: The Object-Oriented Programming II Visual and Web Programming with Django course offers an in-depth exploration of advanced OOP principles in the context of web development, focusing on practical application. Students delve into sophisticated concepts like **inheritance, polymorphism, encapsulation, and abstraction**, learning to apply them effectively within the **Django framework**. This comprehensive program not only covers Django's models and databases for creating robust applications but also emphasizes web development fundamentals such as **HTML, CSS, etc**. With hands-on projects and collaborative development using tools like **Git,** students gain practical experience and are equipped with the skills needed for careers in web development and software engineering. By the course's end, students emerge with a solid understanding of advanced OOP principles and the ability to develop dynamic web applications using Django, positioning them for success in the dynamic and ever-evolving field of visual and web programming.

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Python Basics	CLO 1
2	Advanced OOP in Python	CLO 2
3	Introduction to Django and Web Development	CLO 3
4	Project-based Learning with Django	CLO 4

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	**Specific Outcome(s)**	**Time Frame**	**Suggested Activities**	**Teaching Strategy(s)**	**Alignment with CLO**
Introduction to Python Basics	Understand fundamental Python concepts and syntax	Week 1-2	Coding exercises to practice using different data types and writing functions.	Lectures on Python basics with live coding demonstrations.	CLO 1
Control Flow and File I/O	Mastery of control flow concepts and file handling techniques	Week 3-4	Write programs using if-else statements, create Python scripts to read from and write to files.	Interactive sessions to explain control flow and file I/O concepts, followed by hands-on coding exercises.	CLO 1

Object-Oriented Programming (OOP) in Python	Understanding of OOP principles and their implementation	Week 5-6	Design and implement classes representing real-world entities, practice inheritance and polymorphism.	In-depth lectures on OOP concepts, followed by group discussions and code reviews.	CLO 2
HTML, CSS, and Python Modules	Proficiency in creating static web pages and utilizing modules	Week 7	Create simple web pages using HTML and CSS, explore Python modules and import them into scripts.	Hands-on workshops on HTML/CSS coding and Python module usage, with guided exercises.	CLO 3
Mid Semester Examination					
Django Fundamentals and Midterm Review	Understanding of Django fundamentals and preparation for midterm	Week 8-9	Set up a basic Django project, create models and views, review past topics for midterm.	Lectures on Django architecture and components, guided practice sessions for setting up Django projects.	CLO 3
Django Forms, Media, and Multiple Apps	Proficiency in implementing forms, managing media files	Week 10-12	Design and implement Django forms for various purposes, integrate media file handling into Django applications.	Practical sessions on Django forms and media handling, group projects to create multiple Django apps.	CLO 3
Advanced Django Concepts and Final Review	Mastery of advanced Django features and readiness for final assessment	Week 13-14	Implement context processors, add search functionality to Django projects, apply filters to data queries.	In-depth discussions on advanced Django topics, review sessions to consolidate learning and prepare for final assessment.	CLO 4
Final Examination					

17. Teaching-Learning Strategies:

Strategies	**Topics**
Active Learning, Coding and Discussions	Introduction to Python Basics
Problem-Based Learning	Advanced Object-Oriented Programming (OOP) in Python
Project-Based Learning	Introduction to Django and Web Development

	Fundamentals
Collaborative project work, mentorship	Project-based Learning with Django

18. Assessment Techniques of each topic of the course:

Assessment Type	**% weight**	**CO 1**	**CO 2**	**CO 3**	**CO 4**
Final Exam	50%	5	20	5	20
Mid Term Exam	20%	2	10	3	5
Class performance (Class Test, Assignment, Problem solving session)	30%	3	15	2	10
Total	**100%**	**10**	**45**	**10**	**35**

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests will be taken during the semester, 2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests on the same CLO, best 1 class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignments in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment.

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category	**Class Tests (30)**
Remember	
Understand	10
Apply	10
Analyze	10
Evaluate	
Create	

SMEB- Semester Mid & End Examination (70 Marks)

Bloom's Category	**Mid (20)**	**Final (50)**
Remember	2	5
Understand		
Apply	10	20

Analyze	3	5
Evaluate		
Create	5	20

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual students will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

a. **Django 4 By Example**

by Melé, A. (2022). Django 4 by Example. Packt Publishing.

Course Outline – Object Oriented Programming II and Web Programming Lab

Part A – Introduction

1. **Course No. / Course Code** : CSE 302
2. **Course Title** : Object Oriented Programming II and Web Programming Lab
3. **Course Type** : Core Course
4. **Level/Term and Section** : 2nd year 2nd semester
5. **Academic Session** : Fall 2023
6. **Course Instructor** : Durjoy Mistry
7. **Prerequisite (If any)** : Nill
8. **Credit Value** : 1.50
9. **Contact Hours** : 3.00
10. **Total Marks** : 100

11. **Course Objectives and Course Summary:**

The Object-Oriented Programming II Visual and Web Programming lab integrates the Django framework to enrich students' comprehension and skills in web development. Through Django, students engage in practical exercises to construct resilient and scalable web applications, strengthening their capacity to implement advanced OOP principles in web programming scenarios. This lab provides students with a foundation to excel in Django web development roles and prepares them for varied opportunities in visual and web programming domains.

12. **Course Learning Outcomes: at the end of the Course, the Student will be able to –**

CLO 1	**Understand** basic programing concept in python
CLO 2	**Apply** advanced concepts of object-oriented programming in python to solve practical problems.
CLO 3	**Analyze** the concept of web development with Django framework
CLO 4	**Create** real-life problem solutions with the knowledge of web framework Django.

13. **Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):**

CLO No.	**Corresponding PLOs (Appendix-1)**	**Bloom's taxonomy domain/level (Appendix-2)**	**Delivery methods and activities**	**Assessment Tools**
CLO1	1	1/Understand	Lecture, Multimedia	Quiz, Assignment, Written Examination
CLO2	2	1/Apply	Lecture, Multimedia	Quiz, Viva, Assignment, Written Examination
CLO3	5	1/Analyze	Lecture, Multimedia	Quiz, Assignment, Written Examination
CLO4	3	1/ Create	Lecture, Multimedia, Illustrations	Quiz, Assignment, Written Examination

Part B – Content of the Course

14. **Course Content:**

Introduction: The Object-Oriented Programming II Visual and Web Programming Lab provides an immersive journey into the intricacies of advanced OOP principles within web development, with a strong emphasis on hands-on application. Students delve into complex concepts such as inheritance, polymorphism, encapsulation, and abstraction, mastering their practical implementation within the Django framework. This lab curriculum extensively covers Django's models and databases, empowering students to construct resilient applications, while also reinforcing essential web development skills including HTML, CSS, and more. Through collaborative projects and utilization of tools like Git, students gain invaluable practical experience, honing their abilities for careers in web development and software engineering. By the conclusion of the lab, students emerge with a firm grasp of advanced OOP principles and the capability to develop dynamic web applications using Django, preparing them for success in the ever-evolving landscape of visual and web programming.

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Python Basics	CLO 1
2	Advanced OOP in Python	CLO 2
3	Introduction to Django and Web Development	CLO 3
4	Project-based Learning with Django	CLO 4

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Week	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Introduction to Python & Github Setup	- Set up Github Account	Week 1	- Solve 50 Python Problems	- Interactive coding sessions, Demonstration of Github usage	CLO 1,2
HTML, CSS Basics & Portfolio Development	- Create a Basic Portfolio Website, Present Portfolio	Week 2	- Practice HTML & CSS Basics, Peer Review & Feedback	- Hands-on Portfolio Development	CLO 2
Understanding Github & Requirement Analysis	- Analyze Project Requirements	Week 3	- Conduct Mock Requirement Analysis, Group Discussions	- Viewing instructional videos, Q&A sessions with instructor	CLO 2
Django Setup & Basics of URLs and Views	- Set up Django Framework, Portfolio Presentation	Week 4	- Create URLs and Views in Django, Peer Review	- Hands-on coding exercises, Project updates	CLO 2
Project Proposal Presentation	- Present Project Proposals, Collaboration & Teamwork	Week 5	- Formal Presentation of Proposals, Facilitated Discussion	- Peer Evaluation and Feedback	CLO 3
Django	- Understand	Week	- Implement	- Hands-on	CLO 3

Administration & CRUD Operations	Django Admin & CRUD Operations	6	Models and CRUD in Django Admin, Peer Review	coding exercises, One-on-one mentoring	
Django Forms & CRUD Operations	- Proficiency in Forms and CRUD Operations	Week 7	- Create CRUD Views in Django, Guided Practice Sessions	- Interactive Sessions, Guided Practice	CLO 3
Django Integration with Bootstrap	- Integrate Bootstrap with Django, Project Update	Week 8	- Implement Login/Signup Functionality, Peer Review	- Hands-on Coding, Peer Review	CLO 3
Lab Mid	- Implement View CRUD Operations for a Specific App	Week 9	- Complete View CRUD Operations, Mentor Sessions	- One-on-one mentoring, Hands-on coding	CLO 3
Handling Media in Django	- Media Handling in Django	Week 10	- Implement Media Handling Features, Hands-on Practice	- Hands-on Coding Exercises, Group Discussions	CLO 3
Connecting Models and Apps in Django	- Integration of Multiple Models and Apps	Week 11	- Integrate Models and Apps in Django, Project Update	- Hands-on Coding, Project Updates	CLO 3
Django Filters & Search	- Implementation of Filters and Search Functionality	Week 12	- Add Filters and Search Functionality in Django	- Hands-on Coding Exercises, Guided Practice Sessions	CLO 3
Project Update	- Last minute changes if needed	Week 13	- Give Project update	- Feedback	CLO 3
Final Project Presentation & Demonstration	- Formal Presentation of Final Projects, Peer Evaluation	Week 14	- Present Final Projects, Peer Evaluation & Feedback	- Peer Review, Formal Presentation	CLO 4

17. Teaching-Learning Strategies:

Strategies	**Topics**
Active Learning, Coding and Discussions	Introduction to Python Basics

Active Learning	HTML, CSS and Portfolio
Project-Based Learning	Introduction to Django and Web Development Fundamentals
Collaborative project work, mentorship	Project-based Learning with Django

18. Assessment Techniques of each topic of the course:

Assessment Type	% weight	CO1	CO2	CO3	CO4
Final Project Demonstration and Documentation	60%	5	5	10	40
Mid Term Exam	20%	2	10	3	5
Class performance (Assignment, Problem solving session)	30%	3	15	2	10
Total	**100%**	**10**	**45**	**10**	**35**

Part C – Assessment and Evaluation

19. Evaluation Policy:

a. **Final Project Demonstration and Documentation: 60%**
   i. The final project will contribute to 60% of the total grade.
   ii. This assessment will include both the demonstration of the final project and the submission of comprehensive documentation.

b. **Midterm Exam: 20%**
   i. A midterm exam will be conducted, contributing 20% to the overall grade.

c. **Class Performance (Assignments, Problem Solving Sessions): 30%**
   i. Class performance, including assignments and participation in problem-solving sessions, will constitute 30% of the total grade.
   ii. Assignments will be given in groups of up to 4 members, and timely submission is mandatory.
   iii. Students will need to present their assignments in class.

20. UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

a. Django 4 By Example

by Melé, A. (2022). Django 4 by Example. Packt Publishing.

Course Outline – Computer Architecture and Organization

Part A – Introduction

1.	**Course No. / Course Code**	**:** CSE 303
2.	**Course Title**	**:** Computer Architecture and Organization
3.	**Course Type**	**:** Core course
4.	**Level/Term and Section**	**:** 5th Semester (3rd Year/1st Semester)
5.	**Academic Session**	**:** Fall 2023
6.	**Course Instructor**	**:** Shammi Akhtar
7.	**Prerequisite (If any)**	**:** CSE 209
8.	**Credit Value**	**:** 3.0
9.	**Contact Hours**	**:** 3.0
10.	**Total Marks**	**:** 100

11. Course Objectives and Course Summary:

The objectives of this course are to:

1. **Explain** the layers of computer organization.
2. **Explain** terms related to computer organization.
3. **Introduce** with clock cycle, instruction cycle, performance, instruction format, addressing mode and instruction throughput of single-cycle, multi-cycle, and pipelined implementations of a simple
instruction set and pipeline hazard.
4. **Provide** the knowledge of computer hardware, memory hierarchy, cache configurations, identification, placement, replacement Strategy and Show how cache design parameters affect cache hit rate.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	Explain theory related to the layers of computer organization.
CLO 2	Apply concepts related to the organization of computers.
CLO 3	Analyze clock cycle, instruction cycle, performance, instruction format, addressing mode and instruction throughput of single-cycle, multi-cycle, and pipelined implementations of a simple instruction
CLO 4	Design computer hardware, memory hierarchy, cache configurations, identification, placement, replacement Strategy and Show how cache design parameters affect cache hit rate.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	**Corresponding PLOs (Appendix-1)**	**Bloom's taxonomy domain/level (Appendix-2)**	**Delivery methods and activities**	**Assessment Tools**
CLO1	1	1/Understand	Lecture, multimedia, Books	Mid and Final Exam
CLO2	2	1/Analyze	Lecture, multimedia, Books	Quiz(1,2,3), Assignment, Mid and Final Exam
CLO3	3	1/Apply	Lecture, multimedia, Books	Final Exam
CLO4	6	1/Understand	Lecture, multimedia, Books	Final ExamQuiz(4)

<u>Part B – Content of the Course</u>

14. Course Content:

Introduction: Computer Architecture and Organization. Instruction set architecture: Overview of MIPS, basic instruction, high level to MIPS conversion of instruction, MIPS control and data path design. Computer arithmetic and number system: Binary review; floating point number representation; basic addition and multiplication algorithm and hardware. Advanced computer arithmetic: Booth multiplication scheme, recoding process, best and worst multiplier, average gain. Computer system performance and performance matrices: Execution time, clock rate, processor speed, CPI-clock per instruction, mathematical problems. Memory and cache hierarchy: Primary memory, secondary memory, memory hierarchy, virtual memory, caching scheme: direct addressed caching, other policies, Control design: Processor control Unit design and data path analysis, Pipelining: Pipelined data path and control, super scalar and dynamic pipelining. I/O organization: Introduction, bus control, I/O systems, programmed IO, DMA and interrupts, I/O processors, multiprocessor system: UMA, NUMA etc.

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	explain and apply knowledge related to the layers of computer organization.	CLO1
2	Analyze clock cycle, instruction cycle, performance, instruction format, addressing mode and instruction throughput of single-cycle, multi-cycle, and pipelined implementations of a simple instruction.	CLO2
3	Design a computer, hardware, memory hierarchy, cache configurations, identification, placement, replacement Strategy and Show how cache design parameters affect cache hit rate.	CLO3
4.	implement computer hardware,	CLO4

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	**Specific Outcome(s)**	**Time Frame**	**Suggested Activities**	**Teaching Strategy(s)**	**Alignment with CLO**
Topic 1: Computer Abstraction and Technology Introduction to computer architecture, processor and memory technologies, performance and power wall, switching from uniprocessor to multiprocessor.	PO-a	Week 1 &2		Lecture, multimedia, Discussions	CLO1
Topic 2: Instructions:	PO-a, PO-f	Week 3		Lecture, multimedia,	CLO1,CO4

Language of the Computer Classifying instructions set architecture, types and size of operands, operations in the instruction set, Instruction for flow control, Instructions format, Addressing modes, MIPS Assembly Language.		to Week5		Web references,Discussions	
Topic 3: Arithmetic for Computers: Arithmetic Operations (Addition, Subtraction, Multiplication and Division), Floating Point Representation, Floating Point Operations (Addition and Multiplication).	PO-a, PO-k	Week 6 to Week7		Lecture, multimedia, Discussions	CLO1, CLO3
Topic 4 : CPU Organization and Design: Datapath, pipelining, pipelined datapath and control, instruction-level parallelism)	PO-a, PO-k	Week 9 to week10		Lecture, multimedia, Problem Solving	CLO1, CLO3
Topic 5: Cache Hierarchies Memory hierarchies, Cache policies, Memory system, RAMs, ROMs – Speed, size and cost	PO-b	Week11 to week14		Lecture, multimedia,Problem Solving, Problem Solving, Group discussion	CLO2

Performance consideration – Virtual **memory**					

17. Teaching-Learning Strategies:

Strategies	Topics
Active Learning and Discussions	Overview of Computer Architecture and Organization
Problem-Based Learning	Different Algorithms
Case-Based Learning	Architectural Design, cache memory ,pipeline strategies.

18. Assessment Techniques of each topic of the course:

SL. No	Topics / Content	Assessment Techniques
1	**Computer Abstraction and Technology** Introduction to computer architecture, processor and memory technologies, performance and power wall, switching from uniprocessor to multiprocessor.	Mid Term Exam
2	**Instructions:** Language of the Computer Classifying instructions set architecture, types and size of operands, operations in the instruction set, Instruction for flow control, Instruction's format, Addressing modes, MIPS Assembly Language.	Mid-Term Exam, Quiz-01
3	Arithmetic for Computers: Arithmetic Operations (Addition, Subtraction, Multiplication and Division), Floating Point Representation, Floating Point Operations (Addition and Multiplication)	Mid-Term Exam, Quiz-02, Final Exam
4.	CPU Organization and Design: Datapath, pipelining, pipelined datapath and control, instruction- level parallelism)	Quiz-03, Final Exam
5.	Cache Hierarchies Memory hierarchies	Quiz-04, Final Exam

<u>Part C – Assessment and Evaluation</u>

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester, 2 class tests will be taken for midterm and 2 class tests will be taken for final term. 3 out of 4 class tests will be considered. Best two from Quiz-1, Quiz-2 & Quiz-3, and Quiz-4 will be considered. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category	Marks (out of 30)
Remember	
Understand	10
Apply	
Analyze	20
Evaluate	
Create	

SMEB- Semester Mid & End Exanimation (70 Marks)

Bloom's Category	**Marks (out of 70)**
Remember	
Understand	30
Apply	10
Analyze	30
Evaluate	
Create	

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual students will be evaluated based on the following criteria with respective weights.

1. Assessment 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50

45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Computer Organization and Design: The Hardware/Software Interface -David A. Patterson, John L. Hennessy (5th Edition).
2. Computer Organization & Architecture-Designing for Performance -William Stallings (6th Edition, Pearson Education).

Course Outline – Systems Analysis and Design

Part A – Introduction

1.	**Course No. / Course Code**	**:** CSE 305
2.	**Course Title**	**:** Systems Analysis and Design
3.	**Course Type**	**:** Core Course
4.	**Level/Term and Section**	**:** 3rd year 1st semester
5.	**Academic Session**	**:** Fall 2023
6.	**Course Instructor**	**:** Dr. Shah Murtaza Rashid Al Masud Muhtasim Noor Alif
7.	**Prerequisite (If any)**	**:**
8.	**Credit Value**	**:** 3.00
9.	**Contact Hours:**	: 3.00
10.	**Total Marks**	**:** 100

11. Course Objectives and Course Summary:

The objectives of this course are to:
1. Understand the objective of Information system designing.
2. Explain the principles, methods and techniques of system development.
3. Analyze requirements, feasibility to develop a system.
4. Apply normalized concept to select the best methodology to develop a system
5. Create project proposals, behavioral diagrams, and structural diagrams.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Describe** the concepts of a system and different stages of system development life cycle
CLO 2	**Demonstrate** standard project planning and project management techniques to feasibility study about the system
CLO 3	**Explain** clear and concise system requirements and convert them into technical specifications
CLO 4	**Design** systems using different models and diagrams

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	1	2/Understand	Lecture, Example from Real Life Systems, Problem solving, Group discussion	Class Tests, Exams
CLO2	2	3/Apply	Lecture, Example from Real Life Systems, Problem solving, Group discussion	Class Tests, Exams
CLO3	3	4/Analyze	Lecture, Example from Real Life Systems, Problem solving, Group discussion	Class Tests, Exams
CLO4	3	6/Create	Lecture, Example from Real Life Systems, Problem solving, Group discussion	Class Tests, Exams

Part B – Content of the Course

14. Course Content:

- Introduction : Introduction to information system, System Analyst Responsibilities, Information Gathering
- System Development Life Cycle : System Development Life Cycle (SDLC) Models, SDLC phases description
- Understanding organizational Systems: Data Flow Diagram, E-R Diagram
- Managing the Information System Projects
- Determining and analyzing System Requirements
- Object oriented Systems analysis and design
- Use Case Diagram
- Activity Diagram
- Class Diagram
- Designing Databases
- Implementing and Maintaining the System, Systems Repository

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Introduction : Introduction to information system, System Analyst Responsibilities, Information Gathering	CLO1
2	System Development Life Cycle : System Development Life Cycle (SDLC) Models, SDLC phases description	CLO1
3	Understanding organizational Systems: Data Flow Diagram, E-R	CLO4

	Diagram	
4	Managing the Information System Projects	CLO2
5	Determining and analyzing System Requirements	CLO3
6	Object oriented Systems analysis and design, Use Case Diagram	CLO4
7	Activity Diagram	CLO4
8	Class Diagram	CLO4
9	Designing Databases	CLO4
10	Implementing and Maintaining the System, Systems Repository	CLO4

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Introduction to information system, System Development Life Cycle (SDLC)	PLO1	Week 1	Get an overview of information systems, SDLC	Lecture, multimedia, Discussions	CLO1
System Development Life Cycle(contd.), SDLC phases Description, System Analyst Responsibilities, Information Gathering	PLO1	Week 2	Learn different types of SDLCs through pros and cons analysis	Lecture, multimedia, Discussions	CLO1
Understanding Organizational Systems: Data Flow Diagram, E-R Diagram	PLO3	Week 3	Design diagrams based on some problem scenario	Lecture, multimedia, Discussions	CLO4
Class test	PLO3	Week 4	Design for a real life problem		CLO4
Managing the Information System Projects	PLO2	Week 5	Learn to estimate required time	Lecture, multimedia, Discussions	CLO2
Managing the Information System Projects	PLO2	Week 6	Learn to estimate required cost	Lecture, multimedia, Discussions	CLO2
Determining and analyzing System Requirements	PLO3	Week 7	Learn to identify the systems requirements	Lecture, multimedia, Discussions	CLO3
MID-TERM EXAMINATION					
Object oriented Systems analysis and design	PLO3	Week 8	Learn various concepts of OOAD	Lecture, multimedia, Discussions	CLO4
Use Case Diagram	PLO3	Week 9	Design diagrams based on some problem scenario	Lecture, multimedia, Discussions	CLO4

Activity Diagram	PLO3	Week 10	Design diagrams based on some problem scenario	Lecture, multimedia, Discussions	CLO4
Class Diagram	PLO3	Week 11	Design diagrams based on some problem scenario	Lecture, multimedia, Discussions	CLO4
Sequence Diagrams	PLO3	Week 12	Design diagrams based on some problem scenario	Lecture, multimedia, Discussions	CLO4
Implementing and Maintaining the System, Systems Repository	PLO3	Week 13	Learn about maintenance, repositories like Github	Lecture, multimedia, Discussions	CLO4
Review Class	PLO1, PLO2, PLO3	Week 14		Lecture, multimedia, Discussions	All CLOs
FINAL EXAMINATION					

17. Teaching-Learning Strategies:

Strategies	Topics
Active Learning and Discussions	SDLC, System Requirements, Project Scheduling, Implementing and Maintaining the System, Systems Repository
Problem-Based Learning	Project Scheduling, Feasibility Study
Case-Based Learning	ER Diagram, Data Flow Diagram, Use Case Diagram, Class Diagram, Activity Diagram, Sequence Diagram
Simulations and Role-Playing	Implementing and Maintaining the System, Systems Repository

18. Assessment Techniques of each topic of the course:

SL. No	Topics / Content	Assessment Techniques
1	SDLC, System Requirements, Project Scheduling	Quiz - 01, Mid-Term Exam
2	ER Diagram, Data Flow Diagram	Mid-Term Exam, Quiz-02
3	Use Case Diagram, Class Diagram	Quiz-03, Final Exam
4.	Feasibility Study	Quiz-04, Final Exam
5.	Activity Diagram, Sequence Diagram	Final Exam

6.	Implementing and Maintaining the System, Systems Repository	Final Exam

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester, 2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best 3 class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category	Marks (out of 30)
Remember	
Understand	10
Apply	
Analyze	20
Evaluate	
Create	

SMEB- Semester Mid & End Examination (70 Marks)

Bloom's Category	Mid	Final
Remember	4	10
Understand	6	10
Apply		10
Analyze	10	20
Evaluate		
Create		

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual students will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. System Analysis and Design by Kendall & Kendall, Latest Edition
2. Modern Systems Analysis and Design by Hoffer, George, Latest Edition

Course Outline: Project Strategy and Management

Part A – Introduction

1. Course Code : CSE 307

2. Course Title : Project Strategy and Management

3. Course Type : Non-credit course

4. Level : 3rd year, 1st Semester

5. Academic Session : Fall 2023

6. Course Instructor : TBD

7. Prerequisite : None

8. Credit Value : 3.00

9. Contact Hours : 3.0

10. Total Marks : 100

11. Course Objectives and Course Summary:

The objectives of this course are to:

1. **Equip** students with the knowledge and skills necessary to effectively plan, execute, and oversee projects within various organizational contexts.

2. **Provide** students with a comprehensive understanding of project management principles, strategies, and methodologies, enabling them to successfully lead and contribute to project initiatives.

The course will provide the fundamental concepts and practical applications of project management within modern business environments. Topics of this course include project initiation, planning, execution, monitoring, and closure, as well as risk management, stakeholder engagement, and project leadership strategies. Through case studies, simulations, and practical exercises, students will develop competencies in project scope definition, resource allocation, schedule management, and quality control. Additionally, the course emphasizes the integration of strategic planning with project management practices to achieve organizational objectives effectively.

13. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Describe** the fundamentals the fundamentals of project integration management
CLO 2	**Understand** the scope, resource,s and time of project management
CLO 3	**Understand** the cost, risk, and quality of project management
CLO 4	**Develop** system strategy and communication in project management

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

*Note: Course Outcome (CO) is the same as the Course Learning Outcome (CLO) and Program Outcome (PO) is the same as the Program Learning Outcome (PLO).

CLO No.	**CLO Statements:** Upon successful completion of the course, students should be able to:	**Corresponding PLOs (Appendix-1)**	**Bloom's taxonomy domain/level (Appendix-2)**	**Delivery methods and activities**	**Assessment Tools**
CLO1	**Describe** the fundamentals of project integration management	a	1/Understand	Lecture, Classwork, Assignments	Quiz, Written exam
CLO2	**Understand** the scope, resource,s and	a	1/Apply	Lecture, Classwork,	Quiz, Written

	time of project management			Assignments	exam
CLO3	**Understand** the cost, risk, and quality of project management	b	1/Apply	Lecture, Classwork, Assignments	Quiz, Written exam
CLO4	**Develop** system strategy and communication in project management	c	1/Apply	Lecture, Classwork, Assignments	Quiz, Written exam

<u>Part B – Content of the Course</u>

14. Course Content:

15. Alignment of topics of the course with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Project management, project integration management, project stakeholder management	CLO1
2	Project scope management, Project resource management, Project time management	CLO2
3	Project cost management, Project risk management, Project quality management	CLO3
4.	Project communication management, system strategy	CLO4

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Program Outcome (PO) (s)	Time Frame	Suggested Activities	Teaching Strategy (s)	Alignment with CLO
Project management 1. Purpose and concept of projects and project management 2. Purpose and concept of projects and project management		Week 1	Practical example, assignment/ quiz	Lecture, Multimedia	CLO1

Project integration management 1. Purpose and concept of project integration management 2. Processes in project integration management		Week 2	Practical example, assignment/ quiz	Lecture, Multimedia	CLO1
Project stakeholder management 1. Purpose and concept of project stakeholder management 2. Processes in project stakeholder management		Week 3	Practical example, assignment/ quiz	Lecture, Multimedia,	CLO1
CT1: Class test 1		Week 4	Class test	Lecture, Multimedia	CLO1
Project scope management 1. Purpose and concept of project scope management 2. Processes in project scope management		Week 5	Practical example, assignment/ quiz	Lecture, Multimedia	CLO2
Project resource management & Project time management 1. Purpose and concept of project resource management 2. Processes in project resource management 3. Purpose and concept of project time management 4. Processes in project time management 5. Typical types of schedules, and their creation and management techniques		Week 6	Practical example, assignment/ quiz	Lecture, Multimedia	CLO2
CT2: Class test 2		Week 7	Class test	Lecture, Multimedia	CLO2
MID-SEMESTER EXAMINATION					
Project cost management 6. Purpose and concept of project cost management 7. Processes in project cost management 8. Typical techniques for		Week 8	Practical example, assignment/ quiz	Lecture, Multimedia	CLO3

estimating and managing costs					
Project risk management 9. Purpose and concept of project risk management 10. Processes in project risk management 11. Methods for identification of typical risks, analysis methods, and responses to risk		Week 9	Practical example, assignment/ quiz	Lecture, Multimedia	CLO3
Project quality management 12. Purpose and concept of project quality management 13. Processes in project quality management 14. Typical quality management techniques		Week 10	Practical example, assignment/ quiz	Lecture, Multimedia	CLO3
CT3: Class test 3		Week 11	Class test	Lecture, Multimedia	CLO3
Project communication management 15. Purpose and concept of project communication management 16. Processes in project communication management 17. Typical information distribution methods		Week 12	Practical example, assignment/ quiz	Lecture, Multimedia	CLO4
System strategy 18. Purpose and concept of system strategy 19. Processes in system strategy 20. Program management 21. Quality control 22. Strategy implementation management		Week 13	Practical example, assignment/ quiz	Lecture, Multimedia	CLO4

CT4: Class test 4 **Review Class**		Week 14	Class test	Lecture, Multimedia	CLO4 CLO1, CLO2, CLO3, CLO4
FINAL EXAMINATION					

17. Teaching-Learning Strategies:

Classroom lectures will be used to introduce key concepts, theories, and frameworks related to project strategy and management to provide a foundational understanding of the subject matter and facilitate discussions on real-world applications. Real-world case studies of successful and unsuccessful projects will be analyzed in the class to allow students to apply theoretical knowledge to practical scenarios to encourage critical thinking, problem-solving, and decision-making skills while illustrating the complexities of project management in various contexts. Group discussions will be facilitated to enable students to share perspectives, exchange ideas, and collaborate on project management challenges to encourage active participation, communication skills development, and the exploration of diverse viewpoints. There will be project-based learning activities allowing students to apply theoretical concepts to real projects, either individually or in teams to develop practical skills, project management competencies, and problem-solving abilities while experiencing the challenges and rewards of project execution.

18. Assessment Techniques of each topic of the course:

Assessment Type	**% weight**	**CLO1**	**CLO2**	**CLO3**	**CLO4**
Final Exam	50%	10	10	10	20
Mid Term Exam	20%	10	10	-	-
Class performance (Class Test, Assignment, Problem-solving session)	30%	10	10	-	10
Total	**100%**	**30**	**30**	**10**	**30**

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester, 2 class tests will be taken for midterm and 2 class tests will be taken for final term. 3 out of 4 class tests will be considered. (Best must be chosen among CTs from the same CLO). No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: Assignments (Written and/or presentation.) will be given throughout the semester. Late submission will result in a 50% deduction in the score. Students will have to do the presentation on the given topic as an assignment.

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 30)	**Tests (20)**	**Assignments (10)**
Remember		
Understand		
Apply	**20**	**10**
Analyze		
Evaluate		
Create		

SMEB- Semester Mid & End Examination (70 Marks)

Bloom's Category	**Test**
Remember	14
Understand	
Apply	42
Analyze	14
Evaluate	
Create	

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual students will be evaluated based on the following criteria with respective weights.

1. Assessment 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75

50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Project Management for Information Systems - James Cadle, Donald Yeates
2. Information Systems Project Management - David Olson
3. Information Systems Project Management - David E. Avison, Gholamreza Torkzadeh

Course Outline – Bioinformatics Engineering

Part A – Introduction

1. **Course No. / Course Code:** BIE 301
2. **Course Title:** Bioinformatics Engineering
3. **Course Type:** Core Course
4. **Level/Term and Section:** 3rd Year 1st Semester
5. **Academic Session:** Fall 2024
6. **Course Instructor:** Md Mahedi Hassan
7. **Pre-requisite (If any):**
8. **Credit Value:** 3.00
9. **Contact Hours:** 3.00
10. **Total Marks:** 100
11. **Course Objectives and Course Summary:** Introduction; Molecular biology basics: DNA, RNA, genes, and proteins; Restriction mapping algorithm; Motif in DNA sequences, motif finding algorithms; Genome rearrangements, sorting by reversals and breakpoints; DNA sequence alignments; Gene prediction; Space-efficient sequence alignments, sub-quadratic alignment; DNA sequencing, genome sequencing, protein sequencing, spectrum graphs;

Combinatorial pattern matching: Exact pattern matching, heuristic similarity search algorithms, approximate string matching, BLAST, FASTA; Clustering: Microarrays, hierarchical clustering, K-means clustering, corrupted cliques problem, CAST clustering algorithm; Evolutionary trees.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO1	**Understand** molecular biology basics such as DNA, RNA, genes, and proteins; motifs in DNA; phylogeny
CLO 2	**Explain** algorithms such as DNA sequencing, DNA fragment assembly, spectrum graphs; sequence similarity; genome alignments and rearrangements; suffix tree, and evolutionary tree
CLO3	**Apply** combinatorial pattern matching such as FASTA, and BLAST to search databases; sequencing, and alignment algorithms; genome rearranging; clustering algorithms
CLO4	**Analyze** genome through alignments, phylogeny through comparison, motifs, and RNA and protein secondary structures

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO 1	PLO-a	Understand	Lectures, Group Discussions	Written Exam
CLO 2	PLO-c	Understand	Lectures, Group Discussions	Written Exam
CLO 3	PLO-c	Apply	Lectures, Problem Solving	Written Exam
CLO 4	PLO-e	Analyze	Lectures, Problem Solving	Written Exam

Part B – Content of the Course

14. **Course Content:** Molecular biology basics, graph algorithms, sequence similarities, genome alignment, motifs in DNA, database search, BLAST, FASTA, phylogenetic reconstruction, protein and RNA secondary structure prediction, clustering, genome rearrangement.

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Molecular biology basics: DNA, RNA, genes, and proteins	CLO1
2	Graph algorithms: DNA sequencing, DNA fragment assembly, Spectrum graphs	CLO3
3	Sequence similarity, Suffix Tree and variants with applications, Evolutionary Tree	CLO2
4	Genome Alignment: maximum unique match, LCS, mutation sensitive alignments, multiple sequence alignment	CLO3, CLO4
5	Motif in DNA sequences, motif finding algorithms	CLO1, CLO3, CLO4
6	Database search: Smith-Waterman algorithm, FASTA, BLAST and its variations, Locality-sensitive hashing	CLO3
7	Phylogeny reconstruction; Phylogeny comparison: similarity and dissimilarity measurements, consensus tree problem	CLO1, CLO4
8	RNA and protein secondary structure prediction	CLO4
9	Clustering: Microarrays, hierarchical clustering, K-means clustering, corrupted cliques problem, CAST clustering algorithm	CLO3
10	Genome rearrangement: types of genome rearrangements, sorting by reversal and other operations	CLO2

16. Class Schedule/Lesson Plan/Weekly Plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO

Molecular biology basics: DNA, RNA, genes, and proteins, Graph algorithms: DNA sequencing, DNA fragment assembly, Spectrum graphs	Molecular biology basics, graph algorithms	Week 1 Week 2 Week 3	Practice, Assignment, Quiz	Lecture, Multimedia	CLO1, CLO3
Sequence similarity, Suffix Tree and variants with applications, Evolutionary Tree, Genome Alignment: maximum unique match, LCS, mutation sensitive alignments, multiple sequence alignment	Sequence similarity and alignment	Week 4 Week 5	Practice, Assignment, Quiz	Lecture, Multimedia	CLO2, CLO3, CLO4
Motif in DNA sequences, motif finding algorithms	Motifs	Week 6 Week 7	Practice, Assignment, Quiz	Lecture, Multimedia	CLO1, CLO3, CLO4
MID-TERM EXAMINATION					
Database search: Smith-Waterman algorithm, FASTA, BLAST and its variations, Locality-sensitive hashing	Use of advanced tools for searching databases	Week 8 Week 9	Practice, Assignment, Quiz	Lecture, Multimedia	CLO3
Phylogeny reconstruction; Phylogeny comparison: similarity and dissimilarity measurements, consensus tree problem	Phylogeny	Week 10 Week 11	Practice, Assignment, Quiz	Lecture, Multimedia	CLO1, CLO4
RNA and protein secondary structure prediction	Secondary structure prediction	Week 12	Practice, Assignment, Quiz	Lecture, Multimedia	CLO4

Clustering: Microarrays, hierarchical clustering, K-means clustering, corrupted cliques problem, CAST clustering algorithm	Clustering	Week 13	Practice, Assignment, Quiz	Lecture, Multimedia	CLO3
Genome rearrangement: types of genome rearrangements, sorting by reversal and other operations	Genome rearrangement	Week 14	Practice, Assignment, Quiz	Lecture, Multimedia	CLO2
FINAL EXAMINATION					

17. Teaching-Learning Strategies:

- Active Learning and Discussions
- Problem-Based Learning
- Case-Based Learning
- Simulations and Role-Playing

18. Assessment Techniques of each topic of the course:

SL. No	Topics / Content	Assessment Techniques
1	Molecular biology basics: DNA, RNA, genes, and proteins	Quiz, Midterm
2	Graph algorithms: DNA sequencing, DNA fragment assembly, Spectrum graphs	Quiz, Midterm
3	Sequence similarity, Suffix Tree and variants with applications, Evolutionary Tree	Quiz, Midterm
4	Genome Alignment: maximum unique match, LCS, mutation sensitive alignments, multiple sequence alignment	Quiz, Midterm, Assignment
5	Motif in DNA sequences, motif finding algorithms	Quiz, Midterm, Final Exam
6	Database search: Smith-Waterman algorithm, FASTA, BLAST and its variations, Locality-sensitive hashing	Quiz, Final Exam, Assignment
7	Phylogeny reconstruction; Phylogeny comparison: similarity and dissimilarity measurements, consensus tree problem	Quiz, Final Exam
8	RNA and protein secondary structure prediction	Quiz, Assignment
9	Clustering: Microarrays, hierarchical clustering, K-means clustering, corrupted cliques problem, CAST clustering algorithm	Assignment
10	Genome rearrangement: types of genome rearrangements,	Quiz, Final Exam

	sorting by reversal, and other operations	

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests each term, the best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of a maximum of 4 members. The topic or case studies will be given as assignments in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do a presentation on the given topic as an assignment.

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 30)	Class Tests (20)	Assignments (10)
Remember		
Understand	5	
Apply	5	
Analyze	5	5
Evaluate	5	5
Create		

SMEB- Semester Mid & End Exanimation (70 Marks)

Bloom's Category	Mid	Final
Remember	5	5
Understand	5	5
Apply	5	10
Analyze	5	20
Evaluate		10
Create		5

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual students will be evaluated based on the following criteria with respective weights.

1. Class Tests and Assignments 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Bioinformatics Computing, Bryan Bergeron, Prentice Hall, 1st Edition, 2002
2. An Introduction to Bioinformatics Algorithms, By Neil C. Jones, Pavel Pevzner, The MIT Press, 1st Edition, 2004.

Course Outline – Business and Entrepreneurship

Part A – Introduction

1. **Course No. / Course Code** **:** BUS 301
2. **Course Title** **:** Business and Entrepreneurship
3. **Course Type** **:** Core
4. **Level/Term and Section** **:** 3rd Year 1st Semester
5. **Academic Session** **:** Fall 2023

6. **Course Instructor** :
7. **Pre-requisite (If any)** : N/A
8. **Credit Value** : 3.0
9. **Contact Hours** : 3.0
10. **Total Marks** : 100
11. **Course Objectives and Course Summary:**

Rationale of the Course: Required course in the CSE program. This knowledge is very important to build up the knowledge of Engineering entrepreneurship and Business management.

12. Course Learning Outcomes: At the end of the course, student will be able to-

CO No.	CO Statements: Upon successful completion of the course, students should be able to:	Corresponding POs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CO1	Define the fundamentals of functional areas of business and Entrepreneur	1	Remember	Lecture, Classwork, Assignments	Quiz, Written exam
CO2	Realize the fundamentals of business organization, environment, human resources, marketing, accounting, finance, and entrepreneurship.	1	Understand	Lecture, Designing Flowcharts	Quiz, Written exam
CO3	Evaluate the marketing strategies and idea of Entrepreneurship ethics in software industries.	1	Understand/ Development	Lecture, Q&A	Assignment, Written exam, Quiz
CO4	Making a business startup using a financial feasibility study and SWOT analysis for the new startup.	2	Understand /Apply	Problem Solving, Practice sessions	Online Contest, Assignment, Written exam, Quiz

13. Mapping/ Alignment of CLOs to Program Learning Outcomes (PLOs):

	PLO 1	PLO 2	PLO3 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO1 10	PLO1 11	PLO1 2
CLO1		√										
CLO2			√									
CLO3										√		
CLO4											√	

Part B – Content of the Course

14. Course Content:

Management: Fundamentals of Management, Managerial Constraints/Environment, Managerial Skills in Software Industries, Managing production and operation. **Organizational:** Basics of Organizational behavioral (OB) theories. **Human Resources Management:** Managing Human Resources, recruitments process, skills an& development works, Motivation, Communication skills and best talent hunt for Software Projects. **Financial Management:** Value Calculation and Residual Earnings, Payback Period, Net Present, Value (NPV) Calculation, Internal Rate of Return (IRR) Calculation. **Marketing:** Marketing Strategies, 7 Ps analysis, Conventional and Digital Marketing. **Accounting Principles:** Accounting Fundamentals, Transaction Analysis, Accounting Cycle, Principles of Ledger, Trial Balance. **Financial Statement:** Income statement, Cash flow statement, Balance sheet, Analysis of Financial Statements. **Managerial & Cost Accounting**: Cost concepts; Cost of Goods, Manufactured Statement, Cost-Volume-Profit analysis, Decision making and reporting. **Entrepreneurship:** Introduction to Entrepreneurship, types of Entrepreneurships, Entrepreneurship Ethics and Government Law. **Business Plan:** Cash-Flow Projection and SWOT (Strengths/Weaknesses/Opportunities/Threats).

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Management:	CLO1
2	Basics of Organizational behavioral	CLO1
3	Human Resources Management	CLO2
4	Financial Management, Value Calculation and Residual Earnings, Payback Period	CLO2
5	Marketing Strategies, 7 Ps analysis, Conventional and Digital Marketing	CLO3
6	Accounting Fundamentals	CLO3
7	Financial Statement: Income statement, Cash flow statement	CLO4
8	Managerial & Cost Accounting: Cost concepts; Cost of Goods	CLO4
9	Introduction to Entrepreneurship, types of Entrepreneurships, Business Plan	CLO4

16. Class Schedule/Lesson Plan/Weekly plan:

Weeks	Topics / Content	CO	Delivery methods	Materials
1	Management functions, theories Fundamentals of Management, Organization of Business in Software Industries.	CO1	Lecture, Multimedia	Slides by teacher

2	Management and Organization Managing production and operation. Managerial Constraints/Environment, Managerial Skills in Software Industries	CO1	Lecture, Multimedia	Introduction to computers by Peter Norton Power Point Slides
3	Project Management &Managerial Skills in Software Industries: Product, Quality management, cost mgt, stockholders mgt, essential skills for managers.	CO1	Lecture, Multimedia	PDF by teacher Class notes
4	Organizational behavior Organization of Business in Software Industries, Managing production and operation. Managerial Constraints/ Environment, Managerial Skills in Software Industries.	CO2		
5	Motivational theories: Motivation –Theory X and theory Y; Motivation-hygiene theory; Job redesign; Equity theory; Reinforcement theory etc. Communication between Software Developers.	CO2	Lecture, Multimedia	PDF by teacher Class notes
6	Motivational theories and Managerial Leadership: Maslow's needs hierarchy, Herzberg's two-factor theory. Adam's equity theory and	CO2		
7	Marketing Concepts Importance and scope of marketing; Marketing concepts, Buyer behavior; Product life-cycle strategies etc.	CO3	Lecture, Multimedia	Book- Kendall and Kendall Ch-04
8	Marketing Management Market segmentation, 7Ps analysis, Product & Price, Distribution and Digital Marketing concepts	CO3	Lecture, Multimedia	Intro to Computers (Book) Slides
8	Digital Marketing Digital Marketing, benefits of digital marketing Over traditional marketing, Digital Marketing tools, Mkt Objectives, Organic and Paid marketing, 5 best digital marketing strategies, Inbound funnel model, Marketing segmentation, Online advertising and Ads types, Affiliate and email marketing.	CO3	Lecture, Multimedia	
	Human Resources Management Personnel management, Manpower planning, Staffing,3 aspects: recruitment, selection and	CO3		

	training, Job analysis and global talent hunt			
9	Entrepreneurship: Introduction to Entrepreneurship, The Benefits of Entrepreneurship. Types of entrepreneurships in Software Industries, Social responsibility and Entrepreneurship Ethics, entrepreneurship Law and Government.	CO3	Lecture, Multimedia; Written Exam	Intro to Computers (Book) Slides
MID SEMESTER EXAMINATION				
10	Accounting Theories and Problems: Accounting Fundamentals, Accounting Cycle, Principles of Journal Entries, Trial Balance in Software Industries.	CO4	Lecture, Multimedia	PDF
10	Managerial and Cost Accounting: Cost concepts and classification of costs; Breakeven (BE) analysis; Cost-volume profit (CVP) analysis	CO4	Lecture, Multimedia	Slides PDF
11	Financial Statement: Income statement, Cash flow statement, Balance sheet, Analysis of Financial Statements for Software Industries	CO4	Lecture, Multimedia	Recommended Books Slides
11	Business Plan: Target Market, The Competition, Risk Assessment, Technology Plan, Exit Plan, Cash-Flow Projection	CO4	Lecture, Multimedia	Recommended Books Slides
12	SWOT Analysis: Strengths/Weaknesses/Opportunities/ Threats of a business.	CO4	Lecture, Problem Solve	Programing Books Slides
14	CT#04, and Case Study: Various case studies relevant to the course for better understanding of the topics covered in this course.		Written Test; Consultation	

17. Teaching-Learning Strategies:

18. Assessment Techniques of each topic of the course:

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester, 2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Multimedia	Quiz, Written Examination
CLO2	Lecture, Multimedia	Written Examination
CLO3	Lecture, Problem Solving	Quiz, Written Examination
CLO4	Lecture, Group discussion	Quiz, Assignment, Written Examination

20. Evaluation Policy

Assessment Type	% Weight	CO1	CO2	CO3	CO4
Final Examination:	50%			25	25
Mid Semester Examination:	20%	10	10		
Continuous Evaluation: Class performance, Short Quizzes, Problem Solving Sessions, Oral Exams	30%	5	10	5	10
Total	100%	15	20	30	35

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

Text Book:

1. Edwin B. Flippo : Personnel Management

2. M Y Khan, PK Jain : Financial Management, Text, Problems and Cases

3. Richard B. Chase, Nicholas J. Aquilano, F. Robert Jacobs : Production and Operations Management: Manufacturing and Services

4. AY H., Eric W. Noreen & Peter C. Brewe Garrision : Managerial Accounting

Reference Books and Materials:

1. Entrepreneurship Development, Nazrul Islam and Muhammad Z Mamun, The University Press Limited.
2. Entrepreneurship Development, An Indo-German Technical Cooperation Project.

Course Outline – Technical Writing and Presentation

Part A – Introduction

1.	**Course Code**	**:** ENG 300
2.	**Course Title**	**:** Technical Writing and Presentation
3.	**Course Type**	**:** Core course
4.	**Level/Term and Section**	**:** 3rd Semester 1st Semester
5.	**Academic Session**	**:** Fall 24
6.	**Course Instructor**	**:** Musfequa Rahman, Lecturer
7.	**Prerequisite (If any)**	**:** Nil
8.	**Credit Value**	**:** 1.5
9.	**Contact Hours**	**:** 3.0
10.	**Total Marks**	**:** 100

11. Course Objectives and Course Summary:

The objectives of this course are to:

1. Understand the fundamentals of technical writing specific to Computer Science and Engineering.
2. Develop effective oral presentation skills tailored to the field's requirements.
3. Demonstrate expertise in the preparation of essential technical documents such as reports, research papers, theses, and books.
4. Utilize essential writing and presentation tools such as LATEX and diagram drawing software proficiently.

This course is structured to provide students with fundamental skills in technical writing tailored specifically to the disciplines of Computer Science and Engineering. Through an exhaustive examination, students will acquire a comprehensive understanding of the nuanced aspects of effective technical writing and oral presentation. Central themes encompass comprehension of the foundational principles underpinning technical writing, mastery of diverse writing styles applicable to definitions, propositions, theorems, and proofs, and proficiency in the creation of an array of technical documents including reports, research papers, theses, and books. Additionally, students will develop adeptness in utilizing essential writing tools such as LATEX, alongside diagram drawing software and presentation tools, to optimize the visual representation and delivery of technical information.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Describe** the qualities of well-organized reports, research papers, theses, and books.
CLO 2	**Analyze** the qualities of a good presentation.
CLO 3	**Apply** technical writing tools to write reports, research papers, theses, and books using the acquired knowledge.

CLO 4	**Use** presentation tools to present information in an organized way
CLO 5	**Apply** technical diagram drawing tools to draw effective and easily understandable diagrams.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	**Corresponding PLOs (Appendix-1)**	**Bloom's taxonomy domain/level (Appendix-2)**	**Delivery methods and activities**	**Assessment Tools**
CLO1	1	1/Understand	Lecture, Discussion, Example analysis	Class work, Problem-solving, Exam
CLO2	2	1/Analyze	Lecture, Discussion, Example analysis	Class work, Problem-solving, Presentation, Project
CLO3	5	1/Apply	Lecture, Practical exercises	Class work, Project
CLO4	2	1/Apply	Lecture, Practical exercises	Problem-solving, Presentation, Exam, Project
CLO5	5	1/Apply	Lecture, Practical exercises	Diagram evaluations, Presentation, Project

Part B – Content of the Course

14. Course Content:

15. Alignment of topics of the courses with CLOs:

SL. No	**Topics / Content**	**Course Learning Outcome (CLO)**
1	Technical Writing and Oral Presentation	CLO1, CLO2
2	Writing Styles: Definitions, Propositions, Theorems, Proofs	CLO1, CLO3
3	Preparation of Technical Documents: Reports, Research Papers, Theses, Books	CLO1, CLO3, CLO4
4.	Proficiency in utilizing writing tools like LATEX, diagram drawing software, and presentation tools	CLO3, CLO4, CLO5

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Introduction to Technical Writing and Oral Presentation		Week 1		Lecture, multimedia	CLO1, CLO2
Writing Styles: Definitions, Propositions, Theorems, Proofs, Introduction to LaTeX basics		Week 2		Lecture, Problem Solving, Hands-on Practice	CLO1, CLO3, CLO4
Advanced LaTeX features: Mathematical equations, bibliographies, figures, tables		Week 3-5		Lecture, Problem Solving, Hands-on Practice	CLO3, CLO4
Customizing LaTeX documents: Headers, footers, fonts, styles Polymorphism, method overriding, Final keyword		Week 6		Lecture, Problem Solving, Hands-on Practice	CLO3, CLO4
MID-TERM EXAMINATION		Week 7			
LaTeX environments: Theorem, proof, definition, example		Week 8		Lecture, Problem Solving, Hands-on Practice	CLO3, CLO4
LaTeX for academic writing: Research papers, theses, books		Week 9-10		Lecture, Problem Solving, Hands-on Practice	CLO3, CLO4, CLO5
LaTeX for scientific writing: Journal articles, conference papers,		Week 10-11		Lecture, Problem Solving, Hands-on Practice	CLO1, CLO4, CLO5
Presentation techniques: Design principles, effective visuals		Week 12		Hands-on Practice, Group Discussion, Presentation Practice	CLO4, CLO5
Presentation practice sessions, Final presentations		Week 13-14		Hands-on Practice,	CLO1, CLO4

				Group Discussion, Presentation Practice	
FINAL EXAMINATION		Week 15			

17. Teaching-Learning Strategies:

18. Assessment Techniques of each topic of the course:

Part C – Assessment and Evaluation

19. Assessment Strategy:

Assignments: Throughout the semester, written assignments and presentations will be given to assess students' understanding and application of technical writing principles and presentation skills.

- Assignments will cover various aspects of technical writing, including LaTeX document creation, customization, and collaborative writing, as well as presentation design and delivery.
- Presentations will focus on topics related to effective presentation techniques, such as design principles and use of visuals.

Final Presentation: At the end of the semester, students will deliver a final presentation, showcasing their mastery of technical writing and presentation skills. This presentation will be evaluated based on clarity, organization, visual aids, and overall effectiveness in communicating complex technical concepts.

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 50)	Assignments (10)	External Participation in Curricular/Co-Curricular Activities (20)
Remember		
Understand		10
Apply	10	
Analyze		10
Evaluate		
Create		

SMEB- Semester Mid & End Examination (70 Marks)

Bloom's Category	**Marks (out of 70)**
Remember	
Understand	**15**
Apply	**35**
Analyze	**20**
Evaluate	
Create	

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Assessment 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Sharon J. Gerson, Steven M. Gerson, "Technical Writing Process and Product", Sixth Edition, 2009, Revised 2017

Reference Books & Materials

1. "Engineers' Guide to Technical Writing", Kenneth G. Budinski, ASM International
2. Others

Third Year Second Semester

Course Outline – Data Communication and Computer Networks

Part A – Introduction

1.	**Course No. / Course Code**	: CSE 311
2.	**Course Title**	: Data Communication and Computer Networks
3.	**Course Type**	: Core course
4.	**Level/Term and Section**	: 6th Semester (3rd Year/2nd Semester)
5.	**Academic Session**	: Fall 2023
6.	**Course Instructor**	: Md Akhtaruzzaman Adnan
7.	**Prerequisite (If any)**	: CSE
8.	**Credit Value**	: 3.0
9.	**Contact Hours**	: 3.0

10. Total Marks **:** 100

11. Course Objectives and Course Summary:

The objectives of this course are to:

1. Understanding Fundamentals: Students will grasp the fundamental concepts of data communication and computer networks, including the OSI model, TCP/IP protocol suite, and the principles of data transmission.
2. Network Design and Implementation: Students will learn the principles of network design, including topology, network hardware, and addressing schemes. They will be able to design and implement basic computer networks to meet specific requirements.
3. Introduce the student to basic data communication principles and concepts, implement data communication system architecture, preparing the student for entry into advanced courses in data communication.
4. To learn analog and digital signal transmission, switching, encoding techniques, multiplexing techniques, error detection and correction techniques.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	Illustrate the concept of Computer Networking, Wireless, and mobile networking, the idea of different networking layers, topologies, and their functionality during message transfer.
CLO 2	Discover the operation of addressing mechanisms in different layers, i.e., port addressing, IP addressing, and MAC addressing, the application of different networking and routing protocols, and congestion control.
CLO 3	Analyze the performance of data communication system architecture for Digital and Analog Transmission.
CLO 4	Evaluate the mechanisms for channel Bandwidth utilization, encoding and decoding methods, Multiplexing, and different error detection and correction techniques.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	**Corresponding PLOs (Appendix-1)**	**Bloom's taxonomy domain/level (Appendix-2)**	**Delivery methods and activities**	**Assessment Tools**
CLO1	1	1/Understand	Lecture, multimedia, Books	Quiz, Written Examination
CLO2	2	1/Apply	Lecture, multimedia, Books	Quiz, Written Examination, Assignment
CLO3	4	1/Analyze	Lecture, multimedia, Books	Quiz, Written Examination
CLO4	5	1/Evaluate	Lecture, multimedia, Books	Quiz, Assignment, Written Examination

Part B – Content of the Course

14. Course Content:

Data Communication and Networking Concept: Introduction to Networking, Networking Devices, Network Architectures; Network Classification, Local Area Networks, Network Model and Protocols; Data Communication Standards, Protocol Architecture, OSI and TCP/IP model, Network Topology, Guided and Unguided transmission media; Wireless transmission and communication; Transmission modulation techniques, modems and interfaces; Multiplexing techniques;

Data link control: Line configurations, flow control, and error control techniques- sliding window, stop and wait ARQ, selective reject ARQ and HDLC protocol. Flow control, Medium Access Control, Error Detection and Correction Schemes, MAC Address, ARP, RARP

Network Layer: IP Overview, IPv4, Subnetting and supernetting- CIDR, Routing and Routing Protocols, IPv6, Transition from IPv4 to IPv6, IPv6 Facilities;

Transport Layer Protocols: UDP and TCP

Application Layer: Different Protocols - HTTP, DNS-Mail-Proxy-DHCP, Firewalls, P2P Model-Bit torrent ISP Configuration and Design Concept, ATM Network, VoIP

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Basics of Computer Networking Concepts	CLO1
2	Addressing mechanisms in different layers	CLO2
3	Digital and Analog Transmission	CLO3
4	Evaluation of Channel Performance	CLO4

16. Class Schedule/Lesson Plan/Weekly Plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO

Data Communication and Networking Concept: Introduction to elements of data communication, Network topology, Protocols and standards,	PO-a	Week 1	problem-solving, discussions, and group activities	Lecture, multimedia, Discussions	CLO1
Network models: OSI and TCP/IP model, Basics concepts of signal: Analog and digital signal and their properties,	PO-a, PO-f	Week 2	problem-solving, discussions, and group activities	Lecture, multimedia, Discussions	CLO1,CO4
Transmission impairment, Data rate limit, Guided and Unguided Medium- Twisted pair, Coaxial and fiber optic cable, radio and microwaves, wireless media.	PO-a, PO-k	Week 3	problem-solving, discussions, and group activities	Lecture, multimedia, Discussions	CLO1, CLO3
Digital to Digital conversion- Line coding, Block coding and Scrambling	PO-a, PO-k	Week 4	problem-solving, discussions, and group activities	Lecture, multimedia, Problem Solving	CLO1, CLO3
Analog to Digital conversion- PCM, DM, Bandwidth utilization: Multiplexing: FDM, WDM, CWDM, DWDM TDM	PO-b	Week 5	problem-solving, discussions, and group activities	Lecture, multimedia, Discussions	CLO2
Different types of errors, Detection vs. Correction, Block coding- Error detection and correction, Hamming distance, CRC, Checksum.	PO-b	Week 6	problem-solving, discussions, and group activities	Lecture, multimedia, Problem Solving, Problem Solving, Group discussion	CLO2
Framing, Flow, and error control protocols- Stop and Wait, Go-back-N ARQ, Selective Repeat ARQ, HDLC.	PO-b	Week 7	problem-solving, discussions, and group activities	Lecture, multimedia, Problem Solving, Problem Solving,	CLO2

				Group discussion	
Midterm Examination		Week 8			
Switching: Structure of circuit, packet, and message switching	PO-b	Week 9	problem-solving, discussions, and group activities	Lecture, multimedia, Problem Solving	CLO2
Introduction of Computer Networking, Addressing Schemes, IP Basics, Concept of Subnetting	PO-b	Week 10	problem-solving, discussions, and group activities	Lecture, multimedia, Problem Solving	CLO2
Discussion on Subnetting FLSM, VLSM, NAT	PO-f	Week 11	problem-solving, discussions, and group activities	Lecture, multimedia, Problem Solving	CLO4
Introducing a different kind of Routing techniques (Distance vector, Link state, multicast routing)	PO-b	Week 12	problem-solving, discussions, and group activities	Lecture, multimedia, Problem Solving	CLO2
Application Layer: HTTP, FTP, SMTP, DNS,	PO-b	Week 13	problem-solving, discussions, and group activities	Lecture, multimedia	CLO2
Connectionless Transport: UDP, Connection-Oriented Transport: TCP, The TCP Connection Link layer addressing ARP, VLANs, MPL	PO-b, PO-f	Week 14	problem-solving, discussions	Lecture, multimedia,	CLO2, CLO4
Local Area Networks (LANs): CSMA/CD, Ethernet	PO-a	Week 15	problem-solving, discussions	Lecture, multimedia,	CLO1

17. Teaching-Learning Strategies:

Strategies	Topics
Active Learning and Discussions	Encourage students to actively engage with the material through problem-solving, discussions, and group activities.
Problem-Based Learning	Campus network design with IP, Subnetting with FLSM and VLSM concepts

Concrete Examples	Relate abstract concepts to real-world applications whenever possible. Show how discrete mathematics is used in computer science.
Peer Instruction	Implement peer instruction techniques where students teach and learn from each other. Encourage peer tutoring, group study sessions, and peer evaluation of problem-solving approaches.

18. Assessment Techniques of each topic of the course:

SL. No	Topics / Content	Assessment Techniques
1	Software Engineering Basic Concept	Mid Term Exam
2	Project Planning and Management	Mid-Term Exam, Quiz-01
3	Software Process Model	Mid-Term Exam, Quiz-02, Final Exam
4.	Software Design Architecture	Quiz-03, Final Exam
5.	Software Security	Quiz-04, Final Exam
6.	Software Testing and Quality Assurance	Final Exam

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester, 2 class tests will be taken for midterm and 2 class tests will be taken for final term. 3 out of 4 class tests will be considered. Best two from Quiz-1, Quiz-2 & Quiz-3, and Quiz-4 will be considered. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category	Marks (out of 30)
Remember	
Understand	**10**
Apply	
Analyze	**20**
Evaluate	
Create	

SMEB- Semester Mid & End Exanimation (70 Marks)

Bloom's Category	Marks (out of 70)
Remember	
Understand	30
Apply	10
Analyze	30

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual students will be evaluated based on the following criteria with respective weights.

1. Assessment 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

art D – Learning Resources

21. Text Book

1. Data Communications and Networking - Behrouz A. Forouzan
2. Computer Networking A Top-Down Approach – James F. Kursse

Reference Books & Materials

1. 1. Computer Networks - Andrew S. Tanenbaum
2. 2. Cloud Services For Dummies, IBM Limited Edition
3. 3. Blockchain for Dummies, IBM Limited Edition by Manav Gupta

Course Outline – Data Communication and Networking Lab

Part A – Introduction

1. **Course No. / Course Code** : CSE 312
2. **Course Title** : Data Communication and Networking Lab
3. **Course Type** : Lab
4. **Level/Term and Section** : 3rd year 2nd semester
5. **Academic Session** :
6. **Course Instructor** :
7. **Pre-requisite (If any)** :
8. **Credit Value** : 1.5
9. **Contact Hours** : 3.0
10. **Total Marks** : 100

11. Course Objectives and Course Summary:

This course will provide students with a hands-on learning experience to complement theoretical knowledge gained in the classroom. The course is structured to give equal emphasis to both data communication and computer networking aspects, ensuring a balanced understanding of core concepts and practical skills.

Throughout the course, students engage in a series of lab sessions designed to reinforce theoretical concepts and develop proficiency in network configuration, troubleshooting, and analysis. These sessions cover a range of topics, including network protocols, LAN/WAN technologies, routing and switching, network security, and wireless networking such as optical fiber communications.

Students work individually and in teams to complete lab assignments and projects, applying their knowledge to real-world scenarios. They configure network devices, implement security measures, analyze network traffic, and design network solutions to meet specific requirements.

At the end of the course, students demonstrate their understanding and skills through a comprehensive final project, which may involve designing and implementing a network infrastructure, diagnosing and resolving complex network issues, or conducting a security assessment.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	Experiment with the concept of Computer Networking: Students will be able to configure different network devices such as routers, switches, and access points to create functional network topologies.
CLO 2	Implement the idea of assigning IP addresses, configuring VLANs, setting up routing protocols, and implementing security measures like access control lists (ACLs).
CLO 3	Evaluate the basic concepts of different components, implement optical fiber communication, communication channel modeling, WDM system, and analog and digital modulation schemes to implement a hybrid opto-wireless communication system.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	b	1/Analyze	Lecture, Problem	

CLO2	e	1/Apply	Lecture, Problem	
CLO3	e	1/Understand	Lecture, Problem	

Part B – Content of the Course

14. Course Content:

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Genome rearrangements, DNA sequence alignments, Combinatorial pattern matching, Statistical and machine learning methods in bioinformatics	**Diminish** important algorithms used in bioinformatics
2	DNA sequencing, genome sequencing, protein sequencing, BLAST, FASTA, Genome assembly, graph-based assembly, Expression analysis, Clustering and classification	**Illustrate** several leading bioinformatics tools to solve biological problems
3	Database search, BLAST, FASTA, Genome assembly, Expression analysis	**Explore** the function and organization of bioinformatics databases, and how they support various types of bioinformatics analysis

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Introduction to Networking and the Internet		Week 1	Lecture, PPT	Lab work, Assignment, Viva	CLO 1
Introducing LAN cables, connectors, cable tester, clamping tools, and preparing cross-over and straight cable for a LAN		Week 2		Lab work, Assignment, Viva	CLO 1
Configuring Local Area Network, IPV4 VLSM calculation,		Week 3		Lab work, Assignment, Viva	CLO 2

Static Routing					
Introduce network devices, i.e., Router, Switch		Week 4		Lab work, Assignment, Viva	CLO 1
Routing Protocols, RIP and RIPV2 configuration		Week 5		Lab work, Assignment, Viva	CLO 2
EIGRP		Week 6		Lab work, Assignment, Viva	CLO 1
OSPF		Week 7		Written Quiz, short question, Oral Exam	CLO 2
MID-TERM EXAMINATION				Written Quiz, short question, Oral Exam	CLO 2
		Week 8		Written Quiz, short question, Oral Exam	CLO 2
		Week 9		Written Quiz, short question, Oral Exam	CLO 3
		Week 10		Written Quiz, short question, Oral Exam	CLO 3
		Week 11		Written Quiz, short question, Oral Exam	CLO 2
		Week 12		Written Quiz, short question, Oral Exam	CLO 2, CLO3
		Week 13		Written Quiz, short question, Oral Exam	CLO 2, CLO3
		Week 14		Written Quiz, short question, Oral Exam	CLO 2, CLO3
FINAL EXAMINATION					CLO1, CLO 2, CLO3

17. Teaching-Learning Strategies:

18. Assessment Techniques of each topic of the course:

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignment in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

CIE- Continuous Evaluation (100 Marks)

Bloom's Category Marks (out of 50)	Exercises (50)	Assignments (20)	Project (30)
Remember			
Understand	**20**		
Apply	**20**		
Analyze	**10**		
Evaluate			
Create			

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Exercises 50%
2. Assignments 20%
3. Project 30%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75

70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Bioinformatics Algorithms an active approach by Phillip Compeau & Pavel Pevzner.

Reference Books & Materials

2. Neil C. Jones and Pavel A. Pevzner. An introduction to bioinformatics algorithms

Course Outline – Software Engineering

Part A – Introduction

1.	**Course No. / Course Code**	**:**	CSE 313
2.	**Course Title**	**:**	Software Engineering
3.	**Course Type**	**:**	Core course
4.	**Level/Term and Section**	**:**	6th Semester (3rd Year/2nd Semester)
5.	**Academic Session**	**:**	Fall 2023
6.	**Course Instructor**	**:**	Fahad Ahmed
7.	**Prerequisite (If any)**	**:**	CSE 305
8.	**Credit Value**	**:**	3.0
9.	**Contact Hours**	**:**	3.0
10.	**Total Marks**	**:**	100

11. Course Objectives and Course Summary:

The objectives of this course are to:

1. **Describe** the basic software engineering methods, models, patterns and their appropriate application.
2. **Relate** the software requirements, SRS document, object-oriented analysis and UML diagrams.
3. **Explain** different software testing approaches, verification, validation and quality control.
4. **Explain** different types of software process models and risk management systems, software evolution and related issues such as version management.
5. **Provide** the knowledge to design and implement of different software process models in different systems and how to ensure good quality software.
6. An **Ability** to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions globally.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Understand** the basic concept of software engineering, software engineering models, various architecture styles, patterns, diagrams, requirement specifications and testing methods that are used to design and develop real-life software applications.
CLO 2	**Identify** appropriate software process model, application framework or web services, design pattern: architecture, interface, data according to requirements, testing techniques for developing and verifying the real-life software applications.
CLO 3	**Predict** project operating cost and estimated time for project evaluation by applying management principles and economic decision model.
CLO 4	**Explain** the impact of software engineering solutions in terms of security and safety, public health and welfare, as well as cultural, social, and economic factors that lead to sustainable development for the upcoming industrial revolution.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	1	1/Understand	Lecture, multimedia, Books	Mid and Final Exam
CLO2	2	1/Analyze	Lecture, multimedia, Books	Quiz(1,2,3), Assignment, Mid and Final Exam
CLO3	11	1/Apply	Lecture, multimedia, Books	Final Exam
CLO4	6	1/Understand	Lecture, multimedia, Books	Final ExamQuiz(4)

Part B – Content of the Course

14. Course Content:

Software Engineering Concept: Introduction, global software market: industry trends and IT sector of Bangladesh, key challenges, software engineering and web 3.0, 4IR, cloud-based software engineering, modern software engineering methodologies for mobile environments, green software engineering and sustainable development with 4IR, software engineering ethics. **Project Management:** Software planning, Software Project Management, schedule: people and effort, timeline and schedule, risk: identification, refinement, mitigation, **Software Requirements:** System requirement specification (SRS): elementary business logic, function description, priority, dependency, nonfunctional requirement, **Cost Factors:** Software engineering cost model (CoCoMo) **Software Process Model:** prescriptive model: waterfall model, v model, evolutionary model: spiral, incremental model: Agile, DevOps, **Design:** Software Design Principles, Strategy of Design: Coupling and Cohesion, Architectural Design, Distributed Systems Architectures, Client-Server Architecture, refinement, refactoring **Interface Design:** interface design pattern**, Data Design:** data design standard and practice. **Development:** Coding Standards and Guidelines, Coding Documentation, Software Reuse, Application Frameworks, Dev-Ops and collaborative software development, Application Programming Interface(API): REST-API. **Software Security**: Basic Software Security concepts, risk management and its solutions. **Verification and Validation:** Planning verification and validation, Software inspections, Verification and formal methods, Cleanroom software development, **Software Testing:** Software Testing Principles, Testing Guidelines, Testing Process, Testing Types: Manual and automated, Testing Documentation, **Software Quality:** Testing vs. QA, QC and Audit, ISO 9000 Certification, Six Sigma. **Software Maintenance:** Types of Software Maintenance, Causes of Software Maintenance Problems, Software Maintenance Supportability

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Software Engineering Basic Concept	CLO1
2	Project Planning and Management	CLO3
3	Software Process Model	CLO2
4.	Software Design Architecture	CLO2
5.	Software Security	CLO4
6.	Software Testing and Quality Assurance	CLO2, CLO4

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Introduction to Software Engineering: software as a product, different types of software, global software market – industry trends and forecast, it sector of Bangladesh, key challenges facing software engineering	Basic knowledge of Software Engineering and software industry market.	Week 1	Search Job requirements in national and international job-related websites	Lecture, multimedia, Discussions	CLO1
Software engineering and web 3.0, 4IR, cloud-based software engineering, modern software engineering	integration of web 3.0 technologies into software engineering practices, leveraging cloud-	Week 2	Learn cutting-edge technologies of the software industry.	Lecture, multimedia, Web references, Discussions	CLO1,CO4

methodologies for mobile environments, green software engineering and sustainable development with 4IR, software engineering ethics	based solutions for development, implementing agile methodologies tailored for mobile environments				
Project Management: Software project management, The 4 P's, Management activities, Project planning, Risk management	planning, execution oversight, and risk management ensure successful software development project delivery	Week 3	Open any version control account	Lecture, multimedia , Discussion s	CLO1, CLO3
Software Requirements: Requirements Engineering (RE),RE Document, RE Process, Feasibility Studies Requirements Elicitation and Analysis, Requirements Validation And Management. **Cost Factors:** Software engineering cost model (CoCoMo)	writing well-documented requirements, streamlined processes, effective feasibility studies, and accurate cost estimation using the CoCoMo model.	Week 4	Create SRS documents for software from customers.	Lecture, multimedia , Problem Solving	CLO1, CLO3
Software Process Models: SDLC, Software Process Model, Waterfall Model, RAD Model, Spiral Model Incremental Model, V-Model, Agile Model, Big bang model, Prototype Model, Agile, DevOps, Comparison among Various SDLC Models	include improved development efficiency, quality assurance, project management effectiveness, and streamlined software delivery.	Week 5	Make a group for their project in the Software Engineering Lab and follow the process model.	Lecture, multimedia ,Problem Solving, Problem Solving, Group discussion	CLO2

Agile, DevOps, Comparison among Various SDLC Models, Case Study	Agile emphasizes flexibility and iterative development, while DevOps focuses on collaboration and continuous integration/continuous delivery (CI/CD).	Week 6	Make a group for their project in the Software Engineering Lab and follow the process model.	Lecture, multimedia, Problem Solving, Problem Solving, Group discussion	CLO2
Software Design: Software Design, Design Principles, Strategy of Design Coupling and Cohesion, Dependency Injection, Architectural Design, SOLID, Abstract machine (layered) with some **case study**.	focuses on principles, strategies, coupling, cohesion, dependency injection, architectural design, and adhering to SOLID principles for robust systems.	Week 7	Design at least one design pattern in their project..	Lecture, multimedia, Coding	CLO2
Distributed software Architecture, Client-Server Architecture, Broker Architectural Style: CORBA, Service-Oriented Architecture (SOA).	Apply distributed software architecture includes client-server, broker (CORBA), and service-oriented architecture (SOA) for scalable and interoperable systems.	Week 8	Design at least one design pattern in their project.	Lecture, Multimedia, Coding	CLO2
Development: Agile methods, Extreme programming, Coding, Coding Standards and Guidelines, Coding Documentation, Software Reuse, Application Frameworks, Model-View-Controller pattern, WAF Features, Dev-Opps and collaborative software	Software reuse leverages application frameworks like MVC for structured development, integrates WAF features, supports DevOps for collaborative development, and implements REST	Week 9	Implement at least one design pattern in their project in corresponding lab course	Lecture, Multimedia, Coding	CLO2

development., API: REST	APIs for interoperability.				
Software Security: Basic Software Security concepts, risk management and its solutions, Web-based attack and solutions, .System based attacks and solutions	enhanced system resilience, reduced vulnerabilities, and strengthened protection against cyber threats through proactive security measures.	Week 10	Create a Vulnerability Assessment and Penetration Testing report for their project in corresponding lab course	Lecture, multimedia	CLO4
Software Testing: Verification and Validation: Planning verification and validation, Software inspections, Automated static analysis, Verification and formal methods, Cleanroom software development	planned verification/validation, effective inspections, automated static analysis, formal verification, and cleanroom software development ensuring reliability and quality.	Week 11	Create a Vulnerability Assessment and Penetration Testing report for their project in corresponding lab course	Lecture, multimedia,	CLO2
Software Testing: Software Testing Principles, Testing Guidelines, Testing Process , Testing Types: Manual & Automated, Black-box Testing & White-box Testing, Grey-box Testing.Unit Testing , Integration Testing System Testing And It Types Acceptance Testing, Testing Documentation	Apply rigorous testing processes, effective test guidelines, diverse testing types, and comprehensive validation across unit, integration, system, and acceptance testing.	Week 12	Create a Vulnerability Assessment and Penetration Testing report for their project in corresponding lab course	Lecture, multimedia	CLO2
Software Quality andMaintenance :	improved quality through ISO 9000	Week 13		Lecture, multimedia,	CLO2, CLO4

Testing vs. QA, QC and Audit ISO 9000 Certification, Six Sigma.Types of Software Maintenance, Causes of Software Maintenance Problems, Software Maintenance,	certification, efficiency via Six Sigma, and effective software maintenance strategies				
Emerging Technologies in upcoming Software industry + Review Class	enhanced efficiency of applications, innovation in AI, blockchain, IoT, and cybersecurity advancements shaping future software industries.	Week 14		Lecture, multimedia ,	CLO1
FINAL EXAMINATION					

17. Teaching-Learning Strategies:

Strategies	Topics
Active Learning and Discussions	Overview of software development life cycles, Importance of collaboration and communication, Requirements Gathering and Analysis
Problem-Based Learning	Software Process Model Design Principles and Patterns, Software Testing and Debugging
Case-Based Learning	Software Architectural Design, Cloud-based Software Engineering
1.1.1 Simulations and Role-Playing	Agile Development and Scrum, DevOps and Continuous Integration, Security and Ethical Considerations

18. Assessment Techniques of each topic of the course:

SL. No	Topics / Content	Assessment Techniques
1	Software Engineering Basic Concept	Mid Term Exam
2	Project Planning and Management	Mid-Term Exam, Quiz-01
3	Software Process Model	Mid-Term Exam, Quiz-02, Final Exam
4.	Software Design Architecture	Quiz-03, Final Exam
5.	Software Security	Quiz-04, Final Exam
6.	Software Testing and Quality Assurance	Final Exam

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester, 2 class tests will be taken for midterm and 2 class tests will be taken for final term. 3 out of 4 class tests will be considered. Best two from Quiz-1, Quiz-2 & Quiz-3, and Quiz-4 will be considered. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category	Marks (out of 30)
Remember	
Understand	**10**
Apply	
Analyze	**20**
Evaluate	
Create	

SMEB- Semester Mid & End Examination (70 Marks)

Bloom's Category	Marks (out of 70)
Remember	
Understand	30
Apply	10
Analyze	30
Evaluate	
Create	

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual students will be evaluated based on the following criteria with respective weights.

1. Assessment 30%
2. Mid-Term and Eid (Final) Examination 70%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

<u>Part D – Learning Resources</u>

21. Text Book

1. Software Engineering by Sommerville, 8th Edition , 10th Edition
2. Design Patterns: Elements of Reusable Object-Oriented Software" by Erich Gamma, Richard Helm, Ralph Johnson, and John Vlissides

Reference Books & Materials

1. Software Engineering a practitioner's approach - Roger S. Pressman, McGraw-Hill Book Company
2. Software Engineering (3rd ed.) by Aggarwal K.K., Singh Yogesh, K.K. Aggarwal, and Yogesh Singh
3. Agile Testing: A Practical Guide for Testers and Agile Teams 1st Edition by Lisa Crispin (Author), Janet Gregory (Author)

Course Outline – Software Engineering Lab

Part A – Introduction

1.	**Course No. / Course Code**	**:** CSE 314
2.	**Course Title**	**:** Software Engineering Lab
3.	**Course Type**	**:** Core Course
4.	**Level/Term and Section**	**:** 3-2
5.	**Academic Session**	**:** Fall-2023
6.	**Course Instructor**	**:** Nipa Anjum, Lecturer
7.	**Credit Value**	**:** 1.5
8.	**Contact Hours**	**:** 3.00/week
9.	**Total Marks**	**:** 100

10. **Course Objectives and Course Summary:** The objectives of this course are to:

1. **Provide** the knowledge to design and implementation of different software process models in different systems and ensure good quality software.
2. **Ensure** industrial state of the practice methods of verifying high-assurance software-intensive system**.**
3. **An Ability** to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global.

Continued from CSE 306, the course emphasize to learn different principles and practices of modern software engineering and the challenges faced in the industry and their resolutions. This course enhances the skills of using different modern tools and languages to analyze, design and testing a real-life complex software system.

11. **Course Learning Outcomes: at the end of the Course, the Student will be able to –**

CLO 1	**Develop** a solution for complex engineering problems using industrial state software engineering methodologies.
CLO 2	**Identify** the requirements of that complex engineering problem by applying principles of software engineering.
CLO 3	**Implement** a working solution for the proposed software-intensive systems.
CLO 4	**Use** a modern/popular IDE to implement complex software-intensive system solutions.
CLO 5	**Assess** societal, health, safety, legal and cultural issues related to the project.
CLO 6	**Recognize** ethical and professional responsibilities in engineering situations.
CLO 7	**Working** effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and

	meet objectives.
CLO 8	**Communicate** effectively, in both oral and written documents on the project.
CLO 9	**Apply** project management principles using a Version Control System, and predict project operating cost and time for complex software-intensive systems.

12. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	l	1/Create	Lecture	Report
CLO2	b	1/Apply	Lecture	Report + Presentation on project idea
CLO3	c	1/Apply	Practice	Continuous Project Evaluation, project demonstration(Video), Report
CLO4	e	1/Apply	Practice	Continuous Project Evaluation
CLO5	f	1/Understand	Lecture	Report
CLO6	h	3/Valuing	Lecture	Viva
CLO7	i	3/Characterizing	Group practice	Continuous Project Evaluation, Viva
CLO8	j	1/Apply	Lecture (report format)	Report, Viva
CLO9	k	1/Apply	Lecture	Report

Part B – Content of the Course

13. Course Content:

Basic concept of complex engineering problem, characteristics and activities, and Project requirement, Discussion on societal, health, safety, legal and cultural issues related to the project, Project management principles, Ethical and professional responsibilities. **Software Engineering Concept**: Introduction, global software market: industry trends and IT sector of Bangladesh, key challenges, software engineering and web 3.0, 4IR, cloud-based software engineering, modern software engineering methodologies for mobile environments, green software engineering and sustainable development with 4IR, software engineering ethics. **Project Management:** Software planning, Software Project Management, schedule: people and effort, timeline and schedule, risk: identification, refinement, mitigation, **Software Requirements:** System requirement specification (SRS): elementary business logic, function description, priority, dependency, nonfunctional requirement, **Cost Factors:** Software engineering cost model (CoCoMo) **Software Process Model:** prescriptive model: waterfall model, v model, evolutionary model: spiral, incremental model: Agile, DevOps, **Design:** Software Design Principles, Strategy of Design: Coupling and Cohesion, Architectural Design, Distributed Systems Architectures, Client-Server Architecture, refinement, refactoring **Development:** Coding Standards and Guidelines, Coding Documentation, Software Reuse, Application Frameworks, Dev-Ops and collaborative software development, Application Programming Interface(API): REST-API. Version control system. **Software Security**: Basic Software Security concepts, risk management and its solutions. **Verification and Validation:** Planning verification and validation, Software inspections, Verification and formal methods, Cleanroom software development, **Software Testing:** Software Testing Principles, Testing Guidelines, Testing Process, Testing Types: Manual and automated, Testing Documentation, **Software Quality:** Testing vs. QA, QC and Audit, ISO 9000 Certification, Six Sigma. **Software Maintenance:** Types of Software Maintenance, Causes of Software Maintenance Problems, Software Maintenance Supportability

14. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Basic concept of complex engineering problem, characteristics and activities, and Project requirement, Discussion on societal, health, safety, legal and cultural issues related to the project, Project management principles, Ethical and professional responsibilities.	CLO1, CLO2, CLO5,CLO6
2	Introduction to software engineering and software requirement	CLO1, CLO2, CLO3, CLO9
3	Introduction to Testing, introduction to software quality assurance, how to write test case, Manual testing.	CLO2, CLO7
4	Software process model [Agile] Software design pattern [MVC]	CLO2, CLO3, CLO7
5	Collaborative development: version control system	CLO4, CLO7, CLO9
6	Introduction to automated Testing, Selenium platform, Installing Selenium and Pycharm, WebDriver installation; Synching project repository. Demonstrating WebDriver Commands with python and Selenium, WebDriver Input Box and Test Box.; Working with Radio Buttons, Check Boxes, Drop Down list, Links etc. Scrolling Web Pages, Working with Links. Concept of system testing, functional and non-functional, introduction to load testing, performance testing, security testing	CLO3, CLO4, CLO7
7	VAPT Recognition, SQL Injection, HTML Sanitization and Play rollback	CLO3, CLO4, CLO7

15. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Program Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Basic concept of complex engineering problem, characteristic and activities, and Discussion on societal, health, safety, legal and cultural issues related to the project, Ethical and professional responsibilities	l, b, f, h	Week 1	PPT Slides, Reference links	Lectures, Individual Tasks	CLO1, CLO2, CLO5 CLO6
Introduction to software engineering, project Management and project requirement	l, b, c, k	Week 2	PPT Slides, Reference links	Lectures, Individual Tasks	CLO1, CLO2, CLO3, CLO9
Designing a systems using a data flow diagram, entity relationship diagram and various UML diagrams to represent and solve common business solutions	c, e	Week 3	PPT Slides, Reference links	Lectures, Individual Tasks	CLO3, CLO4
Project Idea Sharing (Presentation), Software process model [Agile] Software design pattern [MVC]	b, c, i	Week 4	PPT Slides, Reference links, Testing practice	Lectures, Group Presentation	CLO2, CLO3, CLO7
Collaborative development:	e, i, k	Week 5	Reference links	Lectures, Practice	CLO4, CLO7, CLO9

version control system					
Project Update-01 Introduction to Testing, introduction to software quality assurance, how to write test case, Manual testing.	b, i	Week 6-Week7	Reference links, Implementation in group project	Lectures, Group Tasks	CLO2, CLO7
Introduction to automated Testing, Selenium platform, Installing Selenium and Pycharm, WebDriver installation; Synching project repository. Demonstrating WebDriver Commands with python and Selenium, WebDriver Input Box and Test Box.; Working with Radio Buttons, Check Boxes, Drop Down list, Links etc. Scrolling Web Pages, Working with Links. Project Update-02	c, e, i	Week 8	Reference links, Testing practice	Lecture, Group Tasks	CLO3, CLO4, CLO7
Project update-04 : Generate automated testing	c, e, i	Week 9	PPT Slides, Reference links, Testing practice	Lecture, Demonstration, Individual Tasks	CLO3,CLO4,CLO7

report (at least up to login system) Concept of system testing, functional and non-functional, introduction to load testing, performance testing					
Security Testing	c, e, i	Week 10	PPT Slides, Reference links, Testing practice	Lecture, Demonstration, Individual Tasks	CLO3, CLO4, CLO7
VAPT Recognition, SQL Injection, HTML Sanitization and Play rollback	c, e, i	Week 11-13	PPT Slides, Reference links, practice	Lecture, Demonstration, Individual Tasks	CLO3, CLO4, CLO7
Final Project Demonstration, Report submission & Viva	l, b, c, e, f, h, i, j, k	Week 14		Demonstration, viva	CO1-9

16. Teaching-Learning Strategies:

There will be lecture sessions for delivering foundational knowledge, interactive group discussions to foster critical thinking and collaboration, problem-solving activities to promote analytical skills and practical application of concepts, and hands-on laboratory work for experiential learning. This holistic approach aims to cater to various learning styles, ensuring a dynamic and effective educational experience for all students.

17. Assessment Techniques of each topic of the course:

SL. No	Topics / Content	Assessment Technique
1	Basic concept of complex engineering problem, characteristics and activities, and Discussion on societal, health, safety, legal and cultural issues related to the project, Ethical and professional responsibilities	Report + Presentation
2	Introduction to software engineering, project management principles and project requirement	Presentation
3	Introduction to Testing, introduction to software quality assurance, how to write test case, Manual testing.	Report

4	Software process model [Agile] Software design pattern [MVC]	Implement and Project Evaluation
5	Collaborative development: version control system	Continuous Project Evaluation
6	Introduction to automated Testing, Selenium platform, Installing Selenium and Pycharm, WebDriver installation; Synching project repository. Demonstrating WebDriver Commands with python and Selenium, WebDriver Input Box and Test Box.; Working with Radio Buttons, Check Boxes, Drop Down list, Links etc. Scrolling Web Pages, Working with Links. Concept of system testing, functional and non-functional, introduction to load testing, performance testing,	Report
7	VAPT Recognition, SQL Injection, HTML Sanitization and Play rollback	Report

Part C – Assessment and Evaluation

18. Assessment Strategy

Presentation: Students will have to present their project idea after forming a group of 5 members (Max 6). They will also need to submit a video demonstration of their project idea where existing features will be shown and discuss what will be their contribution to the project.

Technical Report: There will be two technical reports submitted by each group. The first report will be the project proposal and the second report will be the final one which will need to be submitted before final project submission.

Viva: Evaluating the final project, each student will be asked questions related to their project.

Continuous Project Evaluation: Students need to give update of their project every week. Each of the students must be present during this evaluation.

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 30)	Presentation (10)	Continuous Project Evaluation (20)
Remember		
Understand		
Apply	10	20
Analyze		
Evaluate		
Create		

SMEB- Semester Mid & End Exanimation (70 Marks)

Bloom's Category	Technical Report Writing	Viva
Remember		

Understand	5	
Apply	35	5
Analyze		
Evaluate		
Create	10	5
Valuing		5
Characterization		5

19. Evaluation Policy

Grades will be calculated as per the university grading structure and individual students will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

20. Text Book

1. Head First Design Patterns (A Brain Friendly Guide)
2. Advanced Selenium Web Accessibility Testing: Software Automation Testing Secrets Revealed by Narayanan Palani

Course Outline: Microprocessors and Microcontrollers

Part A – Introduction

1.	**Course Code:**	CSE 315
2.	**Course Title:**	Microprocessors and Microcontrollers
3.	**Course Type:**	Core course
4.	**Level:**	3^{rd} year 2^{nd} Semester
5.	**Academic Session:**	Fall 2023
6.	**Course Instructor:**	Shaila Rahman (SHR), Assistant Professor-Sec A, D
	i.	Asma Mariam(ASM), Lecturer-Sec B,C
7.	**Prerequisite:**	None
8.	**Credit Value:**	3.0
9.	**Contact Hours:**	3.0
10.	**Total Marks:**	100

Course Objectives and Course Summary:

The objectives of this course are to:

1. **Explain** Instruction set, addressing modes of Instructions (Data Transfer, Arithmetic, Logical, String, Stack, I/O etc. related instructions) of 8086 Microprocessor
2. P**rovide** knowledge on microprocessors. Introduction to Intel Corporation, Internal architecture of a general purpose microprocessor and its operation, Intel 8086 Microprocessor features, Architecture, Register Set, Memory Management, Segmentation
3. S**olve** Program Development and problem solving using Assembly Language Programming.
4. **Demonstrate** 8086 System Design in different modes (Minimum and Maximum) including hardware details, functions & operations of Pins of Intel 8086 and associated interfacing components, Bus Operation and Interrupts. Pipelining, Evaluation of 8086 series.

The course will offer a comprehensive Introduction to Intel microprocessor family. 8086 architecture, pipelining concept, addressing modes, Instruction format, Instruction set, Bus cycle, 8086 system design, Interrupt system, Interfacing, Assembly language programming using 8086 instruction set for arithmetic logic and decision making, looping ,string and arrays and DOS interrupts.

Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	Interpret microprocessor and microcontroller's internal architecture and their operation.
CLO 2	Analyze how the high-level language structure is converted to low level languages and how a processor executes a program line by line.
CLO 3	Design programs to interface microprocessor to external devices and design a microcontroller-based system.
CLO 4	Apply knowledge and programming proficiency using various addressing modes and data transfer instructions of the target microprocessor and solve assembly language programs.

Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

*Note: Course Outcome (CO) is the same as the Course Learning Outcome (CLO) and Program Outcome (PO) is the same as the Program Learning Outcome (PLO).

CLO No.	CLO Statements: Upon successful completion of the course, students should be able to:	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	Interpret microprocessor and microcontroller's internal architecture and their operation.	e	1, 2/Remember, Understand	Lecture, Classwork, Assignments	Quiz, Written exam
CLO2	Analyze how the high-level language structure is converted to low level languages and how a processor executes a program line by line.	a	4/Analyze	Lecture, Classwork, Assignments	Quiz, Written exam

CLO3	Design programs to interface microprocessor to external devices and design a microcontroller-based system.	d	3, 6/Apply, Create	Lecture, Classwork, Assignments	Quiz, Written exam
CLO4	Apply knowledge and programming proficiency using various addressing modes and data transfer instructions of the target microprocessor and solve assembly language programs.	b	3, 5/Apply, Evaluate	Lecture, Classwork, Assignments	Quiz, Written exam

<u>Part B – Content of the Course</u>

Course Content:

Alignment of topics of the course with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	knowledge on microprocessors, architecture, functional units, registers, memory Management, Stack	CLO1
2	Instruction set, addressing modes and Instructions (Data Transfer, Arithmetic, Logical, String, Stack, I/O etc.) of 8086. Microprocessor	CLO2
3	Program Development and problem solving using Assembly Language Programming.	CLO3
4.	8086 system design and in different modes, Pipelining, evaluation of different processors including hardware detail. Recognize the need and have the preparation and ability to engage in independent and life- long learning in the broadest context of Microprocessor evaluation.	CLO4

Class Schedule/Lesson Plan/Weekly plan:

Topics	**Specific Outcome (s)**	**Time Frame**	**Suggested Activities**	**Teaching Strategy (s)**	**Alignment with CLO**
Introduction to Microprocessors, 8086 Microprocessors its Features. 8086 Architecture, Functional units,		Week 1		Lecture, Multimedia	CLO1

8086 Pipelining Concept. 8086 registers		Week 2		Lecture, Multimedia ,	CLO1
Introduction to IBM PC Assembly Programming Language, Assembly Language programming structure, Model, Instructions and Operands, Different Arithmetic Instructions. CT1: Class Test 1		Week 3		Lecture, Multimedia	CLO2
BIOS and DOS Interrupts, ASCII codes, Input/output Operations using DOS functions.		Week 4		Lecture, Multimedia	CLO2
8086 Flag Register, Memory Segmentation, Physical Address Calculation, and Instruction set. Effect of flag after different instruction execution.		Week 5		Lecture, Multimedia	CLO2
Addressing Modes- Finding the addressing mode of an operand in instruction CT2: Class Test 2		Week 6		Lecture, Multimedia	CLO2
Flow control instructions, Decision making		Week 7		Lecture, Multimedia	CLO3
MID SEMESTER EXAMINATION					
Different Logic, shift and rotate instructions,		Week 8		Lecture, Multimedia	CLO2
The stack and introduction to procedures, Multiplication and division instructions,		Week 9		Lecture, Multimedia	CLO3
8086 hardware details, functions & operations of pins & signals of Intel 8086, Minimum versus Maximum mode operation CT3: Class Test 3		Week 10			CLO4
System design in Minimum and Maximum modes and associated interfacing components		Week 11		Lecture, Multimedia	CLO4
Bus Operation, Processor Read & Write bus cycles		Week 12		Lecture, Multimedia	CLO4

CT4: Class Test 4					
Interrupts and Interrupt Handing system design using 8086, Basic I/O Interfacing: Parallel I/O, Programmed I/O		Week 13, 14		Lecture, Multimedia	CLO4
Architectural overview of advanced Intel Processors- 80186/80286/80386/80486/Pentium/Pentium Pro/ Duel Core/ Core i3, i5,i7,i9		Week 14		Lecture, Multimedia	CLO4
FINAL EXAMINATION					

Teaching-Learning Strategies:

Assessment Techniques of each topic of the course:

Part C – Assessment and Evaluation

Assessment Strategy

Class Tests: Altogether 5 class tests may be taken during the semester, 3 class tests will be taken for midterm and 2 class tests will be taken for final term. 3 out of 5 class tests will be considered. CT1, best of CT2 & CT3, and best of CT4 & CT5 will be considered. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: Assignment (Written and/or presentation.) will be given throughout the semester. Late submission will result in a 50% deduction in score. Students will have to do the presentation on the given topic as an assignment.

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 30)	Tests (20)	Assignments (10)
Remember		
Understand		
Apply	20	10
Analyze		
Evaluate		
Create		

SMEB- Semester Mid & End Examination (70 Marks)

Bloom's Category	**Test**
Remember	14
Understand	
Apply	42
Analyze	14
Evaluate	
Create	

Evaluation Policy

Grades will be calculated as per the university grading structure and individual students will be evaluated based on the following criteria with respective weights.

1. Assessment 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

Text Book

1. Barry B. Brey, The Intel Microprocessors, Processor Architecture, Programming, and Interfacing, Eighth Edition, 2009, Prentice Hall
2. Douglas V. Hall, Microprocessors and Microcomputer Based System Design, McGraw-Hill.
3. M. Rafiquzzaman., Microprocessors Theory and Applications: Intel and Motorola, 2003, Prentice Hall of India. Pvt. Ltd., New Delhi, 6.
4. Assembly Language Programming and Organization of the IBM PC by Ytha Yu and Charles Marut.

Course Outline: Microprocessors and Microcontrollers Lab

Part A – Introduction

1.	**Course Code:**	CSE 316
2.	**Course Title:**	Microprocessors and Microcontrollers Lab
3.	**Course Type:**	Core course
4.	**Level:**	3rd year 2nd Semester
5.	**Academic Session:**	Fall 2023
6.	**Course Instructor:**	Shaila Rahman, Asma Mariam
7.	**Prerequisite:**	None
8.	**Credit Value:**	1.5
9.	**Contact Hours:**	3.0
10.	**Total Marks:**	100

Course Objectives and Course Summary:

The objectives of this course are to:

1. To achieve practical knowledge on the low-level language of microprocessors. To obtain an understanding of microprocessor-based systems and their use in instrumentation, control and communication systems.
2. Investigate microprocessor and microcontroller-based systems and produce software for a microprocessor-based system, interface microprocessor-based systems and understand usage of programmable logic controllers.

The course will offer a comprehensive Introduction to Intel microprocessor family. 8086 architecture, pipelining concept, addressing modes, Instruction format, Instruction set, Bus cycle, 8086 system design, Interrupt system, Interfacing, Assembly language programming using 8086 instruction set for arithmetic logic and decision making, looping ,string and arrays and DOS interrupts.

Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	Understand how low-level languages are implemented and how a processor executes a program line by line
CLO 2	Design basic assembly programs using the microprocessor 8086 and interface with its associated components.
CLO 3	Experiment using a microcontroller in a group project.

Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

*Note: Course Outcome (CO) is the same as the Course Learning Outcome (CLO) and Program Outcome (PO) is the same as the Program Learning Outcome (PLO).

CLO No.	CLO Statements: Upon successful completion of the course, students should be able to:	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	Understand how low-level languages are implemented and how a processor executes a program line by line	d	1, 2, 3/Remember, Understand, Apply	Lecture, Classwork, Assignments	Quiz, Written exam
CLO2	Design basic assembly programs using the microprocessor 8086 and interface with its associated components.	a, e	3, 4, 6/Apply, Analyze, Create	Lecture, Classwork, Assignments	Quiz, Written exam
CLO3	Experiment using a microcontroller in a group project.	e, l	3, 4, 6/Apply, Analyze, Create	Lecture, Classwork, Assignments	Quiz, Written exam

Part B – Content of the Course

Course Content:
Alignment of topics of the course with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	knowledge on microprocessors, architecture, functional units, registers, memory Management, Stack	CLO1
2	Instruction set, addressing modes and Instructions (Data Transfer, Arithmetic, Logical, String, Stack, I/O etc.) of 8086. Microprocessor	CLO2
3	Program Development and problem solving using Assembly Language Programming.	CLO3
4.	8086 system design and in different modes, Pipelining, evaluation of different processors including hardware detail. Recognize the need and have the preparation and ability to engage in independent and life- long learning in the broadest context of Microprocessor evaluation.	CLO3

Class Schedule/Lesson Plan/Weekly plan:

Topics	**Specific Outcome (s)**	**Time Frame**	**Suggested Activities**	**Teaching Strategy (s)**	**Alignment with CLO**
Introduction to Microprocessors, 8086 Microprocessors its Features. 8086 Architecture, Functional units,		Week 1		Lecture, Multimedia	CLO1
8086 Pipelining Concept. 8086 registers		Week 2		Lecture, Multimedia ,	CLO1
Introduction to IBM PC Assembly Programming Language, Assembly Language programming structure, Model, Instructions and Operands, Different Arithmetic Instructions. CT1: Class Test 1		Week 3		Lecture, Multimedia	CLO2
BIOS and DOS Interrupts, ASCII codes, Input/output Operations using DOS functions.		Week 4		Lecture, Multimedia	CLO2

8086 Flag Register, Memory Segmentation, Physical Address Calculation, and Instruction set. Effect of flag after different instruction execution.		Week 5		Lecture, Multimedia	CLO2
Addressing Modes- Finding the addressing mode of an operand in instruction CT2: Class Test 2		Week 6		Lecture, Multimedia	CLO2
Flow control instructions, Decision making		Week 7		Lecture, Multimedia	CLO3
MID SEMESTER EXAMINATION					
Different Logic, shift and rotate instructions,		Week 8		Lecture, Multimedia	CLO2
The stack and introduction to procedures, Multiplication and division instructions,		Week 9		Lecture, Multimedia	CLO3
8086 hardware details, functions & operations of pins & signals of Intel 8086, Minimum versus Maximum mode operation CT3: Class Test 3		Week 10			CLO3
System design in Minimum and Maximum modes and associated interfacing components		Week 11		Lecture, Multimedia	CLO3
Bus Operation, Processor Read & Write bus cycles CT4: Class Test 4		Week 12		Lecture, Multimedia	CLO3
Interrupts and Interrupt Handing system design using 8086, Basic I/O Interfacing: Parallel I/O, Programmed I/O		Week 13, 14		Lecture, Multimedia	CLO3
Architectural overview of advanced Intel Processors-80186/80286/80386/80486/Pentium/Pentium Pro/ Duel Core/ Core i3, i5,i7,i9		Week 14		Lecture, Multimedia	CLO3
FINAL EXAMINATION					

Teaching-Learning Strategies:

Assessment Techniques of each topic of the course:

Part C – Assessment and Evaluation

Assessment Strategy
Class Tests: Altogether 5 class tests may be taken during the semester, 3 class tests will be taken for midterm and 2 class tests will be taken for final term. 3 out of 5 class tests will be considered. CT1, best of CT2 & CT3, and best of CT4 & CT5 will be considered. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: Assignment (Written and/or presentation.) will be given throughout the semester. Late submission will result in a 50% deduction in score. Students will have to do the presentation on the given topic as an assignment.

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 30)	Tests (20)	Assignments (10)
Remember		
Understand		
Apply	20	10
Analyze		
Evaluate		
Create		

SMEB- Semester Mid & End Examination (70 Marks)

Bloom's Category	**Test**
Remember	14
Understand	
Apply	42
Analyze	14
Evaluate	
Create	

Evaluation Policy

Grades will be calculated as per the university grading structure and individual students will be evaluated based on the following criteria with respective weights.

4. Assessment 30%
5. Term Examination 50%
6. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75

50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

Text Book

5. Barry B. Brey, The Intel Microprocessors, Processor Architecture, Programming, and Interfacing, Eighth Edition, 2009, Prentice Hall
6. Douglas V. Hall, Microprocessors and Microcomputer Based System Design, McGraw-Hill.
7. M. Rafiquzzaman., Microprocessors Theory and Applications: Intel and Motorola, 2003, Prentice Hall of India. Pvt. Ltd., New Delhi, 6.
8. Assembly Language Programming and Organization of the IBM PC by Ytha Yu and Charles Marut.

Course Outline – Computer and Cyber Security

Part A – Introduction

1. **Course No. / Course Code** : CSE 317
2. **Course Title** : Computer and Cyber Security
3. **Course Type** : Core
4. **Level/Term and Section** : 3rd Year 2nd semester
5. **Academic Session** : Fall 2023
6. **Course Instructor** :
7. **Pre-requisite (If any)** : N/A
8. **Credit Value** : 3.0
9. **Contact Hours** : 3.0
10. **Total Marks** : 100

Course Objectives and Course Summary:

Rationale of the Course: Required course in the CSE program. This course builds on the fundamental concepts of cryptography, computer security, and cyber security. Standard methodologies and tools for the evaluation and application of organizational security policies related to confidentiality, integrity, and availability will also be covered.

12. Course Learning Outcomes: At the end of the course, student will be able to-

CO No.	CO Statements: Upon successful completion of the course, students should be able to:	Corresponding POs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools

CO 1	Understand the basic concepts related to computer security and identify the security vulnerabilities of networked systems and Digital Forensic.	1	Understand	Lecture, Classwork, Assignments	Quiz, Written exam
CO 2	Apply cryptographic algorithms for authentication, cryptanalysis, and steganography.	1	Apply	Lecture, Designing Flowcharts	Quiz, Written exam
CO 3	Analyzed the security threats on networked systems, assess the existing state of security, and deduce realistic security policies.	1	Analyzed	Lecture, Q&A	Assignment, Written exam, Quiz
CO 4	Design realistic prevention of intrusion and disaster recovery solutions; thus, able to write policy and action reports.	2	Development	Problem Solving, Practice sessions	Online Contest, Assignment, Written exam, Quiz

13. Mapping/ Alignment of CLOs to Program Learning Outcomes (PLOs):

	PLO 1	PLO 2	PLO3 3	PLO 4 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO1 10	PLO1 11	PLO1 2
CLO1	√											
CLO2		√										
CLO3		√		√						√		
CLO4			√								√	

<u>Part B – Content of the Course</u>

14. Course Content:

Introduction to the Fundamental Concepts of Computer Security; Well-known attack types and vulnerabilities; Social engineering attacks; Cryptography and classical cryptosystems; Authentication protocols and public key infrastructure; IPSec, VPNs, E-commerce issues; Attack classification and vulnerability analysis; Security models and policy issues; Security evaluation and auditing of networked systems; intrusion detection, prevention, response, containment (Digital Forensic Evidence) and disaster recovery; Network defense tools: Firewalls, VPNs, intrusion detection, and filters. Cyber-attack, data incident handling, new approaches to management of cybersecurity and new threats, vulnerabilities and controls.

Prerequisite: CSE 319 Computer Networks

16. Class Schedule/Lesson Plan/Weekly plan:

Weeks	Topics / Content	CO	Delivery methods	Materials
1	Topics of Discussion Basic computer and network security, Requirement to maintain a system. Expected Learning Outcome, Needs of computer security in the private and public network, Application of network security in real life	CO1	Lecture, Multimedia	Slides by teacher
2	Mechanism and attack of security. Identify the relationship between sender, receiver and third party. Explain the hierarchy of cryptograph	CO1	Lecture, Multimedia	Introduction to computers by Peter Norton Power Point Slides
3	Cryptography and Classifications Cryptographic algorithms, Cryptographies attacks, Expected Learning Outcome Knowledge of different cryptographic systems. Acquire knowledge about various encryption algorithm. Knowledge about different cryptographies attacks.	CO1	Lecture, Multimedia	PDF by teacher Class notes
4	Automatic key distribution and Message Authentication. One way hash function. Public key, Secure Sockets Layer, Handshake protocol, Expected Learning Outcome, Explain several keys. Message authentication methods. Able to know the properties of hash function Knowledge of Handshake protocol	CO2		
5	Network security issues, Basic security techniques. Expected Learning Outcome Explain the attack on different layers Able to learn about Hashing, Symmetric Key Cryptography	CO2	Lecture, Multimedia	PDF by teacher Class notes
6	Topics of Discussion Combinations of Basic Techniques Digital Signature and Signed Hashes Expected Learning Outcome Explain Hashing Message Authentication Code. Verify a Digital Envelope carrying Digitally Signed Data.	CO2		
7	Security and Network Layers Comparing IPSec, SSL/TLS, and SSH Expected Learning Outcome, Able to know	CO3	Lecture, Multimedia	Book- Kendall and Kendall Ch-04

	the implementation of Security at any of the network layers. Operate at different network layers.			
8	Fundamental of cipher text How do we distribute the keys? Expected Learning Outcome, Able to get basic idea of cipher text. Justify public and private keys.	CO3	Lecture, Multimedia	Intro to Computers (Book) Slides
9	How to apply firewall in public and private network? Students will share their knowledge about security..	CO3	Lecture, Multimedia	
10	Classification of firewall Firewall mode overview, Expected Learning Outcome, Identify and implement different firewall configuration strategies, Able to use a remote management system, can explain the positive effects of firewall.	CO3		
11	Configure DNS server on cisco router. ACL Lab example, ASA Firewall Lab example, expected Learning Outcome Basic command with configuration of ACL Configuring DNS server, unfit ASA Firewall	CO3	Lecture, Multimedia; Written Exam	Intro to Computers (Book) Slides
MID SEMESTER EXAMINATION				
12	Overview of VPN Classifications of VPNs, Expected Learning Outcome, how to build and operate a network. Able to explain different types of model.	CO4	Lecture, Multimedia	PDF
13	Attack classification and vulnerability analysis. Security models and policy issues	CO4	Lecture, Multimedia	Slides PDF
14	CT and Quiz:: Cyber-attack, data incident handling, new approaches to management of cybersecurity and new threats, vulnerabilities and controls	CO4	Lecture, Multimedia	Recommended Books Slides

17. Teaching-Learning Strategies:

18. Assessment Techniques of each topic of the course:

Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Multimedia	Quiz, Written Examination
CLO2	Lecture, Multimedia	Written Examination

CLO3	Lecture, Problem Solving	Quiz, Written Examination
CLO4	Lecture, Group Discussion	Quiz, Assignment, Written Examination

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester, 2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

20. Evaluation Policy

Assessment Type	% Weight	CO1	CO2	CO3	CO4
Final Examination:	**50%**			25	25
Mid Semester Examination:	**20%**	10	10		
Continuous Evaluation: Class performance, Short Quizzes, Problem Solving Sessions, Oral Exams	**30%**	5	10	5	10
Total	**100%**	15	20	30	35

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21.Text Book:

1. Cybersecurity: Public Sector Threats and Responses, Author(s): Kim J. Andersson, Series: Public Administration and Public Policy, Publisher: CRC Press

2. Cyber-Security and Information Warfare, Nicholas J. Daras

3. Cybercrime and Digital Forensics: An Introduction, By Thomas J. Holt, Adam M. Bossler, 2022, published by Routledge

4. Sanjib Sinha, Sanjib Sinha, and Karkal. Beginning Ethical Hacking with Kali Linux. Apress, 2018.

Reference Books:

1. Charles P. Pfleeger, Security in Computing, 5th Edition, Prentice Hall, 2015, ISBN-10: 0134085043,

Course Outline – Modern and Quantum Physics

Part A – Introduction

1.	**Course No. / Course Code**	**:** PHY 301
2.	**Course Title**	**:** Modern and Quantum Physics
3.	**Course Type**	**:** Core course
4.	**Level/Term and Section**	**:** 3rd year, 1st semester
5.	**Academic Session**	**:**
6.	**Course Instructor**	**:**
7.	**Pre-requisite (If any)**	**:** PHY 101
8.	**Credit Value**	**:** 3.0
9.	**Contact Hours**	**:** 3.0
10.	**Total Marks**	**:** 100

11. Course Objectives and Course Summary:

The objectives of this course are to:

1. Inform about the historical and theoretical background of modern physics.
2. Develop mathematical and theoretical intuition to interpret various quantum phenomena.
3. Show the relevance of quantum physics in computation.

This course provides a comprehensive overview of modern physics, starting with its historical development and the distinction between classical and modern physics. It delves into the various branches of modern physics, with a special focus on quantum physics, exploring quantum states, superposition, entanglement, and key phenomena like the photoelectric effect and Compton scattering. The course also covers the Schrödinger Equation, quantum mechanics, and the behavior of the hydrogen atom, including the uncertainty principle. Additionally, it introduces quantum computation, including qubits and gates, and quantum information theory, offering a deep understanding of the fundamental principles and applications of modern physics.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Understand** the basic principles of modern physics
CLO 2	**Develop** a strong background on quantum physics
CLO 3	**Analyze** different quantum phenomena
CLO 4	**Apply** quantum physics concepts to computational problems

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	1	1/Understand	Lecture, Multimedia, Group Discussion	Quiz, Written Examination
CLO2	1	1/Understand	Lecture, Theoretical explanation, Mathematical deduction, Active participation	Written Examination
CLO3	2	1/Analyze	Lecture, Case study, problem solving practice	Quiz, Assignment, Written Examination
CLO4	3	1/Apply	Lecture, Problem solving	Quiz, Written Examination

Part B – Content of the Course

14. Course Content:

Modern physics: brief history, difference between classical and modern physics, branches of modern physics, Quantum physics, **Quantum mechanics:** Introduction to quantum states, superposition, entanglement, photoelectric effect, Compton scattering, De Broglie wavelength, Galilean Transformations, Schrödinger Equation, angular momentum in quantum mechanics, structure and behavior of the hydrogen atom, uncertainty principle, **Quantum computation:** Qubits and Gates, Quantum Information Theory

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Modern physics	CLO1, CLO2
2	Quantum mechanics	CLO2, CLO3
3	Quantum computation	CLO3, CLO4

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Program Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Brief history of modern physics	PLO1, PLO6	Week 1	Discussion	Lecture, multimedia	CLO1,CLO 2
difference between classical and modern physics, branches of modern physics	PLO1	Week 2	Report on "classical and modern physics"	Lecture, multimedia , active learning	CLO1,CLO 2
Quantum physics, Quantum mechanics	PLO1	Week 3	Group discussion	Lecture, multimedia ,	CLO2
Introduction to quantum states, superposition, entanglement	PLO1	Week 4	Group discussion	Lecture, multimedia	CLO2
photoelectric effect	PLO1,PLO4	Week 5	Mathematical deduction	Lecture, multimedia , home work	CLO3
Compton scattering	PLO1,PLO4	Week 6	Mathematical deduction	Lecture, multimedia , home work	CLO3
De Broglie wavelength	PLO1,PLO4	Week 7	Mathematical deduction	Lecture, multimedia , problem solving	CLO3

MID-TERM EXAMINATION					
Galilean Transformations	PLO2	Week 8	Mathematical deduction	Lecture, multimedia, problem solving	CLO3
Schrödinger Equation	PLO2	Week 9	Mathematical formulation	Lecture, multimedia	CLO3
angular momentum in quantum mechanics	PLO1	Week 10	Mathematical formulation	Lecture, multimedia, problem solving	CLO3
structure and behavior of the hydrogen atom	PLO2	Week 11	Group discussion	Lecture, multimedia	CLO3
uncertainty principle	PLO1	Week 12	Mathematical formulation	Lecture, multimedia, problem solving	CLO3
Quantum computation: Qubits and Gates	PLO1	Week 13	Problem solving	Lecture, problem solving, home work	CLO4
Quantum Information Theory	PLO3	Week 14	Problem solving	Lecture, multimedia, problem solving, home work	CLO4
FINAL EXAMINATION					

17. Teaching-Learning Strategies:

Strategies	**Topics**
Active Learning and Discussions	Modern Physics
Problem-Based Learning	Quantum Mechanics
Case-Based Learning	Quantum Phenomena
Simulations and Role-Playing	Quantum Computation

18. Assessment Techniques of each topic of the course:

SL. No	Topics / Content	Assessment Techniques
1	Modern Physics	Mid Term Exam
2	Quantum Mechanics	Mid-Term Exam, Quiz-01
3	Quantum Mechanics	Mid-Term Exam, Quiz-02, Final Exam
4.	Quantum Phenomena	Quiz-03, Final Exam
5.	Quantum Computation	Quiz-04, Final Exam
6.	Quantum Computation	Final Exam

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignment in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category Marks (out of 30)	Tests (20)	Assignments (10)
Remember	5	
Understand	5	
Apply	5	10
Analyze	5	
Evaluate		
Create		

SMEB- Semester Mid & End Exanimation (70 Marks)

Bloom's Category	Mid	Final
Remember	5	5
Understand	5	10
Apply	5	20
Analyze	5	10
Evaluate		5
Create		

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Susskind, L., & Friedman, A. (2014). Quantum mechanics: The theoretical minimum. Basic Books.

Reference Books & Materials

2. Zwiebach, B. (2022). Mastering Quantum Mechanics: Essentials, Theory, and Applications. MIT Press.

Fourth Year First Semester

Course Outline – Final Year Design Project

Part A – Introduction

1.	**Course No. / Course Code**	**:** CSE 400-A
2.	**Course Title**	**:** Final Year Design Project
3.	**Course Type**	**:** Core course
4.	**Level/Term and Section**	**:** 7th Semester (4th Year)
5.	**Academic Session**	**:** Fall 23
6.	**Course Instructor**	**:** Faculty members
7.	**Prerequisite (If any)**	**:** 50% of the total credit should be completed
8.	**Credit Value**	**:** 6
9.	**Contact Hours**	**:** 6
10.	**Total Marks**	**:** 100

11. Course Objectives and Course Summary:

The main objective of the Final Year Design project is to provide the students an opportunity to apply the knowledge and skills gathered through the course work to solving a real-life complex engineering problem. Working in teams, students will identify a problem and design and build a solution. This experience will help them develop essential skills for the practical field.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO1	Identify a real-life problem that can be translated to an engineering and/or computing solution through design, development and validation.
CLO2	Identify outcomes and functional requirements of the proposed solution considering software and/or hardware specification and standards.
CLO3	Identify the milestones and prepare timeline and appropriate budget using the project management skill.
CLO4	Identify and validate the impact of environmental considerations and the sustainability of a system/subsystem of a complete project.
CLO5	Assess professional, ethical, and social impacts and responsibilities of the design project.
CLO6	Function effectively in a multi-disciplinary team.
CLO7	Analyze, design, build, and evaluate engineering/computing system/subsystem with given specifications and requirements.
CLO8	Present design project results through written technical documents and oral presentations.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Student activities	Assessment Tools
CLO1	12	Reading relevant research papers and identify the gaps	Interim Report/Presentation
CLO2	2,3	Meeting with the stakeholder to gather requirements. Designing the solution using the relevant methodology/techniques.	Interim Report/Presentation
CLO3	11	Studying the existing tools for project management and selecting the appropriate tool such as Github.	Interim Report/Presentation

CLO4	7		Interim Report/Presentation
CLO5	6,8		Interim Report/Presentation
CLO6	9		Reflective Journal / Version Control
CLO7	3,4,5	Create and/or select and/or apply appropriate techniques, resources, tool to implement the solution	Project Demo
CLO8	10		Report, Presentation

Part B – Content of the Course

14. Course Content:

15. Alignment of topics of the courses with CLOs:
The list of topics will depend on the "Area of Interest"

16. Class Schedule/Lesson Plan/Weekly plan:
Students will provide the timeline of their project.

17. Teaching-Learning Strategies:

18. Assessment Techniques of each topic of the course:

Part C – Assessment and Evaluation

19. Assessment Strategy
In 4th year 1st semester, students will be evaluated out of 100 and CO1 – CO6, and CO8 will be assessed.
In 4th year 2nd semester, students will be evaluated out of 100 and CO4 – CO8 will be assessed.
For CO-wise marks distribution please see the table below

Final Mark = 0.3 * (Marks obtained in 4-1) + 0.7 * (Marks obtained in 4-2)

CLOs	Marks	Semester
CLO1	30	4-1

CLO2	10	4-1
CLO3	10	4-1
CLO4	5	4-1
	5	4-2
CLO5	5	4-1
	5	4-2
CLO6	20	4-1
	20	4-2
CLO7	40	4-2
CLO8	20	4-1
	30	4-2

Remarks:

a) Department will assign one external evaluator/guide per Group in addition to the supervisor, from 4th year 1st semester. External guides will be responsible for ensuring quality of the project as per OBE guideline of Complex Engineering Problem and crosscheck the deliverables of the project.
b) Every group should submit the mapping of CO_PO and P's and A's (an example of such mapping is attached) along with the report of CO1. This report should be submitted to the department before Midterm examination of 4-1 semester along with the signature of the supervisor and the external evaluator/guide.
c) Every group must achieve each and every COs as per UAP guideline for OBE system.
d) However, each may have different P's and A's of Complex Engineering Problem (CEP)
e) Supervisors should guide students to fulfill requirement of Complex Engineering Problems

Table: Rubrics

COs	Description	Marks	Unsatisfactory(1) <40%	Satisfactory(2) 40% to 59%	Good(3) 60% to 79%	Excellent(4) 80% to 100%
CO 1	Identify a real-life problem that can be translated to an engineering and/or computing solution through design, development and validation.	30	Demonstrates an inability in identifying a problem statement or related contextual factors	Begins to demonstrate the ability to construct a problem statement with evidence of most relevant contextual factors, but problem statement is not complete	Demonstrates the ability to construct a problem statement with evidence of most relevant contextual factors, and problem statement is adequately detailed.	Demonstrates the ability to construct a clear and insightful problem statement with evidence of all relevant contextual factors.
CO 2	Identify outcomes and functional requirements of the proposed solution considering software and/or hardware specification and standards.	10	Demonstrates the inability in identifying or not justifying outcomes and functional requirements of the proposed solution software and/or hardware specification and standards listed not justified.	Identified outcomes and functional requirements but not complete software and/or hardware specification and standards listed need improvement.	Demonstrates the ability to Identify the most relevant outcomes and functional requirement Major components of software and/or hardware specification and standards are considered.	Demonstrates the ability to Identify the all relevant outcomes and functional requirements All required components of software and/or hardware specification and standards are considered.
CO 3	Identify sub components of a complex problem, prepare timeline and appropriate	10	Could not identify the sub components No timeline provided No	Not all sub components are identified Provided Timeline is not practical.	Major sub components are identified Few Components of the presented Timeline are not	All sub components are identified Provided Timeline is practical

	budget using the project management skill.		budget/cost analysis provided.	Budget preparation is not practical.	practical. Budget needs improvement.	Budget analysis is practical.
CO 4	Identify and validate the impact of environmental considerations and the sustainability of a system/subsystem of a complete project.	5	Not considered / unclear.	Not all issues are identified and validated.	Most relevant issues are identified and validated.	All issues are identified and validated
CO 5	Assess professional, ethical, and social impacts and responsibilities of the design project.	5	Not considered / unclear.	Not all issues are identified and validated.	Most relevant issues are identified and validated.	All issues are identified and validated
CO 6	Function effectively in a multi-disciplinary team.	20	Fail to function as a team and individual performance is not satisfactory.	Team is functioning partially and the members of the team should work harder to improve the performance.	Team is functioning moderately but there is a scope for improvement in individual performance.	Team is functioning properly and every team member is properly performing his/her duties.
CO 7	Analyze, design, build, and evaluate engineering/computing system/subsystem with given specifications and	40	Analysis is not performed. Design/ detailing of components is not done.	Analytical methods are not appropriate with the project objective. Design is not appropriate.	Analytical methods need improvement to achieve the project objective. Design is not	Analytical methods are appropriate with the project objective. Design is appropriate and

	requirements.				complete.	complete.
CO 8	Present design project results through written technical documents and oral presentations.	20/ 30	Poor presentation. Body language / Professionalism is not appropriate. Failed to answer questions	Not appealing presentation. Body language / Professionalism is not sufficiently appropriate. Partially addressed few questions	Spoken and visual presentation mostly integrated. Body language / Professionalism needs improvement. Could answer all the questions but few answers are not satisfactory.	Effectively integrates spoken and visual presentation. Body language / Professionalism is appropriate Satisfactorily. Answered all relevant questions.

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Assessment 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

Course Outline – Operating Systems

Part A – Introduction

1.	**Course No. / Course Code**	: CSE 401
2.	**Course Title**	: Operating Systems
3.	**Course Type**	: Theory
4.	**Level/Term and Section**	: 4^{th} year 1^{st} semester (4-1)
5.	**Academic Session**	: Fall 2023
6.	**Course Instructor**	: Noor Mairukh Khan Arnob
7.	**Pre-requisite (If any)**	**:** CSE 203 (Data Structure and Algorithms 1), CSE 303 (Computer Architecture) and Organization
8.	**Credit Value**	: 3
9.	**Contact Hours**	: 3
10.	**Total Marks**	: 100

11. Course Objectives and Course Summary:

Operating System is a key part of a computer system. This course teaches how computers work. This course also teaches the basic operating system abstractions, mechanisms, and their implementations. The core of the course contains concurrent programming (threads and synchronization), inter process communication, process scheduling, and memory management, file management, paging etc.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Remember** elementary and foundational concepts of Operating System.
CLO 2	**Understand** operating system applications and their association with hardware.
CLO 3	**Apply** different algorithms to handle processes to schedule for execution, allocating resources and synchronization and manages deadlock.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	1	1/Remember	Multimedia presentation	Class Test, Mid and Final Exams
CLO2	1	1/Understand	Multimedia presentation	Class Test, Mid and Final Exams
CLO3	2	1/Apply	Multimedia presentation	Class Test, Assignment, Mid and Final Exams

<u>Part B – Content of the Course</u>

14. **Course Content:**

Operating system overview: OS functions, evolution of OS functions, batch processing systems, single user multiprogramming systems, time sharing systems, real-time operating systems, OS structure. **Processes:** Process definition, process control, interacting processes, implementation of interacting processes, threads. **Scheduling:** job scheduling, process scheduling, process management, Scheduling algorithms, priority control. **Deadlocks:** Definitions, resource status modeling, handling deadlocks, deadlock detection and resolution, deadlock avoidance, **Process synchronization:** Implementing control synchronization, semaphores concurrency, inter process communication. **Memory management:** Principles, requirements and design of memory management system, program loading and linking. **Virtual Memory:** locality, page table, translation look aside buffer, segmentation. **I/O Management and disk scheduling:** Organization of the I/O function. Direct memory access. Design issues. I/O buffering. **File management:** Overview. File management systems. File organization and access, file directories, files sharing, File systems protection and security; design and implementation methodology.

15. Alignment of topics of the courses with CLOs:

SL. No	**Topics / Content**	**Course Learning Outcome (CLO)**
1	OS overview, Processes	CLO1
2	Virtual Memory, I/O Management, Direct Memory Access, File management, Memory Management	CLO2
3	Process Synchronization, Deadlocks	CLO3

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	**Specific Outcome(s)**	**Time Frame**	**Suggested Activities**	**Teaching Strategy(s)**	**Alignment with CLO**
Course Overview and Introduction to Operating Systems	**Understand the basics**	**Week 1**	**Discussion, Group discussion**	**Lecture, Multimedia**	**CLO1**
Operating System Structures	**Understand the structure**	**Week 2**	**Discussion, Group discussion**	**Lecture, Multimedia**	**CLO1**

Process Concept, PCB, IPC	**Understand the processes**	**Week 3**	**Discussion, Group discussion, class test 1**	**Lecture, Multimedia**	**CLO1**
Threads and Concurrency	**Understand the threads**	**Week 4**	**Discussion, Group discussion, assignment**	**Lecture, Multimedia**	**CLO1**
Process Scheduling FCFS, SJF Priority, Round Robin	**Apply the algorithms**	**Week 5**	**Discussion, Group discussion, exercise**	**Lecture, Multimedia**	**CLO3**
Process Scheduling FCFS, SJF Priority, Round Robin(cont.)	**Apply the algorithms**	**Week 6**	**Discussion, Group discussion, class test 2**	**Lecture, Multimedia**	**CLO3**
Process Synchronization	**Apply the algorithms**	**Week 7**	**Discussion, Group discussion**	**Lecture, Multimedia**	**CLO3**
Review for Mid Term, Deadlock	**Apply deadlock algorithms**	**Week 8**	**Discussion, Group discussion, assignment**	**Lecture, Multimedia**	**CLO1, CLO3**
MID-TERM EXAMINATION					
Memory Management	**Understand memory managemen t strategies**	**Week 9**	**Discussion, Group discussion**	**Lecture, Multimedia**	**CLO2**
Virtual Memory Management	**Understand Virtual memory managemen t**	**Week 10**	**Discussion, Group discussion, class test 3**	**Lecture, Multimedia**	**CLO2**

Page replacement Algorithms	**Understand Page replacement algorithms**	**Week 11**	**Discussion, Group discussion, exercise**	**Lecture, Multimedia**	**CLO2**
Page replacement Algorithms(Cont.)	**Understand Page replacement algorithms**	**Week 12**	**Discussion, Group discussion, exercise**	**Lecture, Multimedia**	**CLO2**
File System (Class Test 4 (optional))	**Understand the file systems**	**Week 13**	**Discussion, Group discussion**	**Lecture, Multimedia**	**CLO2**
Review for Final Exam	**Revision**	**Week 14**	**Discussion, Group discussion**	**Lecture, Multimedia**	**CLO1,CLO2,CLO3**
FINAL EXAMINATION					

17. Teaching-Learning Strategies:

1. **Lecture using multimedia**
2. **Lecture using white board**
3. **Group discussion**
4. **Assignments**

18. Assessment Techniques of each topic of the course:

OS overview, Processes: Quiz, Mid, Assignment
Virtual Memory, I/O Management, Direct Memory Access, File management, Memory Management: Mid, Final, Quiz
Process Synchronization, Deadlocks: Quiz, Final, Assignment

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignment in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of

assignments will be accepted. Students will have to do the presentation on the given topic as assignment

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 50)	**Assignments (10)**	**Quizzes (20)**
Remember	**5**	**10**
Understand	**5**	**0**
Apply	**0**	**10**

SMEB- Semester Mid & End Exanimation (70 Marks)

Bloom's Category	**Mid(20)**	**Final(50)**
Remember	10	10
Understand	0	30
Apply	10	10

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

Operating System Concept Essentials, by Silbershatz, Galvin, and Gagne, 9th Edition.

Reference Books & Materials

1.Operating System Principles, Prentice-Hall of India, B. Hausen.Modern Operating Systems, by Andrew S. Tanenbaum , Herbert Bos,4th Edition.

Course Outline – Operating Systems Lab

Part A – Introduction

1.	**Course No. / Course Code**	**: CSE 402**
2.	**Course Title**	**: Operating System Lab**
3.	**Course Type**	**: Lab**
4.	**Level/Term and Section**	**: 4th year 1st semester**
5.	**Academic Session**	**: Fall 2023**
6.	**Course Instructor**	**: Tahira Alam**
7.	**Pre-requisite (If any)**	**: N/A**
8.	**Credit Value**	**: 1.5**
9.	**Contact Hours**	**: 3**
10.	**Total Marks**	**: 100**

11. Course Objectives and Course Summary:

The objectives of this course are to teach various operating system operations and functions, explain various scheduling, file management and memory allocation methods in real life applications and also learn applications of Linux operating system and apply these skills in real life and also demonstrate various concepts and mechanisms related to operating systems.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	Describe various operating system operations and functions
CLO 2	Implement various scheduling, file management and memory allocation methods in real life applications and also learn applications of Linux operating system and apply these skills in real life.
CLO 3	Demonstrate various concepts and mechanisms related to operating systems.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	1	1/Understand	Live lecture, multimedia presentation	Viva
CLO2	3	1/Apply	Live lecture, multimedia presentation, problem solving	Lab exam
CLO3	9	3/Responding	Live lecture, multimedia presentation	Presentation

Part B – Content of the Course

14. Course Content:

Installing Linux operating System, operating dual port, User account management, Hardware set up and Troubleshooting, Operating Linux command line interface, Opening terminal, Opening files, Changing directories, Creating folders and directories, Move/rename files, Operating Linux shell commands, Change file directory, Concatenation and print data, Spool file for line printing, Connecting to printer and/or other hardware, Remove jobs from the line printer queue, Print working directory, File systems and File permissions, Change file groups, Change file mode, Copy file data, Display file data in terminal, Find files, search in a file, Update access and modification times of a file, Use of shell commands in detail, Writing fork programs and implementing various applications with fork, Writing a program which will retrieve information from a given file using stat, Kernel configuration, compilation & installation, Using Linux shell scripts, Introduction to bash shell/program, Using Semaphore and practically using semaphores for synchronizing multiple processes, Use of variable, string, array, conditions (if, else), loop and others, Implementation of a simple project using shell scripts, Writing program to simulate the following contiguous memory allocation techniques a) Worst-fit b) Best-fit c) First-fit, Writing program to simulate the following non-preemptive CPU scheduling algorithms to find turnaround time and waiting time. a) FCFS b) SJF c) Round Robin d) Priority, Writing program to simulate the following file allocation strategies. a) Sequential b) Indexed c) Linked.

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Various operating system operations and functions	**CLO1**
2	Various scheduling, file management and memory allocation methods in real life applications and also learn applications of Linux operating system and apply these skills in real life.	**CLO2**
3	various concepts and mechanisms related to operating systems	**CLO3**

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Installing Linux operating System, operating dual port, User account	Application	Week 1	Live demo	Lecture	CLO2

management, Hardware set up and Trouble shooting					
Operating Linux command line interface, Opening terminal, Opening files, Changing directories, Creating folders and directories, Move/rename files.	Application	Week 2	Live demo	Lecture	CLO1, CLO2
Operating Linux shell commands, Change file directory, Concatenation and print data, Spool file for line printing, Connecting to printer and/or other hardware, Remove jobs from the line printer queue, Print working directory.	Application	Week 3	Live demo	Lecture	CLO1, CLO2
File systems and File permissions, Change file groups, Change file mode, Copy file data, Display file data in terminal, Find files, search in a file, Update access and modification times of a file	Application	Week 4	Live demo	Lecture	CLO2
Use of shell commands in detail, Writing fork programs and implementing various applications with fork, Writing a program which will retrieve information from a given file using stat	Implementation	Week 5	Programming	Lecture, Multimedia	CLO2
Kernel configuration, compilation & installation + Reviews.	Implementation	Week 6	Programming	Lecture, Multimedia	CLO2
MID-TERM EXAMINATION and		Week 7			CLO3

Presentation					
Using Linux shell scripts, Introduction to bash shell/program, Using Semaphore and practically using semaphores for synchronizing multiple processes.	Implementation	Week 8	Programming	Lecture, Multimedia	CLO1,CLO2
Use of variable, string, array, conditions (if, else), loop and others.	Implementation	Week 9	Programming	Lecture, Multimedia	CLO2
Implementation of a simple project using shell scripts.	Implementation	Week 10	Programming	Lecture, Multimedia	CLO2
Writing program to simulate the following contiguous memory allocation techniques a) Worst-fit b) Best-fit c) First-fit	Implementation	Week 11	Programming	Lecture, Multimedia	CLO1,CLO2
Writing program to simulate the following non-preemptive CPU scheduling algorithms to find turnaround time and waiting time. a) FCFS b) SJF c) Round Robin d) Priority	Implementation	Week 12	Programming	Lecture, Multimedia	CLO2
Writing program to simulate the following file allocation strategies. a) Sequential b) Indexed c) Linked.	Implementation	Week 13	Programming	Lecture, Multimedia	CLO2
FINAL EXAMINATION		Week 14			CLO1,CLO2

17. Teaching-Learning Strategies:

1. Live demo
2. Live Programming
3. Lecture
4. Assignments
5. Presentations

18. Assessment Techniques of each topic of the course:

Various operating system operations and functions: Viva
Various scheduling, file management and memory allocation methods in real life applications and also learn applications of Linux operating system and apply these skills in real life: Programming
Various concepts and mechanisms related to operating systems: Presentation

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignment in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

CIE- Continuous Internal Evaluation (50 Marks)

SMEB- Semester Mid & End Exanimation (100 Marks)

Bloom's Category	**Mid(40)**	**Final(60)**
Understand	**20**	**20**
Apply	**0**	**40**
Responding	**20**	**0**

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	**Letter Grade**	**Grade Point**
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00

55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1.Operating System Concept Essentials, by Silbershatz, Galvin, and Gagne, 9th Edition.

Reference Books & Materials

1.Operating System Principles, Prentice-Hall of India, B. Hausen.Modern Operating Systems, by Andrew S. Tanenbaum , Herbert Bos,4th Edition.

Course Outline – Industry and Operational Management

Part A – Introduction

1. **Course No. / Course Code** : IMG 401
2. **Course Title** : Industry and Operational Management
3. **Course Type** : Theory
4. **Level/Term and Section** : 4th Year 2nd Semester
5. **Academic Session** : Fall 2023
6. **Course Instructor** :
7. **Pre-requisite (If any)** :
8. **Credit Value** : 3.0
9. **Contact Hours** : 3.0
10. **Total Marks** : 100
11. **Course Objectives and Course Summary** :

Course Objectives:

1. Understand the historical evolution and fundamental principles of industry and operational management.
2. Analyze organizational structures and coordination mechanisms to enhance efficiency and effectiveness.
3. Evaluate personnel management strategies, including motivation, leadership, and performance appraisal, to optimize human resources.
4. Apply cost and financial management techniques, such as break-even analysis and budgetary control, to ensure financial sustainability.
5. Explore marketing and technology management concepts to develop strategies for innovation and competitive advantage.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Understand** the landscape of various industries including software development, IT services, and hardware manufacturing.
CLO 2	**Explain** the fundamentals of operations management as applied to both software and hardware development processes.
CLO 3	**Analyze** the importance of effective motivation theories and leadership styles for managing technical teams.
CLO 4	**Apply** principles of supply chain management to software and hardware development processes, including production and process design.
CLO 5	**Analyze** case studies of technology companies, focusing on how they apply operational management principles for innovation and competitive advantage.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	a	1/Remember	Lectures, Guest Speakers	Quiz, written exam
CLO2	a,e	1/Understand	Lectures, Case Studies	assignment/ presentation
CLO3	i	1/Analyze	Group Discussions, Role-Playing Exercises	Peer-review, written exam
CLO4	d, f	1/Apply	Case Studies, Simulation Exercises	Report/ presentation
CLO5	c,k	1/Evaluate	Case Studies, Group Projects	group presentation

Part B – Content of the Course

14. Course Content:

Introduction: Industry Landscape (Software Dev., IT Services, Hardware M) - Operations Management Fundamentals (For Software & Hardware Dev.)

Organizational Structures & Management: Project Management (Life cycle, scope, resources, risk, agile) - Teamwork & Collaboration - Human Resource Management (For Technical Teams)

Supply Chain Management & Operations: Software Supply Chain Management - Hardware Supply Chain Management - Production & Process Design

Quality Management in Technology: Software Quality Assurance (SQA) - Hardware Quality Control
Marketing Management: Incorporating aspects of marketing relevant to technical fields: technical writing, product launches, Case Studies of tech companies, Guest Lectures by industry Professionals

15. Alignment of topics of the courses with CLOs:

Sl. No.	Topics / Content	Course Learning Outcome (CLO)
1	Introduction: Industry Landscape	CLO 1
2	Operations Management Fundamentals (For Software & Hardware Dev.)	CLO 2
3	Organizational Structures & Management, Project Management (Life cycle, scope, resources, risk, agile), Teamwork & Collaboration, Human Resource Management (For Technical Teams)	CLO 3
4	Supply Chain Management & Operations: Software Supply Chain Management, Hardware Supply Chain Management, Production & Process Design, Quality Management in Technology, Software Quality Assurance (SQA), Hardware Quality Control	CLO4
5	Marketing Management: Incorporating aspects of marketing relevant to technical fields: technical writing, product launches, Case Studies of tech companies, Guest Lectures by industry Professionals	CLO5

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Introduction to Industry Landscape	Identify various industries including software development, IT services, and hardware manufacturing	Week 1	Industry overview lecture, Guest speaker from IT industry, Class discussion on different industry types	Lectures, Guest Speakers	CLO1
Introduction to Industry Landscape	Understand the landscape and characteristics of various industries including software development, IT services, and hardware manufacturing	Week 2	Case study analysis of different industry types, Group presentations on selected industries	Lectures, Guest Speakers	CLO1
Operations	Explain the	Week	Interactive lecture,	Lectures,	CLO2

Management Fundamentals	fundamentals of operations management	3	Group work on defining key terms, Review of real-world examples	Case Studies	
Operations Management Fundamentals	Apply operations management principles to software and hardware development processes	Week 4	Case study analysis, Group activity on applying principles to a hypothetical company	Lectures, Case Studies	CLO2
Organizational Structures & Management	Analyze various organizational structures in technical teams	Week 5	Group discussions on pros and cons of different structures, Role-playing different management scenarios	Group Discussions, Role-Playing Exercises	CLO3
Organizational Structures & Management	Evaluate the effectiveness of different management and leadership styles in technical teams	Week 6	Role-playing exercises, Analysis of leadership case studies, Peer reviews	Group Discussions, Role-Playing Exercises	CLO3
Supply Chain Management & Operations	Apply supply chain management principles to software and hardware development	Week 7	Case study analysis of supply chain processes, Simulation exercises in class	Case Studies, Simulation Exercises	CLO4
Mid-Term Examination					
Supply Chain Management & Operations	Design and optimize production and process design in technology environments	Week 8	Simulation exercises, Group project on optimizing a supply chain, Presentation of findings	Case Studies, Simulation Exercises	CLO4
Quality Management in Technology	Analyze quality management processes in technology	Week 9	Case study review, Guest lecture on quality management,	Case Studies, Simulation Exercises	CLO4

	companies		Group discussion		
Quality Management in Technology	Implement quality management techniques in software and hardware development	Week 10	Practical workshop on quality tools, Group activity on creating a quality management plan	Case Studies, Simulation Exercises	CLO4
Marketing Management	Evaluate marketing strategies used by technology companies	Week 11	Group projects on analyzing marketing strategies, Case study analysis	Case Studies, Group Projects	CLO5
Marketing Management	Analyze the impact of marketing management on technology product success	Week 12	Group presentations, Guest lecture from a marketing professional, Class discussion	Case Studies, Group Projects	CLO5
Case Study Analysis and Review	Analyze case studies of technology companies for operational management insights	Week 13	In-depth case study analysis, Group discussions, Presentations	Case Studies, Group Projects	CLO5
Case Study Analysis and Review	Evaluate how operational management principles contribute to innovation and competitive advantage in technology companies	Week 14	Final project presentations, Peer reviews, Group discussions on insights	Case Studies, Group Projects	CLO5
Final Examination					

17. Teaching-Learning Strategies:

Active Learning and Guest Speakers:

Objective : Engage students with interactive learning and industry insights.

Approach : Encourage problem-solving, discussions, and group activities. Include guest speakers to provide real-world perspectives and industry knowledge.
Outcomes : CLO1, CLO3

Case Studies and Visualization:
Objective: Connect theory to practice and simplify complex concepts.
Approach: Analyze real-world examples and use diagrams, flowcharts, and simulations to explain supply chain management, quality management, and other abstract concepts.
Outcomes: CLO2, CLO4, CLO5

Group Projects, Peer Instruction, and Peer Reviews:
Objective: Enhance collaborative learning, teamwork, and critical thinking.
Approach: Implement group projects that involve collaboration on marketing strategies, operational management analyses, and case study reviews. Use peer instruction where students teach and learn from each other through peer tutoring, group study sessions, and peer evaluation.
Outcomes: CLO3, CLO5

Simulation Exercises:
Objective: Provide hands-on experience.
Approach: Use simulation software to mimic real-world supply chain and operations management scenarios, allowing students to apply theoretical knowledge.
Outcomes: CLO4

Presentations:
Objective: Improve communication and presentation skills.
Approach: Require students to present their findings from group projects and case studies, facilitating class discussions.
Outcomes: CLO2, CLO5

Assignments, Reports, and Exams:
Objective: Assess understanding and application of concepts.
Approach: Assign written tasks, reports, and periodic exams to evaluate students' ability to explain, analyze, and apply operational management theories and practices.
Outcomes: CLO1, CLO2, CLO3, CLO4

Sl. No.	**Topics**	**Strategy(s)**
1.	Introduction to Industry Landscape	Lectures, Guest Speakers
2.	Operations Management Fundamentals	Lectures, Case Studies
3.	Organizational Structures & Management	Group Discussions, Role-Playing Exercises

4.	Supply Chain Management & Operations	Case Studies, Simulation Exercises
5.	Quality Management in Technology	Case Studies, Simulation Exercises
6.	Marketing Management	Case Studies, Group Projects
7.	Case Study Analysis and Review	Case Studies, Group Projects

18. Assessment Techniques of each topic of the course:

Sl. No.	Topics	Assessment Technique
1.	Introduction to Industry Landscape	Quizzes, Participation in Class Discussions
2.	Operations Management Fundamentals	Written Exams, Case Study Analysis Assignments, Quizzes
3.	Organizational Structures & Management	Written Reports/ Assignments, Peer Reviews, Quizzes
4.	Supply Chain Management & Operations	Written Exams, Case Study Analysis
5.	Quality Management in Technology	Written Exams, Quality Management Plan Report, Quizzes
6.	Marketing Management	Case Study Analysis, Assignments, Quizzes
7.	Case Study Analysis and Review	In-depth Case Study Analysis, Final Written Reports, Peer Reviews

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignment in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 50)	Presentation/ Tests (20)	Reports/ Assignments (10)
Remember	**5**	
Understand	**10**	
Apply		
Analyze	**5**	**10**
Evaluate		
Create		

SMEB- Semester Mid & End Examination (70 Marks)

Bloom's Category	Mid (20)	Final (50)
Remember	**5**	**10**
Understand	**10**	**10**
Apply		**10**
Analyze	**5**	**10**
Evaluate		**10**
Create		

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Operations Management: Sustainability and Supply Chain Management" by Jay Heizer, Barry Render, and Chuck Munson
2. Project Management: A Systems Approach to Planning, Scheduling, and Controlling" by Harold Kerzner
3. "Human Resource Management" by Gary Dessler
4. "Supply Chain Management: Strategy, Planning, and Operation" by Sunil Chopra and Peter Meindl
5. "Lean Software Development: An Agile Toolkit" by Mary Poppendieck and Tom Poppendieck

Reference Books & Materials

6. Operations Management by William J. Stevenson

Fourth Year 2nd Semester

Course Outline – Final Year Design Project

Part A – Introduction

1.	**Course No. / Course Code**	**:** CSE 400-B
2.	**Course Title**	**:** Final Year Design Project
3.	**Course Type**	**:** Core course
4.	**Level/Term and Section**	**:** 8th Semesters (4th Year)
5.	**Academic Session**	**:** Fall 23
6.	**Course Instructor**	**:** Faculty members
7.	**Prerequisite (If any)**	**:** CSE 400-A
8.	**Credit Value**	**:** 6
9.	**Contact Hours**	**:** 6
10.	**Total Marks**	**:** 100

11. Course Objectives and Course Summary:

The main objective of the Final Year Design project is to provide the students an opportunity to apply the knowledge and skills gathered through the course work to solving a real-life complex engineering problem. Working in teams, students will identify a problem and design and build a solution. This experience will help them develop essential skills for the practical field.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO1	Identify a real-life problem that can be translated to an engineering and/or computing solution through design, development and validation.
CLO2	Identify outcomes and functional requirements of the proposed solution considering software and/or hardware specification and standards.

CLO3	Identify the milestones and prepare timeline and appropriate budget using the project management skill.
CLO4	Identify and validate the impact of environmental considerations and the sustainability of a system/subsystem of a complete project.
CLO5	Assess professional, ethical, and social impacts and responsibilities of the design project.
CLO6	Function effectively in a multi-disciplinary team.
CLO7	Analyze, design, build, and evaluate engineering/computing system/subsystem with given specifications and requirements.
CLO8	Present design project results through written technical documents and oral presentations.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Student activities	Assessment Tools
CLO1	12	Reading relevant research papers and identify the gaps	Interim Report/Presentation
CLO2	2,3	Meeting with the stakeholder to gather requirements. Designing the solution using the relevant methodology/techniques.	Interim Report/Presentation
CLO3	11	Studying the existing tools for project management and selecting the appropriate tool such as Github.	Interim Report/Presentation
CLO4	7		Interim Report/Presentation
CLO5	6,8		Interim Report/Presentation
CLO6	9		Reflective Journal / Version Control
CLO7	3,4,5	Create and/or select and/or apply appropriate techniques, resources, tool to implement the solution	Project Demo
CLO8	10		Report, Presentation

<u>Part B – Content of the Course</u>

14. Course Content:

15. Alignment of topics of the courses with CLOs:

The list of topics will depend on the “Area of Interest”

16. **Class Schedule/Lesson Plan/Weekly plan:**
    Students will provide the timeline of their project.
17. **Teaching-Learning Strategies:**
18. **Assessment Techniques of each topic of the course:**

Part C – Assessment and Evaluation

19. **Assessment Strategy**
    In 4th year 1st semester, students will be evaluated out of 100 and CO1 – CO6, and CO8 will be assessed.
    In 4th year 2nd semester, students will be evaluated out of 100 and CO4 – CO8 will be assessed.
    For CO-wise marks distribution please see the table below

Final Mark = 0.3 * (Marks obtained in 4-1) + 0.7 * (Marks obtained in 4-2)

CLOs	Marks	Semester
CLO1	30	4-1
CLO2	10	4-1
CLO3	10	4-1
CLO4	5	4-1
	5	4-2
CLO5	5	4-1
	5	4-2
CLO6	20	4-1
	20	4-2
CLO7	40	4-2
CLO8	20	4-1
	30	4-2

Remarks:

f) Department will assign one external evaluator/guide per Group in addition to the supervisor, from 4th year 1st semester. External guides will be responsible for ensuring quality of the project as per OBE guideline of Complex Engineering Problem and crosscheck the deliverables of the project.
g) Every group should submit the mapping of CO_PO and P's and A's (an example of such mapping is attached) along with the report of CO1. This report should be submitted to the department before Midterm examination of 4-1 semester along with the signature of the supervisor and the external evaluator/guide.
h) Every group must achieve each and every COs as per UAP guideline for OBE system.
i) However, each may have different P's and A's of Complex Engineering Problem (CEP)
j) Supervisors should guide students to fulfil requirement of Complex Engineering Problems

Table: Rubrics

COs	Description	Marks	Unsatisfactory(1) <40%	Satisfactory(2) 40% to 59%	Good(3) 60% to 79%	Excellent(4) 80% to 100%
CO 1	Identify a real-life problem that can be translated to an engineering and/or computing solution through design, development and validation.	30	Demonstrates an inability in identifying a problem statement or related contextual factors	Begins to demonstrate the ability to construct a problem statement with evidence of most relevant contextual factors, but problem statement is not complete	Demonstrates the ability to construct a problem statement with evidence of most relevant contextual factors, and problem statement is adequately detailed.	Demonstrates the ability to construct a clear and insightful problem statement with evidence of all relevant contextual factors.
CO 2	Identify outcomes and functional requirements of the proposed solution considering software and/or hardware specification and	10	Demonstrates the inability in identifying or not justifying outcomes and functional requirements of the proposed solution	Identified outcomes and functional requirements but not complete software and/or hardware specification and standards listed need	Demonstrates the ability to Identify the most relevant outcomes and functional requirement Major components of software and/or	Demonstrates the ability to Identify the all relevant outcomes and functional requirements All required components of software and/or

	standards.		software and/or hardware specification and standards listed not justified.	improvement.	hardware specification and standards are considered.	hardware specification and standards are considered.
CO 3	Identify sub components of a complex problem, prepare timeline and appropriate budget using the project management skill.	10	Could not identify the sub components No timeline provided No budget/cost analysis provided.	Not all sub components are identified Provided Timeline is not practical. Budget preparation is not practical.	Major sub components are identified Few Components of the presented Timeline are not practical. Budget needs improvement.	All sub components are identified Provided Timeline is practical Budget analysis is practical.
CO 4	Identify and validate the impact of environmental considerations and the sustainability of a system/subsystem of a complete project.	5	Not considered / unclear.	Not all issues are identified and validated.	Most relevant issues are identified and validated.	All issues are identified and validated
CO 5	Assess professional, ethical, and social impacts and responsibilities of the design project.	5	Not considered / unclear.	Not all issues are identified and validated.	Most relevant issues are identified and validated.	All issues are identified and validated
CO 6	Function effectively in a multi-disciplinary	20	Fail to function as a team and individual performance is	Team is functioning partially and the members of the	Team is functioning moderately but there is a scope	Team is functioning properly and every team

	team.		not satisfactory.	team should work harder to improve the performance.	for improvement in individual performance.	member is properly performing his/her duties.
CO 7	Analyze, design, build, and evaluate engineering/computing system/subsystem with given specifications and requirements.	40	Analysis is not performed. Design/ detailing of components is not done.	Analytical methods are not appropriate with the project objective. Design is not appropriate.	Analytical methods need improvement to achieve the project objective. Design is not complete.	Analytical methods are appropriate with the project objective. Design is appropriate and complete.
CO 8	Present design project results through written technical documents and oral presentations.	20/ 30	Poor presentation. Body language / Professionalism is not appropriate. Failed to answer questions	Not appealing presentation. Body language / Professionalism is not sufficiently appropriate. Partially addressed few questions	Spoken and visual presentation mostly integrated. Body language / Professionalism needs improvement. Could answer all the questions but few answers are not satisfactory.	Effectively integrates spoken and visual presentation. Body language / Professionalism is appropriate Satisfactorily. Answered all relevant questions.

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

4. Assessment 30%
5. Term Examination 50%
6. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00

75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

Course Outline – Industrial Training

Part A – Introduction

1. **Course No. / Course Code** : CSE 404
2. **Course Title** : Industrial Training
3. **Course Type** : Core Course
4. **Level/Term and Section** : 4-2
5. **Academic Session** : Fall-2023
6. Course Instructor : Prof. Dr. Aloke Kumar Saha
7. **Credit Value** : 1.50
8. **Contact Hours** : 1.50
9. **Total Marks** : 100
10. **Course Objectives and Course Summary:**

This course has been designed for the students to have real life experiences to help them prepare for their career.

Objectives:
1. To expose student to work responsibility and ethics in working environment.
2. To develop communication and interpersonal skills effectively within the working environment.
3. To apply theoretical, applied and academic knowledge for solving the industrial problem.
4. To acquire the knowledge on preparation of training report and presentation.

11. **Course Outcomes: at the end of the Course, the Student will be able to –**

CO 1	Practice good professional ethics and commitment to professional responsibilities in working environment.
CO 2	Communicate effectively within the working environment
CO 3	Apply theoretical, applied and academic knowledge for solving the industrial problem.
CO 4	Prepare training report and presentation

12. Mapping / Alignment of COs with Program Outcomes (PO) (Optional):

CLO No.	Corresponding POs	Bloom's taxonomy domain/level	Delivery methods and activities	Assessment Tools
CO1	6, 8, 9	C3/Apply A5/Characterization	As designed by the respective industry.	Report, Presentation
CO2	10	A2/Responding	As designed by the respective industry.	Presentation
CO3	12	C3/Apply	As designed by the respective industry.	Assignment
CO4	5, 10	C6/Create A3/Valuing	As designed by the respective industry.	Report, Presentation

Part B – Content of the Course

13. Course Content:
As designed by the respective industry.

14. Alignment of topics of the courses with COs:

SL. No	Topics / Content	Course Learning Outcome (CO)
1	As per industrial plan	CO1
2	As per industrial plan	CO2
3	As per industrial plan	CO3
4	As per industrial plan	CO4

15. Teaching-Learning Strategies:

Strategies	**Activities**
Face-to-face learning	**Lectures, Practical, Tutorial, Student-centered learning**
Self-directed learning	Non face-to-face learning, Revision, Assignment preparation

16. Assessment Techniques and Strategies of the course:

SL. No	**Topics / Content**	**Assessment Techniques**	**Assessment Strategies**
1	As per industrial plan	Evaluation by the industry supervisor as	70%

		per the criteria setup by the department	
2	Preparing report on the basis of industrial training	Report	20%
3	Weekly basis discussion with the course teacher on the progress of industrial training	Continuous assessment, Attendance	10%

Part C – Assessment and Evaluation

17. Evaluation Policy

Grades will be calculated as per the university grading structure and individual students will be evaluated based on the following criteria with respective weights.

4. Evaluation by Industry Supervisor 70%
5. Report 20%
6. Continuous Assessment, Attendance 10%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

18. Text Book

As guided by the respective industry.

Course Outline – Functional Bengali Language

Part A – Introduction

1. **Course No. / Course Code** : BNG 401
1. **Course Title** : Functional Bengali Language
2. **Course Type** : Core Course
3. **Level/Term and Section** : 4-2
4. **Academic Session** : Fall-2023
5. **Course Instructor** :
6. **Credit Value** : 3.00
7. **Contact Hours** : 3.00
8. **Total Marks** : 100
9. **Course Objectives and Course Summary:** The objectives of this course are to:
    1. **Build** a foundation in Natural Language Processing and teach core concepts applicable to any language and working with Bengali text data specifically.
    2. **Explore** techniques for sentiment analysis, machine translation, named entity recognition, and more, considering Bengali's unique characteristics.

    This course will empower students to navigate the exciting world of Natural Language Processing (NLP) for Bengali. Students will build a strong foundation in core NLP concepts while diving deep into the specifics of the Bengali language, including its morphology and script. The course equips them with practical skills to analyze and extract meaning from Bengali text data, exploring techniques like sentiment analysis, machine translation, and named entity recognition. By the end, they will be confident in applying NLP to unlock the potential of Bengali language data.

10. **Course Learning Outcomes: at the end of the Course, the Student will be able to –**

CLO 1	**Apply** core NLP concepts like text processing, tokenization, stemming/lemmatization, and feature engineering to Bengali text data.
CLO 2	**Analyze** the morphological characteristics of Bengali, including agglutination and sandhi rules, and explain their impact on NLP tasks.
CLO 3	**Implement** techniques like sentiment analysis, named entity recognition, and machine translation for Bengali text data using relevant tools and libraries.
CLO 4	**Develop** a basic NLP application for a specific Bengali language processing task.

11. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	**Corresponding PLOs**	**Bloom's taxonomy domain/level**	**Delivery methods and activities**	**Assessment Tools**
CLO1	a	1/Apply	Lecture, Classwork,	Quiz, Written Exam

			Assignment	
CLO2	b	1/Analyze	Lecture, Classwork, Assignment	Quiz, Written Exam
CLO3	a	1/Apply	Lecture, Classwork, Assignment	Quiz, Written Exam
CLO4	c	1/Develop	Lecture, Classwork, Assignment	Quiz, Written Exam

Part B – Content of the Course

12. Course Content:

Introduction to Natural Language Processing skills for Bengali, explore core concepts like text processing and feature engineering, delve into Bengali's unique morphology and script, and then conquer practical applications like sentiment analysis, named entity recognition, and machine translation. By building your own NLP application and exploring real-world tools, you'll graduate confident in unlocking the potential of Bengali language data.

13. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Introduction & Core NLP Concepts for Bengali Language	CLO1, CLO2
2	Bengali Language Specificity	CLO1, CLO2, CLO3
3	Core NLP Techniques for Bengali	CLO1, CLO3, CLO4
4	Advanced Applications & Evaluation	CLO1, CLO2, CLO4

14. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Program Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Course Introduction, NLP Overview, Applications of Bengali NLP	a	Week 1	Resource analysis	Lectures, Slides	CLO1
Text Processing Fundamentals: Tokenization, Normalization, Encoding (for Bengali script)	a	Week 2	Resource analysis	Lectures, Slides	CLO1
Understanding Morphology: Stemming, Lemmatization (considering Bengali agglutination) CLASS TEST - 1	b	Week 3	Resource analysis	Lectures, Slides	CLO2
Morphology in Detail: Sandhi	b	Week	Resource	Lectures,	CLO2

Rules and their impact on NLP tasks, Part-of-Speech Tagging for Bengali Text		4	analysis	Slides	
Feature Engineering for Bengali NLP: Extracting meaningful features from text data	a	Week 5	Resource analysis	Lectures, Slides	CLO3
Part-of-Speech Tagging, Introduction to NLP Libraries for Bengali CLASS TEST - 2	a	Week 6	Resource analysis	Lectures, Slides	CLO1
Sentiment Analysis in Bengali: Identifying Positive, Negative, and Neutral Sentiment	c	Week 7	Assignment	Lectures, Slides	CLO4
MID-SEMESTER EXAMINATION					
Named Entity Recognition (NER) for Bengali: Recognizing people, places, organizations	a	Week 8	Group discussion	Lectures, Slides	CLO1
Machine Translation: Bengali-English and English-Bengali Translation Techniques	a	Week 9	Assignment	Lectures, Slides	CLO1
Introduction to Advanced Techniques (optional): Topic Modeling, Text Summarization	a	Week 10	Group discussion	Lectures, Slides	CLO3
Explore real-world applications of NLP for Bengali language processing in various domains (e.g., sentiment analysis for social media, machine translation for news articles) CLASS TEST - 3	a	Week 11	Group discussion	Lectures, Slides	CLO1
Error Analysis & Challenges in Bengali NLP: Discuss common errors encountered in Bengali NLP tasks and explore the challenges posed by the language's unique characteristics (e.g., agglutination, ambiguity). CLASS TEST - 4	b	Week 12	Assignment	Lectures, Slides	CLO2
Evaluation Metrics for Bengali NLP: Introduce students to	c	Week 13	Assignment	Lectures, Slides	CLO4

metrics used to evaluate the performance of NLP techniques for Bengali data (e.g., accuracy, precision, recall for sentiment analysis or NER).					
Course Review & Future Directions: Summarize key concepts, address student questions, and discuss future directions in Bengali NLP research and applications.		Week 14			
FINAL EXAMINATION					

15. Teaching-Learning Strategies:

SL. No	Topics / Content	Strategies
1	Introduction & Core NLP Concepts for Bengali Language	Lecture, Slide, Presentation
2	Bengali Language Specificity	Lecture, Slide, Presentation
3	Core NLP Techniques for Bengali	Lecture, Slide, Presentation, Implementation
4	Advanced Applications & Evaluation	Lecture, Slide, Presentation, Implementation

16. Assessment Techniques of each topic of the course:

SL. No	Topics / Content	Assessment Technique
1	Introduction & Core NLP Concepts for Bengali Language	Assignment, Quiz, Exam
2	Bengali Language Specificity	Assignment, Quiz, Exam
3	Core NLP Techniques for Bengali	Assignment, Quiz, Exam
4	Advanced Applications & Evaluation	Assignment, Quiz, Exam

Part C – Assessment and Evaluation

17. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignment in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of

assignments will be accepted. Students will have to do the presentation on the given topic as assignment

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 30)	**Test(20)**	**Assignment(10)**
Remember		
Understand		
Apply	**10**	**20**
Analyze		
Evaluate		
Create		

SMEB- Semester Mid & End Exanimation (70 Marks)

Bloom's Category	**Test**
Remember	
Understand	
Apply	20
Analyze	40
Evaluate	10
Create	
Valuing	
Characterization	

18. Evaluation Policy

Grades will be calculated as per the university grading structure and individual students will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25

40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

19. Text Book

1. Speech and Language Processing: An introduction to natural language processing, computational linguistics, and speech recognition. Daniel Jurafsky & James H. Martin.
2. Natural Language Processing with Python– Analyzing Text with the Natural Language Toolkit Steven Bird, Ewan Klein, and Edward Loper

Optional Courses

Option - I: Software and Applications Development

Course Outline – Numerical and Mathematical Analysis for Engineers

Part A – Introduction

1. **Course No. / Course Code** : CSE 405
2. **Course Title** : Numerical and Mathematical Analysis for Engineers
3. **Course Type** : Core course
4. **Level/Term and Section** : 7^{th} Semester (4^{th} Year/1^{st} Semester)
5. **Academic Session** : Fall 2023
6. **Course Instructor** : Dr. Shah Murtaza Rashid Al Masud
7. **Prerequisite (If any)** : N/A
8. **Credit Value** : 3.0
9. **Contact Hours** : 3.0
10. **Total Marks** : 100
11. **Course Objectives and Course Summary:**

The objectives of this course are to:

1. Develop logical understanding of the subject.
2. Develop mathematical skill so that students are able to apply mathematical methods and principals in solving problem from engineering fields.
3. Make aware students about the importance and symbiosis between Mathematics and Engineering.

12. **Course Learning Outcomes: at the end of the Course, the Student will be able to –**

CLO 1	**Describe** the knowledge regarding principles of numerical methods and their terminologies**,** mathematical equations and formulas used in engineering disciplines.
CLO 2	**Analyze** various numerical methods and complex algorithms using different theories of engineering mathematics
CLO 3	**Design** solution for real-world engineering problems using various numerical methods and mathematical models.
CLO 4	**Apply** various numerical methods, recurrence theory, number theory, principles of Laplace transforms and Fourier analysis and probability theory to solve engineering problems

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	1	1/Understand	Lecture, discussion, tutorial, problem solving, group activities	Class tests, Assignment, Midterm exam, final exam
CLO2	1	1/Analyze	Lecture, discussion, tutorial, problem solving, group activities	Class tests, Assignment, Midterm exam, final exam
CLO3	2	1/Create	Lecture, discussion, tutorial, problem solving, group activities	Class tests, Assignment, Midterm exam, final exam
CLO4	1	1/Apply	Lecture, discussion, tutorial, problem solving, group activities	Class tests, Assignment, Midterm exam, final exam

Part B – Content of the Course

14. Course Content:

Numerical analysis: Introduction to numerical methods, Measuring errors, Sources of error, Binary representation of numbers, floating point representation of numbers, Propagation of errors, Taylor series. **Differential Equation, Ordinary Differential Equations:** Euler's Method, Runge-Kutta 2nd order Method, Runge-Kutta 4th order Method, **Partial Differential Equations. Laplace transforms:** Forward transform, inverse transform. Applications of Laplace transform. **Fourier**

analysis: Properties of Fourier series, Fourier sine and cosine series, Fourier transform of continuous and discrete signals, various applications of Fourier analysis. **Regression:** Linear Regression, Nonlinear regression**. Recurrent Problems:** Tower of Hanoi, Lines in a plane, Josephus Problem**. Number Theory:** Prime Numbers, Euler's theorem, Hash function. **Poisson distribution, Eigenvalues and Eigenvectors, Ackermann function, Naïve-Bayes theorem, Stochastic Processes, Markov Chains, properties, model. Queuing Model**: Basics of Queuing process, **Linear Optimization.**

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Numerical methods	**CLO1, CLO2**
2	Differential Equation, Ordinary and partial differential equation	**CLO1, CLO4**
3	Laplace transform	**CLO3, CLO4**
4.	Fourier analysis	**CLO3, CLO4**
5.	Regression	**CLO2, CLO3, CLO4**
6.	Recurrent problems	**CLO1, CLO2, CLO3, CLO4**
7	Number theory, Prime number, Euler's theorem, Hash Function	**CLO1, CLO2, CLO4**
8	Poisson distribution, Eigenvalues and Eigenvectors, Ackermann function, Naïve-Bayes theorem,	**CLO1, CLO2, CLO3, CLO4**
9	Stochastic Processes, Markov Chains, properties, model.	**CLO1, CLO2, CLO3, CLO4**
10	Queuing Model: Basics of Queuing process, Linear Optimization.	**CLO1, CLO2, CLO3, CLO4**

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Introduction to numerical methods, Measuring errors, Sources of error, Binary representation of numbers, floating point representation of numbers, Propagation of errors, Taylor series.	Understanding various numerical methods, theorems, terminologies. Apply the principles of numerical methods.	Week 1	Problem-solving, discussions and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer Instruction	CLO1, CLO2
Differential Equation,	Understanding the	Week	Problem-	Lecture, Active	CLO1,

Ordinary Differential Equations: Euler's Method, Runge-Kutta 2nd order Method, Runge-Kutta 4th order Method, Partial Differential Equations.	theories of differential equation, ordinary differential equation and partial differential equation. Apply the theories of differential equation, ordinary differential equation and partial differential equation in various mathematical solutions.	2-3	solving, discussions, and group activities	Learning, Visualization, Concrete Examples, Peer Instruction	CLO2
Laplace transforms: Forward transform, inverse transform. Applications of Laplace transform.	Understand, apply and analyze Laplace transform in engineering problem solution.	Week 4-5	Problem-solving, discussions and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer Instruction	CLO3, CLO4
Fourier analysis: Properties of Fourier series, Fourier sine and cosine series, Fourier transform of continuous and discrete signals, various applications of Fourier analysis.	Identify, apply and analyze Fourier analysis in engineering problem solution.	Week 6-7	Problem-solving, discussions and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer Instruction	CLO3, CLO4
Midterm Examination		Week 8			
Regression: Linear Regression, Nonlinear regression. Recurrent Problems: Tower of Hanoi, Lines in a plane, Josephus Problem.	Understand the algorithms and theories of regression and recurrent problem. Apply the theories and algorithms of regression and recurrent problems in engineering field.	Week 9-10	Problem-solving, discussions and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer Instruction	CLO2, CLO3, CLO4

Number Theory: Prime Numbers, Euler's theorem, Hash function.	Define the formulas and algorithms of various number theories. Apply the theories of Prime Numbers, Euler's theorem, Hash function in real world problems' solutions.	Week 11	Problem-solving, discussions and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer Instruction	CLO1, CLO2, CLO4
Poisson distribution, Eigenvalues and Eigenvectors, Ackermann function, Naïve-Bayes theorem, Stochastic Processes, Markov Chains, properties, model.	Identify, analyze, apply and design the theorems and algorithms of Poisson distribution, Eigenvalues and Eigenvectors, Ackermann function, Naïve-Bayes theorem, Stochastic Processes, Markov Chains, properties, model in engineering problem.	Week 12-13	Problem-solving, discussions and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer Instruction	CLO1, CLO2, CLO3, CLO4
Queuing Model: Basics of Queuing process, Linear Optimization.	Describe, analyze, determine and design the theorems and algorithms of Queuing Model, Basics of Queuing process, Linear Optimization in engineering problem.	Week 14	Problem-solving, discussions and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer Instruction	CLO1, CLO2, CLO3, CLO4
Final Examination		Week 15			

17. Teaching-Learning Strategies:

Active Learning: Encourage students to actively engage with the material through problem-solving, discussions, and group activities.

Visualization: Numerical analysis and mathematical analysis in engineering discipline often deal with abstract concepts that can be difficult to grasp. Utilize visual aids such as diagrams, graphs, and animations to illustrate key concepts of various theories, algorithms, formulas and terminologies.

Concrete Examples: Relate abstract concepts to real-world applications whenever possible. Show how numerical analysis and mathematical analysis are used in computer science and engineering.
Peer Instruction: Implement peer instruction techniques where students teach and learn from each other. Encourage peer tutoring, group study sessions, and peer evaluation of problem-solving approaches.

18. Assessment Techniques of each topic of the course:

SL. No.	Topic/Content	Assessment Tools
1	Numerical analysis	Class tests, Assignment, Midterm exam, final exam
2	Differential Equation, Fourier Analysis	Class tests, Assignment, Midterm exam, final exam
3	Regression, Recurrent Problems	Class tests, Assignment, Midterm exam, final exam
4	Number Theory	Class tests, Assignment, Midterm exam, final exam

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests will be taken during the semester, 2 class tests will be taken before midterm examination and 2 class tests will be taken before final examination. 3 out of 4 class tests will be considered for assessment of CLOs and corresponding PLOs. CT1, CT2, and best of CT3 and CT4 will be considered. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: Assignment (Written and/or presentation.) will be given throughout the semester.
Late submission will result in a 50% deduction in score.

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category	Marks (out of 30)
Remember	
Understand	**10**
Apply	**10**
Analyze	**10**
Evaluate	

Create	

SMEB- Semester Mid & End Exanimation (70 Marks)

Bloom's Category	**Marks (out of 70)**
Remember	
Understand	10
Apply	20
Analyze	20
Evaluate	
Create	20

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual students will be evaluated based on the following criteria with respective weights.

1. Assessment 30%
2. Final Examination 50%
3. Midterm Examination 20%

UAP Grading Policy

Numeric Grade	**Letter Grade**	**Grade Point**
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Engineering Mathematics: A Foundation for Electronic, Electrical, Communications and Systems Engineers, Latest Edition. - Anthony Croft, Robert Davison Martin Hargreaves, James Flint.
2. Numerical Methods with Applications, Latest Edition: Abridged – Autar Kaw, Egwu Kalu. http://nm.mathforcollege.com/topics/textbook_index.html
3. Introduction to Probability Models, Latest Edition. - Sheldon M. Ross, Latest edition
4. Kreyszig, E., Advanced Engineering Mathematics, Latest edition. John Wiley & Sons.
5. Mathematics for Computer Science, by Eric Lehman, F Thomson Leighton, Albert R Meyer, Latest Edition

Reference Books & Materials

1. Concrete Mathematics: A Foundation for Computer Science by Ronald Graham, Donald Knuth, and Oren Patashnik. Latest Edition. - Addison-Wesley Professional, Latest edition
2. O'Neil, Peter V. (2011). Advanced Engineering Mathematics, 7th edition. Cengage learning.
3. Dyke, P.P.G. (2001). An Introduction to Laplace Transforms and Fourier Series. Springer-Verlag London Ltd.

Course Outline – Artificial Intelligence and Expert Systems

1. **Course Code** **:** CSE 407
2. **Course Title** **:** Artificial Intelligence and Expert Systems
3. **Course Type** **:** Non-Core course
4. **Level/Term and Section** **:** 4^{th} year 1^{st} Semester
5. **Academic Session** **:** Fall 23
6. **Course Instructor** **:** Dr. Nasima Begum (DNB), Associate Professor
7. **Prerequisite (If any)** **:** CSE 205, CSE 207
8. **Credit Value** **:** 3.0
9. **Contact Hours** **:** 3.0
10. **Total Marks:** 100
11. **Course Objectives and Course Summary:**

The objectives of this course are to:

1. Provide the fundamental knowledge of AI, history, success, achievement, inference, intelligent agent, types of agent, expert systems, knowledge representation techniques and analyze them in various practical scenarios.

2. Explain various AI search techniques and game theory for different real life problems.

3. Demonstrate different probabilistic reasoning techniques for various cases.

4. Explain different advanced AI topics such as Artificial Neural Network (ANN), Machine Learning and advanced AI techniques to build AI agents.

This is a core course of Bachelor of Computer Science and Engineering Program which will help the students to understand Computer Vision, Robotics and Machine Learning in the CSE program. This knowledge is very important for the field of Pattern Recognition and Machine Learning professionals

12. **Course Learning Outcomes: at the end of the Course, the Student will be able to –**

CLOs	Statements

CLO1	**Incorporate** the fundamental concepts of AI and intelligent agents into various practical scenarios.
CLO2	**Analyze** various AI search techniques and Game Theory for different real-life problems.
CLO3	**Apply** different knowledge representation and reasoning (KRR) techniques and Fuzzy Logic in various scenarios.
CLO4	**Interpret** the Markov Model, the Naive Bayes rule in uncertainty and probabilistic reasoning.
CLO5	**Design and experiment** with ANN, different types of learning, and advanced AI techniques.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	**CLO Statements:** Upon successful completion of the course, students should be able to:	**Corresponding PLOs (Appendix-1)**	**Bloom's taxonomy domain/level (Appendix-2)**	**Delivery methods and activities**	**Assessment Tools**
CLO1	**Incorporate** the fundamental concepts of AI and intelligent agents into various practical scenarios.	2	1/Apply	Lecture, Multimedia, Group Discussion	Assignment, Class Test, Written exam
CLO2	**Analyze** various AI search techniques and Game Theory for different real-life problems.	4	1/Analyze	Lecture, Problem Analysis, and Implementation, Group Discussion	Assignment, Quiz, Written exam
CLO3	**Apply** different knowledge representation and reasoning (KRR) techniques and Fuzzy Logic in different scenarios.	5	1/Apply	Lecture, Problem Analysis, and Implementation,Group Discussion	Assignment, Class Test, Written exam
CLO4	**Interpret** the Markov Model,	3	1/Analyze	Lecture, Problem Analysis, and	Assignment, Class Test,

	the Bayesian Rule in uncertainty and probabilistic reasoning.			Implementation, Group Discussion	Written exam
CLO5	**Design and experiment** with ANN, different types of learning, and advanced AI techniques.	4	1/Apply	Lecture, Problem Analysis, and Implementation, Group Discussion	Problem Solving, Assignment, Class Test, Written Exam

Part B – Content of the Course

14. Course Content:

Introduction to AI: Definition, Foundation, and Expert Systems; **Agent:** Characteristics, Environments, Agent Types, **Knowledge Representation and Reasoning:** propositional and first order logic; fuzzy logic; **Searching: Uninformed Search:** Uniform-Cost Search (UCS), Depth-Limited Search (DLS), Iterative Deepening Search (IDS), **Informed Search:** Greedy Best-First Search, Heuristic admissibility and consistency, A* Search; **Local Search:** hill climbing, genetic algorithm, **Game Playing:** Game Definition, Game Theory, Zero Sum Game, Minimax Algorithm, AlphaBeta Pruning, **Probabilistic Reasoning:** Uncertainty, Markov Model, Naïve Bayes, **Machine Learning:** Symbolic and non-Symbolic Learning, Supervised Learning, Unsupervised Learning, Reinforcement Learning, Q-learning, Regression and Decision Tree. **Artificial Neural Networks**: Structure of Neurons, Perceptron, Activation Functions, Back-propagation. And Advanced AI techniques such as NLP.

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Introduction to AI, agents, expert systems	**CLO1**
2	Uninformed Search, informed search, genetic algorithm, heuristic Search, game theory	**CLO2**
3	Propositional and first order logic, fuzzy logic	**CLO3**
4	Uncertainty, Markov Model, Naïve Bayes	**CLO4**
5	Artificial Neural Networks, Machine Learning, and Advanced AI techniques	**CLO5**

16. **Class Schedule/Lesson Plan/Weekly plan:**

Topics	Specific Program Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Introduction to AI	2	Week 1	Lecture,	AIMA: ch 1,	CLO1

			multimedia	Lecture Slides	
Intelligent Agent	2	Week 2	Lecture, multimedia, Group discussion	AIMA: ch 2, Lecture Slides	CLO1
CT-1					
Uninformed Search (BFS, DFS, UCS, IDS)	4	Week 3	Lecture, multimedia, Case Study	AIMA: ch 3, Lecture Slides	CLO2
Informed Search (Best-First, Greedy Best-First, A*, Heuristics)	4	Week 4-5	Lecture, multimedia, Case Study	AIMA: ch 3, Lecture Slides	CLO2
CT-2					
Local Search, Genetic Algorithm	4	Week 6	Lecture, multimedia,, Problem Solving	AIMA: ch 4, Lecture Slides	CLO2
Adversarial Search, Game Theory	4	Week 6-7	Lecture, multimedia, Case Study	AIMA: ch 5, Lecture Slides	CLO2
CT-3					
Mid Term Exam					
KRR, Fuzzy Logic	5	Week 8-9	Lecture, multimedia	AIMA: ch 7-8, Lecture Slides	CLO3
Understand probabilistic reasoning, Interpret Bayesian Rule, basics of Markov Model	3	Week 10-11	Lecture, multimedia, Problem Solving	AIMA: ch 13-14, Lecture Slides	CLO4
CT-4					
Intro to Artificial Neural Networks and different Learning Techniques	4	Week 12	Lecture, multimedia, Case Study	AIMA: ch 18, Lecture Slides	CLO5
Intro to multilayer Neural Networks and different problems	4	Week 13	Lecture, multimedia, problem solving	AIMA: ch 18, Lecture Slides	CLO5
Review Class		Week 14	Lectures, multimedia	AIMA all ch, Lecture Slides	All CLOs
Final Exam					

17. Teaching-Learning Strategies:

SL. No.	Topics/Contents	Strategies
1.	Introduction to AI, agents, expert systems	**Active Learning and Discussions**
2.	Uninformed search, informed search, genetic algorithm, heuristic search, game theory	**Problem-Based and Simulation-Based Learning**

3.	Propositional logic, first order logic, and fuzzy logic	**Case-Based Learning**
4.	Uncertainty, Markov Model, Naïve Bayes	**Problem-Based Learning**
5.	Artificial Neural Networks, Machine Learning, and Advanced AI techniques	**Simulations and Role-Playing**

18. Assessment Techniques of each topic of the course:

SL. No	Topics / Content	Assessment Techniques
1.	Introduction to AI, agents, and expert systems	**CT-1, Mid Term Exam**
2.	Uninformed search, informed search, genetic algorithm, heuristic search, game theory,	**CT-2, CT-3, Mid Term Exam, Final Exam**
3.	Propositional and first order logic, fuzzy logic	**CT-4, Final Exam**
4.	Uncertainty, Markov Model, Naïve Bayes	**Final Exam**
5.	Artificial Neural Networks, Machine Learning, and Advanced AI techniques	**Final Exam**

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 5 class tests may be taken during the semester, 2 class tests will be taken for midterm and 3 class tests will be taken for final term. 3 out of 5 class tests will be considered. CT1, best of CT2 & CT3, and CT4, CT5 will be considered. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: Assignment (written and/or presentation.) will be given throughout the semester. Late submission will result in a 50% deduction in score. Students will have to do the presentation on the given topic as an assignment.

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category	Marks (out of 30)
Remember	
Understand	**10**
Apply	
Analyze	**20**
Evaluate	
Create	

SMEB- Semester Mid & End Examination (70 Marks)

Bloom's Category	Marks (out of 30)
Remember	
Understand	10
Apply	15
Analyze	15
Evaluate	30
Create	

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual students will be evaluated based on the following criteria with respective weights.

1. Assessment 30%
2. Mid-Term Examination 20%
3. Final Examination 50%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

<u>Part D – Learning Resources</u>

21. Text Book

1. AIMA = Artificial Intelligence: A Modern Approach, 4th Edition, Stuart J. Russell and Peter Norvig, Pearson.
2. AIMA = Artificial Intelligence: A Modern Approach, 3rd Edition, Stuart J. Russell and Peter Norvig, Pearson.
3. Artificial Intelligence-by Patrick Henry Winston

<u>Course Outline – Machine Learning</u>

<u>Part A – Introduction</u>

1. **Course No. / Course Code** : CSE 413
2. **Course Title** : Machine Learning
3. **Course Type** : Optional
4. **Level/Term and Section** : 4th Year 2nd Semester
5. **Academic Session** : Fall 2023
6. **Course Instructor** :
7. **Pre-requisite (If any)** :
8. **Credit Value** : 3.0
9. **Contact Hours** : 3.0
10. **Total Marks** : 100
11. **Course Objectives and Course Summary** :

The objectives of this course are to:

The primary objective of this Machine Learning Foundations course is to equip students with a solid understanding of the fundamental concepts, algorithms, and applications of machine learning. Upon successful completion of this course, students will be able to:

Understand the Fundamental Concepts: Grasp the core principles of machine learning including supervised and unsupervised learning, model evaluation, and the bias-variance trade-off.

Develop Machine Learning Models: Gain hands-on experience in designing, implementing, and tuning machine learning models using Python and popular libraries such as NumPy, Pandas, Scikit-learn, and TensorFlow or PyTorch.

Apply Machine Learning Algorithms: Become proficient in applying various machine learning algorithms, including linear regression, logistic regression, decision trees, random forests, support vector machines (SVM), neural networks, and clustering techniques.

The course will offer a comprehensive introduction to data mining and machine learning; Data preparation, model building, and data mining and machine learning techniques such as clustering, decisions trees and neural networks; Induction of predictive models from data: classification, regression, and probability estimation.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Differentiate** between the objectives and terminologies associated with ML
CLO 2	**Explain** the basic concepts of ML algorithms
CLO 3	**Apply** appropriate data preprocessing, feature engineering, and data splitting techniques to prepare datasets for machine learning.
CLO 2	**Explain** the basic concepts of ML algorithms
CLO 3	**Apply** appropriate data preprocessing, feature engineering, and data splitting techniques to prepare datasets for machine learning.
CLO 4	**Design** various machine learning algorithms using Python and libraries such as NumPy, Pandas, Scikit-learn, and TensorFlow or PyTorch to solve real-world problems.
CLO5	**Analyze** the outcome of results and performances of the algorithms and the parameters associated with the algorithms

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	**CLO Statements:** Upon successful completion of the course, students should be able to:	**Corresponding PLOs (Appendix -1)**	**Bloom's taxonomy domain/level (Appendix-2)**	**Delivery methods and activities**	**Assessment Tools**
CLO1	**Differentiate** between the objectives and terminologies associated with ML	a	1/Understand	Lecture, Classwork, Assignments	Quiz, Written exam

CLO2	Explain the basic concepts of ML algorithms	a	1/Understand	Lecture, Classwork, Assignments	Quiz, Written exam
CLO3	**Apply** appropriate data preprocessing, feature engineering, and data splitting techniques to prepare datasets for machine learning.	b	1/Apply	Lecture, Classwork, Assignments	Quiz, Written exam
CLO4	**Design** various machine learning algorithms using Python and libraries such as NumPy, Pandas, Scikit-learn, and TensorFlow or PyTorch to solve real-world problems.	c	1/Apply	Lecture, Classwork, Assignments	Quiz, Written exam
CLO5	**Analyze** the outcome of results and performances of the algorithms and the parameters associated with the algorithms	c	1/Apply	Lecture, Classwork, Assignments	Quiz, Written exam

Part B – Content of the Course

14. Course Content:

Usually covering a wide range of subjects, this course aims to give students both theoretical knowledge and practical skills. First, basic ideas like supervised and unsupervised learning, data preprocessing, and model evaluation are introduced. Comprehensive research is done on fundamental algorithms such as neural networks, support vector machines, decision trees, and linear regression. The curriculum frequently incorporates practical projects that make use of well-known libraries like TensorFlow, PyTorch, and Scikit-Learn, enabling students to apply machine learning methods to datasets from the real world. Deep learning, natural language processing, and reinforcement learning are examples of advanced topics. The course also places a strong emphasis on ethics in AI, best practices for model deployment, and keeping up with the most recent findings and developments in the industry.

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Overview of machine learning, data mining, and statistical pattern recognition. Types of machine learning (supervised, unsupervised, reinforcement learning). Applications and challenges in machine learning.	**CLO1**

2	Mathematical foundations underlying major machine learning algorithms, including but not limited to linear regression, logistic regression, decision trees, and neural networks.	**CLO2**
3	Appropriate data preprocessing, feature engineering, and data splitting techniques to prepare datasets for machine learning	**CLO3**
4	Practical session with implementations.	**CLO4**

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	**Specific Program Outcome (PO) (s)**	**Time Frame**	**Suggested Activities**	**Teaching Strategy (s)**	**Alignment with CLO**
Overview of machine learning, data mining, and statistical pattern recognition. Types of machine learning (supervised, unsupervised, reinforcement learning). Applications and challenges in machine learning.		Week 1	Assignment on basic understanding	Lecture, Multimedia	CLO1
Data cleaning, normalization, and transformation. Feature selection and dimensionality reduction. Handling missing data and outliers.		Week 2		Lecture, Multimedia	CLO1
Linear regression: simple and multiple regression analysis. Polynomial regression and model evaluation metrics. **CT1: Class Test 1**		Week 3	Practical session: Implementing regression models with Scikit-learn.	Lecture, Multimedia	CLO1
Logistic regression, K-Nearest Neighbors (KNN). Decision Trees and Random Forests. Model evaluation: confusion matrix, accuracy, precision, recall, F1-score.		Week 4		Lecture, Multimedia	CLO2

Linear SVM for classification. Kernel SVM for nonlinear data.		Week 5	Practical session: SVM implementations	Lecture, Multimedia	CLO3
K-Means clustering, hierarchical clustering. DBSCAN and cluster evaluation metrics. **CT1: Class Test 2**		Week 6	Practical session: Clustering with Scikit-learn.	Lecture, Multimedia	CLO3
Review Class		Week 7			
MID-SEMESTER EXAMINATION					
Bagging, boosting, and stacking. Random Forests and AdaBoost. Principal Component Analysis (PCA). t-Distributed Stochastic Neighbor Embedding (t-SNE).		Week 8, 9	Practical session: Building ensemble models.	Lecture, Multimedia	CLO4
Introduction to neural networks, perceptrons. Deep learning frameworks overview (TensorFlow, PyTorch). Building a simple neural network. Convolutional Neural Networks (CNN) Understanding convolutions and pooling. Applications of CNNs in image recognition and classification. **CT3: Class Test 3**		Week 10, 11,	Practical session: Building a CNN with TensorFlow or PyTorch.	Lecture, Multimedia	CLO4
Introduction to RNNs and the problem of long-term dependencies. Long Short-Term Memory (LSTM) networks.		Week 12	Implementing an RNN for sequence data.	Lecture, Multimedia	CLO3
Text preprocessing and representation. Introduction to NLP applications: sentiment analysis, text classification. **CT4: Class Test 4**		Week 13, 14	NLP with Python’s NLTK or Spa Cy.	Lecture, Multimedia	CLO4

Review Class		Week 14		Lecture, Multimedia	
FINAL EXAMINATION					

17. Teaching-Learning Strategies:

SL. No	Topics / Content	Strategies
1	Overview of machine learning, data mining, and statistical pattern recognition. Types of machine learning (supervised, unsupervised, reinforcement learning). Applications and challenges in machine learning.	Lecture, Slide, Presentation
2	Data cleaning, normalization, and transformation. Feature selection and dimensionality reduction. Handling missing data and outliers.	Lecture, Slide, Presentation
3.	Linear regression: simple and multiple regression analysis. Polynomial regression and model evaluation metrics.	Lecture, Slide, Presentation
4.	Convolutional neural networks (CNNs) for image recognition tasks.	Lecture, Slide, Presentation
5.	Recurrent neural networks (RNNs) for sequence modeling and time series analysis.	Lecture, Slide, Presentation
6.	Bagging, boosting, and stacking. Random Forests and AdaBoost. Principal Component Analysis (PCA). t-Distributed Stochastic Neighbor Embedding (t-SNE)	Lecture, Slide, Presentation
7.	Transfer learning and pre-trained models.	Lecture, Slide, Presentation
8.	Implementing Machine learning models using Python and deep learning libraries.	Lecture, Slide, Presentation

18. Assessment Techniques of each topic of the course:

SL. No	Topics / Content	Assessment Technique
1	Overview of machine learning, data mining, and statistical pattern recognition. Types of machine learning (supervised, unsupervised, reinforcement learning).	Assignment, Quiz, Exam

	Applications and challenges in machine learning.	
2	Data cleaning, normalization, and transformation. Feature selection and dimensionality reduction. Handling missing data and outliers.	Assignment, Quiz, Exam
3.	Linear regression: simple and multiple regression analysis. Polynomial regression and model evaluation metrics.	Assignment, Quiz, Exam
4.	Convolutional neural networks (CNNs) for image recognition tasks.	Assignment, Quiz, Exam
5.	Recurrent neural networks (RNNs) for sequence modeling and time series analysis.	Assignment, Quiz, Exam
6.	Bagging, boosting, and stacking. Random Forests and AdaBoost. Principal Component Analysis (PCA). t-Distributed Stochastic Neighbor Embedding (t-SNE)	Assignment, Quiz, Exam
7.	Transfer learning and pre-trained models.	Assignment, Quiz, Exam
8.	Implementing Machine learning models using Python and deep learning libraries.	Assignment, Quiz, Exam

<u>Part C – Assessment and Evaluation</u>

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignment in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 50)	**Tests (20)**	**Assignments (10)**
Remember		
Understand		
Apply	**20**	**10**
Analyze		
Evaluate		
Create		

SMEB- Semester Mid & End Exanimation (70 Marks)

Bloom's Category	**Mid**	**Final**
Remember	**14**	
Understand		
Apply	**42**	
Analyze	**14**	
Evaluate		
Create		

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

<u>Part D – Learning Resources</u>

21. Text Book

1. Machine Learning" by Tom M. Mitchell

2. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron

3. Introduction to Machine Learning with Python: A Guide for Data Scientists" by Andreas C. Müller & Sarah Guido

Course Outline – Deep Learning

Part A – Introduction

1. **Course No. / Course Code** : CSE 415
2. **Course Title** : Deep Learning
3. **Course Type** : Optional
4. **Level/Term and Section** : 4th year 2nd Semester
5. **Academic Session** : Fall 2023
6. **Course Instructor** :
7. **Prerequisite (If any)** :
8. **Credit Value** : 3
9. **Contact Hours** : 3
10. **Total Marks** : 100
11. **Course Objectives and Course Summary** :

The primary objective of this Deep Learning Foundations course is to provide students with a comprehensive understanding of the principles, techniques, and applications of deep learning. Upon successful completion of this course, students will be equipped to:

Understand Deep Learning Fundamentals: Grasp the core concepts of deep learning, including neural network architecture, activation functions, optimization algorithms, and regularization techniques.

Develop Deep Learning Models: Gain practical experience in designing, implementing, and optimizing deep learning models using Python and industry-standard libraries such as TensorFlow or PyTorch. Students will become proficient in handling large-scale datasets and implementing advanced architectures such as convolutional neural networks (CNNs) and recurrent neural networks (RNNs).

Apply Deep Learning Algorithms: Learn how to apply deep learning algorithms to various tasks such as image classification, object detection, natural language processing (NLP), and sequence generation. Students will explore cutting-edge techniques including transfer learning, attention mechanisms, and reinforcement learning in the context of deep learning.

The course will offer a comprehensive introduction to deep learning, covering topics such as data preprocessing, model training, evaluation, and deployment. Students will gain hands-on experience through practical exercises and projects, enabling them to tackle real-world problems using state-of-the-art deep learning techniques.

12. **Course Learning Outcomes: at the end of the Course, the Student will be able to –**

CLO 1	Differentiate between the objectives and terminologies associated with Deep Learning
CLO 2	Explain the basic concepts of Deep Learning algorithms
CLO 3	Apply the techniques and algorithms of Deep Learning on various datasets
CLO 4	Design the methodologies of Deep Learning techniques and the optimization steps

CLO 5	Analyze the outcome of results and performances of the algorithms and the parameters associated with the algorithms

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	**CLO Statements:** Upon successful completion of the course, students should be able to:	**Corresponding PLOs (Appendix-1)**	**Bloom's taxonomy domain/level (Appendix-2)**	**Delivery methods and activities**	**Assessment Tools**
CLO1	**Explain** the foundational principles and theories behind deep learning, including neural network architecture, activation functions, and optimization algorithms.	a	1/Understand	Lecture, Classwork, Assignments	Quiz, Written exam
CLO2	**Describe** the mathematical concepts underlying deep learning algorithms, such as backpropagation, gradient descent, and regularization techniques.	a	1/Understand	Lecture, Classwork, Assignments	Quiz, Written exam
CLO3	**Apply** data preprocessing techniques, such as normalization, scaling, and augmentation, to prepare datasets for deep learning tasks.	b	1/Apply	Lecture, Classwork, Assignments	Quiz, Written exam
CLO4	**Implement** various deep learning architectures, including convolutional neural networks (CNNs) and recurrent neural networks (RNNs), using Python and frameworks like TensorFlow or PyTorch.	c	1/Apply	Lecture, Classwork, Assignments	Quiz, Written exam

14. Course Content:

Introduction to deep learning concepts and applications, neural network architecture: perceptrons, activation functions, optimization algorithms (e.g., gradient descent), deep learning frameworks and libraries (e.g., TensorFlow, PyTorch), convolutional neural networks (CNNs) for image recognition tasks, recurrent neural networks (RNNs) for sequence modeling and time series analysis, transfer learning and pre-trained models, data preprocessing techniques for deep learning tasks (e.g., normalization, augmentation), implementing deep learning models using Python and deep learning libraries.

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome CLO)
1	Introduction to deep learning concepts and applications.	CLO1
2	Neural network architecture: perceptrons, activation functions, optimization algorithms (e.g., gradient descent).	CLO1
3.	Deep learning frameworks and libraries (e.g., TensorFlow, PyTorch).	CLO1
4.	Convolutional neural networks (CNNs) for image recognition tasks.	CLO2
5.	Recurrent neural networks (RNNs) for sequence modeling and time series analysis.	CLO2
6.	Transfer learning and pre-trained models.	CLO2
7.	Data preprocessing techniques for deep learning tasks (e.g., normalization, augmentation).	CLO3
8.	Implementing deep learning models using Python and deep learning libraries.	CLO4

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Program Outcome (PO) (s)	Time Frame	Suggested Activities	Teaching Strategy (s)	Alignment with CLO
Introduction to deep learning concepts and applications. Neural network architecture: perceptrons, activation functions, ptimization algorithms.	**a**	Week 1	Assignment on basic understanding	Lecture, Multimedia	CLO1
Deep learning frameworks and libraries (e.g., TensorFlow, PyTorch). Convolutional neural networks (CNNs) for image recognition	**a**	Week 2		Lecture, Multimedia	CLO1

tasks.					
Recurrent neural networks (RNNs) for sequence modeling and time series analysis. Transfer learning and pre-trained models. **CT1: Class Test 1**	**a**	Week 3	Practical session: Implementing regression models with Scikit-learn.	Lecture, Multimedia	CLO1
Data preprocessing techniques for deep learning tasks (e.g., normalization, augmentation). Implementing deep learning models.	**b**	Week 4		Lecture, Multimedia	CLO2
Linear SVM for classification. Kernel SVM for nonlinear data. K-Means clustering, hierarchical clustering.	**c**	Week 5	Practical session: SVM implementations.	Lecture, Multimedia	CLO3
DBSCAN and cluster evaluation metrics. Bagging, boosting, and stacking. Random Forests and AdaBoost. **CT1: Class Test 2**	**c**	Week 6	Practical session: Clustering with Scikit-learn.	Lecture, Multimedia	CLO3
Review Class		Week 7			
MID-SEMESTER EXAMINATION					
Principal Component Analysis (PCA). t-Distributed Stochastic Neighbor Embedding (t-SNE).	**c**	Week 8, 9	Practical session: Building ensemble models.	Lecture, Multimedia	CLO4
Introduction to neural networks, perceptrons. Deep learning frameworks overview (TensorFlow,	**c**	Week 10, 11,	Practical session: Building a CNN with TensorFlow or PyTorch.	Lecture, Multimedia	CLO4

PyTorch). Building a simple neural network. Convolutional Neural Networks (CNNs). Understanding convolutions and pooling. **CT3: Class Test 3**					
Applications of CNNs in image recognition and classification. Introduction to RNNs and the problem of long-term dependencies. Long Short-Term Memory (LSTM) networks. Implementing an RNN for sequence data. Text preprocessing and representation.	**c**	Week 12	Implementing an RNN for sequence data.	Lecture, Multimedia	CLO3
Introduction to NLP applications: sentiment analysis, text classification. NLP with Python's NLTK or SpaCy. **CT4: Class Test 4**	**c**	Week 13, 14	NLP with Python's NLTK or SpaCy.	Lecture, Multimedia	CLO4
Review Class		Week 14		Lecture, Multimedia	
FINAL EXAMINATION					
Topics	**Specific ProgramOutcome (PO) (s)**	**Time Frame**	**Suggested Activities**	**Teaching Strategy (s)**	**Alignment with CLO**
Overview of machine learning, data mining, and statistical pattern recognition. Types of machine learning (supervised,	c	Week 1	Assignment on basic understanding	Lecture, Multimedia	CLO1

unsupervised, reinforcement learning). Applications and challenges in machine learning.					

17. Teaching-Learning Strategies:

SL. No	Topics / Content	Strategies
1	Introduction to deep learning concepts and applications.	Lecture, Slide, Presentation
2	Neural network architecture: perceptrons, activation functions, optimization algorithms (e.g., gradient descent).	Lecture, Slide, Presentation
3.	Deep learning frameworks and libraries (e.g., TensorFlow, PyTorch).	Lecture, Slide, Presentation
4.	Convolutional neural networks (CNNs) for image recognition tasks.	Lecture, Slide, Implementation
5.	Recurrent neural networks (RNNs) for sequence modeling and time series analysis.	Lecture, Slide, Implementation
6.	Transfer learning and pre-trained models.	Lecture, Slide, Presentation
7.	Data preprocessing techniques for deep learning tasks (e.g., normalization, augmentation).	Lecture, Slide, Implementation
8.	Implementing deep learning models using Python and deep learning libraries.	Lecture, Slide, Implementation

18. Assessment Techniques of each topic of the course:

SL. No	Topics / Content	Assessment Technique
1	Introduction to deep learning concepts and applications.	Assignment, Quiz, Exam
2	Neural network architecture: perceptrons, activation functions, optimization algorithms (e.g., gradient descent).	Assignment, Quiz, Exam
3.	Deep learning frameworks and libraries (e.g., TensorFlow, PyTorch).	Assignment, Quiz, Exam

4.	Convolutional neural networks (CNNs) for image recognition tasks.	Assignment, Quiz, Exam
5.	Recurrent neural networks (RNNs) for sequence modeling and time series analysis.	Assignment, Quiz, Exam
6.	Transfer learning and pre-trained models.	Assignment, Quiz, Exam
7.	Data preprocessing techniques for deep learning tasks (e.g., normalization, augmentation).	Assignment, Quiz, Exam
8.	Implementing deep learning models using Python and deep learning libraries.	Assignment, Quiz, Exam

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignment in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category	Class Tests (30)
Remember	
Understand	10
Apply	10
Analyze	10
Evaluate	
Create	

MEB- Semester Mid & End Examination (70 Marks)

Bloom's Category	Mid (20)	Final (50)
Remember	2	5
Understand		
Apply	10	20
Analyze	3	5
Evaluate		
Create	5	20

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Arora, Renu and Sood S.K, Fundamentals of Entrepreneurship and Small Business, 1't Edition (2003), Kalyani Publishers, New ‘Delhi, India’.

Reference Books & Materials

2. Barringer, Bruce R. and Ireland Duane R., Entrepreneurship Successfully Lunching New Ventures. 3'd Edition (2010) Pearson Education Inc., New Delhi, India
3. Others

Course Outline – Data Science and Applications

Part A – Introduction

1.	**Course No. / Course Code**	: CSE 417
2.	**Course Title**	: Data Science and Applications
3.	**Course Type**	: Optional
4.	**Level/Term and Section**	: 4th Year 2nd Semester
5.	**Academic Session**	: Fall 2023
6.	**Course Instructor**	:
7.	**Pre-requisite (If any)**	:
8.	**Credit Value**	: 3.0
9.	**Contact Hours**	: 3.0
10.	**Total Marks**	: 100

11. **Course Objectives and Course Summary** :

The objectives of this course are to:

The primary objective of this Course is to equip students with the theoretical knowledge, practical skills, and ethical understanding necessary to effectively analyze, interpret, and communicate data-driven insights across a variety of domains. Upon successful completion of this course, students will be able to:

Understand the core principles of data science, including data processing, analysis, and visualization, along with the mathematical and statistical underpinnings of data science methodologies.

Apply machine learning algorithms and statistical models to solve real-world problems, using leading data science tools and programming languages, primarily Python.

Develop skills for effectively communicating complex data insights to both technical and non-technical audiences, and foster collaboration within diverse teams for successful project execution.

12. **Course Learning Outcomes: at the end of the Course, the Student will be able to –**

CLO 1	**Describe** a comprehensive understanding of the data science lifecycle, including data collection, preprocessing, analysis, and visualization.
CLO 2	**Explain** the mathematical and statistical foundations underlying data science algorithms and techniques.
CLO 3	**Apply** techniques for data cleaning, preprocessing, and transformation to prepare datasets for analysis.
CLO 4	**Implement** machine learning algorithms using Python libraries (e.g., Pandas, NumPy, Scikit-learn, TensorFlow) to solve real-world data science problems.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	**CLO Statements:** Upon successful completion of the course, students should be able to:	**Corresponding PLOs (Appendix-1)**	**Bloom's taxonomy domain/level (Appendix-2)**	**Delivery methods and activities**	**Assessment Tools**
CLO1	**Describe** a comprehensive understanding of the data science lifecycle, including data collection, preprocessing, analysis,	a	1/Understand	Lecture, Classwork, Assignments	Quiz, Written exam

	and visualization.				
CLO2	**Explain** the mathematical and statistical foundations underlying data science algorithms and techniques.	a	1/Understand	Lecture, Classwork, Assignments	Quiz, Written exam
CLO3	**Apply** techniques for data cleaning, preprocessing, and transformation to prepare datasets for analysis.	b	1/Apply	Lecture, Classwork, Assignments	Quiz, Written exam
CLO4	**Implement** machine learning algorithms using Python libraries (e.g., Pandas, NumPy, Scikit-learn, TensorFlow) to solve real-world data science problems.	c	1/Apply	Lecture, Classwork, Assignments	Quiz, Written exam

Part B – Content of the Course

14. Course Content:

This course covers a wide range of subjects in order to give students a thorough understanding of data science concepts and useful application skills. The first part of the course typically covers foundational topics like data collection, cleaning, and preprocessing. Exploratory data analysis and visualization techniques using Python, R, and libraries like Pandas, NumPy, and Matplotlib are then covered.

Essential machine learning algorithms like regression, classification, clustering, and dimensionality reduction are among the core subjects, along with statistical analysis, probability, and hypothesis testing. In addition, students study cutting edge methods in time series analysis, natural language processing, and deep learning.

With projects and case studies in fields like finance, healthcare, marketing, and social sciences, the application component of the course focuses on developing practical problem-solving abilities.

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Comprehensive understanding of the data science lifecycle, including data collection, preprocessing,	**CLO1**

	analysis, and visualization	
2	The mathematical and statistical foundations underlying data science algorithms and techniques.	**CLO2**
3	Techniques for data cleaning, preprocessing, and transformation to prepare datasets for analysis.	**CLO3**
4	Machine learning algorithms using Python libraries (e.g., Pandas, NumPy, Scikit-learn, TensorFlow) to solve real-world data science problems.	**CLO4**

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Program Outcome (PO) (s)	Time Frame	Suggested Activities	Teaching Strategy (s)	Alignment with CLO
Overview of Data Science and its significance Key components: Data exploration, modeling, inference, and decision-making Introduction to the data science workflow		Week 1	Assignment on basic understanding	Lecture, Multimedia	CLO1
Data cleaning, normalization, and transformation. Feature selection and dimensionality reduction. Handling missing data and outliers.		Week 2		Lecture, Multimedia	CLO1
Descriptive statistics and probability theory Inferential statistics: hypothesis testing, confidence intervals Statistical significance and p-values **CT1: Class Test 1**		Week 3		Lecture, Multimedia	CLO1
Overview of machine learning: supervised vs. unsupervised learning Key concepts: overfitting, underfitting, model evaluation		Week 4	Practical session: Implementing regression models with	Lecture, Multimedia	CLO2

Introduction to machine learning libraries (e.g., Scikit-learn)			Scikit-learn.		
Linear SVM for classification. Kernel SVM for nonlinear data.		Week 5	Practical session: SVM implementations.	Lecture, Multimedia	CLO3
K-Means clustering, hierarchical clustering. DBSCAN and cluster evaluation metrics. **CT1: Class Test 2**		Week 6	Practical session: Clustering with Scikit-learn.	Lecture, Multimedia	CLO3
Review Class		Week 7			
MID-SEMESTER EXAMINATION					
Principles of effective data visualization Introduction to data visualization tools (e.g., Matplotlib, Seaborn, Tableau) Interactive visualizations and dashboards		Week 8, 9	Practical session: Building Visualization & Dashboards	Lecture, Multimedia	CLO4
Introduction to big data concepts and tools (e.g., Hadoop, Spark) Big data processing and analysis techniques **CT3: Class Test 3**		Week 10, 11,	Case studies in big data applications	Lecture, Multimedia	CLO4
Text preprocessing and representation. Introduction to NLP applications: sentiment analysis, text classification. **CT4: Class Test 4**		Week 12, 13	NLP with Python's NLTK or SpaCy.	Lecture, Multimedia	CLO4
Review Class		Week 14		Lecture, Multimedia	
FINAL EXAMINATION					

17. Teaching-Learning Strategies:

SL. No	Topics / Content	Strategy
1	Overview of Data Science and its significance Key components: Data exploration, modeling, inference, and decision-making Introduction to the data science workflow	Lecture, Slide, Presentation
2	Data cleaning, normalization, and transformation. Feature selection and dimensionality reduction. Handling missing data and outliers.	Lecture, Slide, Presentation
3.	Descriptive statistics and probability theory Inferential statistics: hypothesis testing, confidence intervals Statistical significance and p-values	Lecture, Slide, Presentation
4.	Overview of machine learning: supervised vs. unsupervised learning Key concepts: overfitting, underfitting, model evaluation Introduction to machine learning libraries (e.g., Scikit-learn)	Lecture, Slide, Presentation
5.	Introduction to big data concepts and tools (e.g., Hadoop, Spark) Big data processing and analysis techniques	Lecture, Slide, Presentation
6.	Principles of effective data visualization Introduction to data visualization tools (e.g., Matplotlib, Seaborn, Tableau) Interactive visualizations and dashboards	Lecture, Slide, Presentation
7.	Text preprocessing and representation. Introduction to NLP applications: sentiment analysis, text classification.	Lecture, Slide, Presentation

18. Assessment Techniques of each topic of the course:

SL. No	Topics / Content	Assessment Technique
1	Overview of Data Science and its significance Key components: Data exploration, modeling, inference, and decision-making Introduction to the data science workflow	Assignment, Quiz, Exam
2	Data cleaning, normalization, and transformation. Feature selection and dimensionality reduction.	Assignment, Quiz, Exam

	Handling missing data and outliers.	
3.	Descriptive statistics and probability theory Inferential statistics: hypothesis testing, confidence intervals Statistical significance and p-values	Assignment, Quiz, Exam
4.	Overview of machine learning: supervised vs. unsupervised learning Key concepts: overfitting, underfitting, model evaluation Introduction to machine learning libraries (e.g., Scikit-learn)	Assignment, Quiz, Exam
5.	Introduction to big data concepts and tools (e.g., Hadoop, Spark) Big data processing and analysis techniques	Assignment, Quiz, Exam
6.	Principles of effective data visualization Introduction to data visualization tools (e.g., Matplotlib, Seaborn, Tableau) Interactive visualizations and dashboards	Assignment, Quiz, Exam
7.	Text preprocessing and representation. Introduction to NLP applications: sentiment analysis, text classification.	Assignment, Quiz, Exam

<u>Part C – Assessment and Evaluation</u>

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignment in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 50)	**Tests (20)**	**Assignments (10)**
Remember		
Understand		
Apply	**20**	**10**
Analyze		
Evaluate		
Create		

SMEB- Semester Mid & End Exanimation (70 Marks)

Bloom's Category	**Mid**	**Final**
Remember	**14**	
Understand		
Apply	**42**	
Analyze	**14**	
Evaluate		
Create		

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython" by Wes McKinney
2. An Introduction to Statistical Learning: with Applications in R" by Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani
3. Big Data: A Revolution That Will Transform How We Live, Work, and Think" by Viktor Mayer-Schönberger and Kenneth Cukier

Course Outline – Big Data Analytics

Part A – Introduction

1.	**Course No. / Course Code**	**:** CSE 419
2.	**Course Title**	**:** Big Data Analytics
3.	**Course Type**	**:** Optional Course
4.	**Level/Term and Section**	**:** 4^{th} Year 1^{st} Semester
5.	**Academic Session**	**:** Fall 2023
6.	**Course Instructor**	**:**
7.	**Prerequisite (If any)**	**:** Nil
8.	**Credit Value**	**:** 3.00
9.	**Contact Hours**	**:** 3.00
10.	**Total Marks**	**:** 100
11.	**Course Objectives and Course Summary**	**:**

The objectives of this course are:

1) To provide a solid conceptual understanding of the fundamentals of Big Data.
2) To learn the basic concepts of Big Data.
3) To learn the architecture of Hadoop Cluster and Ecosystem.
4) To learn distributed data storage and processing systems.
5) To learn the fundamental tools used in Big Data.

The summary of this course are to:

Big Data is the hot new buzzword in IT circles. The proliferation of digital technologies with digital storage and recording media has created massive amounts of diverse data, which can be used for marketing and many other purposes. The concept of Big Data refers to massive and often unstructured data, on which the processing capabilities of traditional data management tools result to be inadequate. Big Data can take up terabytes and petabytes of storage space in diverse formats including text, video, sound, images, and more. The course gives an overview of the Big Data phenomenon, focusing then on extracting value from the Big Data using predictive analytics techniques, the main big data tools (Hadoop) focusing on its basic components, the concept of IoT, M2M and IoT communication protocols.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Interpret** the components, tools, and techniques of Big Data
CLO 2	**Classify** the Hadoop model and identify their differences in implementation.
CLO 3	**Explain** how information can be sent via IoT communication protocols and Models.
CLO 4	**Determine** the various IoT levels and their applications and Fields in development sectors.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	5	Understand	Lecture, Multimedia	Class Test, Assignment, Written Examination
CLO2	2	Apply	Lecture, Multimedia	Class Test, Assignment, Written Examination
CLO3	4	Apply	Lecture, Multimedia	Class Test, Assignment, Written Examination
CLO4	1	Analyze	Lecture, Multimedia	Class Test, Assignment, Written Examination

Part B – Content of the Course

14. Course Content: Introduction to Big Data, Small Data and Big Data, How Big Data Comes, Types of Big Data, Big Data Characteristics, Big Data Analytics, Big Data Applications Domains, Hadoop, Hadoop Distributed File Systems, Map Reduce, Yet Another Resource Negotiator, Hadoop Cluster and Ecosystem, Apache Sqoop, Apache Hive, Apache Pig, Introduction to IoT, IoT Protocols, Communication Models in IoT: Request & Response Model, Publish-Subscribe Model(Pub-Sub), Push-Pull Model, Exclusive Pair Model, IoT advantages and Disadvantages, Machine to Machine Communication, Software Defined Networking, Network Function Virtualization, Different Types of IoT Level (Level 1 to Level 6).

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Core concepts of big data and big data analytics, including evolution of big data, 5'Vs of big data, life cycle and types of big data analytics.	CLO1
2	Basic components of Hadoop with a special focus on HDFS, MapReduce Approach and can describe the need for YARN including Yarn Components, Architecture and Working flow	CLO2
3	The services of Hadoop ecosystem components such as Apache	CLO1

	Sqoop, Apache Flume, Apache Pig & Hive and can distinguish among their functionalities.	
4	Concept of IoT, elements, characteristics of an IoT ecosystem, IoT Levels and Templates, the concept of M2M, difference between IoT and M2M, SDN, NFV for IoT, M2M Value Chains, IoT Value Chains and being able to demonstrate various IoT communication protocols.	CLO3, CLO4

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
What is big data How is big data different from traditional data sources? / Small data vs Big data Attributes of big data Big data as an opportunity		Week 1	To be Shared in Google Classroom	Lecture, Multimedia	CLO1
Why big data important Use / Applications of big data Key Computing Resources for Big Data. Why big data analytics		Week 2	https://icpc.global/	Lecture, multimedia	CLO2
What is big data analytics Life cycle of big data analytics Types of big data analytics		Week 3	To be shared in Google Classroom	Lecture, Practice sessions	CLO2
Tools used in big data analytics Big data application Domains		Week 4	To be shared in Google Classroom	Lecturer, Multimedia	CLO1, CLO3
Why Hadoop comes (Problems regarding RDBMS and DataWarehouse) What is Hadoop History of Hadoop Examples of commercial distribution company for Hadoop		Week 5	To be shared in Google Classroom	Lecture, multimedia, Practice sessions, Problem solving	CLO1, CLO3
Basic Introduction to Hadoop components Introduction to Masternode, Slavenode & Self healing		Week 6	To be shared in Google Classroom	Lecture, Practice sessions	CLO1, CLO3

MID-TERM EXAMINATION		Week 7	To be shared in Google Classroom	Practice Sessions	CLO1, CLO2, CLO3
What is DFS and HDFS File Block and Replication Rack HDFS Architecture HDFS File Read Operation HDFS Write Read Operation Rack Awareness		Week 8	Chapter 7 of required text	Lecture, Practice sessions, Problem Solving	CLO1, CLO4
What is Hadoop MapReduce MapReduce in Nutshell Advantages of MapReduce Hadoop MapReduce Approach with an example Hadoop 1.1		Week 9	Chapter 8 of required text	Lecture, Practice Sessions, Problem Solving	CLO3, CLO4
Limitations of Hadoop 1.1 Need for yarn Hadoop 2.0 Hadoop MapReduce Yarn Components Yarn Architecture Yarn Working flow		Week 10	To be shared in Google Classroom	Lecture, Practice Sessions, Problem Solving	CLO3, CLO4
What is Hadoop Cluster Hadoop Cluster Architecture Size of Hadoop Architecture Single Node and Muti-Node Cluster [Textbook: Chapter-6, Page (175-179)]		Week 11	To be shared in Google Classroom	Lecture, Practice Sessions, Problem Solving	CLO3, CLO4
Communication Protocol in Hadoop Cluster Benefits of Hadoop Cluster Challenges of Hadoop Cluster Hadoop Ecosystem: [Textbook: Chapter-10, Page (264-282)]		Week 12	To be shared in Google Classroom	Lecture, Practice Sessions, Problem Solving	CLO1, CLO4
Concept, Apache		Week	To be shared	Problem	CLO1,

sqoop, Apache flume, Apache pig, Apache hive. [Textbook: Chapter-12, Page (325-334)]		13	in Google Classroom	Solving	CLO4
FINAL EXAMINATION		Week 14	To be shared in Google Classroom	Problem Solving	CLO1, CLO3, CLO4

17. Teaching-Learning Strategies:

18. Assessment Techniques of each topic of the course:

Assessment Type	**% weight**	**CO1**	**CO2**	**CO3**	**CO4**
Final Exam	50%	5	20	5	20
Mid Term Exam	20%	2	10	3	5
Class performance (Class Test, Assignment, Problem solving session)	30%	3	15	2	10
Total	**100%**	**10**	**45**	**10**	**35**

<u>Part C – Assessment and Evaluation</u>

19. Assessment Strategy

Class Tests: Altogether 4 class tests will be taken during the semester, 2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests on the same CLO, best 1 class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignments in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment**.**

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 50)	**Class Test and Assignment (30)**
Remember	
Understand	**5**
Apply	**15**
Analyze	**10**
Evaluate	
Create	

SMEB- Semester Mid & End Examination (70 Marks)

Bloom's Category	Mid (20)	Final (50)
Remember		
Understand	10	15
Apply	5	20
Analyze	5	15
Evaluate		
Create		

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Big Data Science & Analytics: A Hands-on Approach Book by Arshdeep Bahga and Vijay K. Madisetti

2. Internet_of_Things_IoT_Systems_Architectures,_Algorithms,_Methodologies
3. Big-Data Analytics for Cloud, IoT and Cognitive Computing

Reference Books & Materials

1. Internet of things and big data analytics toward next-generation intelligence
2. Handbook of Research on Big Data and the IoT, By Gurjit Kaur and Pradeep Tomar
3. Big Data Analytics for Internet of Things (1st Edition), by Tausifa Jan Saleem (Editor), Mohammad Ahsan Chishti (Editor

Course Outline – Natural Language Processing

Part A – Introduction

1. **Course No. / Course Code** : CSE 421
2. **Course Title** : Natural Language Processing
3. **Course Type** : Optional
4. **Level/Term and Section** : 4^{th} year 2^{nd} Semester
5. **Academic Session** : Fall 2023
6. **Course Instructor** : Nadeem Ahmed
7. **Pre-requisite (If any)** : NIL
8. **Credit Value** : 3.0
9. **Contact Hours** : 3.0
10. **Total Marks** : 100
11. **Course Objectives and Course Summary** :

    This course will enhance existing machine learning and deep learning skills with the addition of Natural Language Processing (NLP) and speech recognition techniques. These skills can be used in various applications, such as part of speech tagging and machine translation, among others. The objective of this course is to develop the skills to start applying NLP techniques to real-world challenges and applications.

12. **Course Learning Outcomes: at the end of the Course, the Student will be able to –**

CLO 1	**Explain** the basic concept, objectives, the main techniques used in NLP.
CLO 2	**Apply** the techniques and algorithms of Machine Learning for NLP on various datasets.
CLO 3	**Analyze** the methodologies NLP techniques and the steps to optimize it.
CLO 4	**Design** the model to measure the outcome of result and performance of the algorithms and the parameters associated with the algorithms used for NLP.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO 1	2	1/Understand	Lecture, Problem Solving, Group discussion	Written exam
CLO 2	2	1/Apply	Lecture, Problem Solving, Group discussion	Written exam
CLO 3	2	1/Analyze	Lecture, Problem Solving, Group discussion	Written exam
CLO 4	3	1/Create	Lecture, Problem Solving, Group discussion	Written exam

Part B – Content of the Course

14. Course Content:

Regular Expressions, Text Normalization, Edit Distance, N-gram Models, Naive Bayes, Text Sentiment, Logistic Regression, Vector Semantics and Embeddings, Neural Networks, RNNs and LSTMs, Transformers and Large Language Models, Fine-Tuning and Masked Language Models, Prompting, In-Context Learning, and Instruct Tuning, Machine Translation, Question Answering and Information Retrieval, Automatic Speech Recognition and Text-to-Speech.

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Regular Expressions, Text Normalization, Edit Distance, N-gram Models	CLO 1
2	Naive Bayes, Text Sentiment, Logistic Regression, Vector Semantics and Embeddings, Neural Networks, RNNs and LSTMs	CLO 2
3	Transformers and Large Language Models, Fine-Tuning and Masked Language Models, Prompting, In-Context Learning, and Instruct Tuning	CLO 3
4	Machine Translation, Question Answering and Information Retrieval, Automatic Speech Recognition and Text-to-Speech	CLO 4

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Regular Expressions, Text	Understand the Chomsky	Week 1, 2	problem-solving,	Lecture, Active Learning,	CLO 1

Normalization, Edit Distance	Hierarchy and normalization process		discussions, and group activities	Visualization, Concrete Examples, Peer Instruction	
N-gram Language Models	Understand the Evaluating Language Models with smoothing techniques	Week 2, 3	problem-solving, discussions, and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer Instruction	CLO 1
Naive Bayes, Text Classification, and Sentiment	Apply the knowledge of Naïve Bayes for sentiment analysis	Week 3	Quiz-1 problem-solving, discussions, and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer Instruction	CLO 2
Logistic Regression	Apply the classification techniques with logistic regression processing models	Week 4	problem-solving, discussions, and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer Instruction	CLO 2
Vector Semantics and Embeddings	Apply the different vector semantics models for evaluation purpose	Week 5	Quiz-2 problem-solving, discussions, and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer Instruction	CLO 2
Neural Networks and Neural Language Models, RNNs and LSTMs	Apply the knowledge of different deep learning models	Week 6, 7	problem-solving, discussions, and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer Instruction	CLO 2
MID-TERM EXAMINATION					
Transformers and Large Language Models	Analyze the use of different transformers in language models	Week 8	problem-solving, discussions, and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer Instruction	CLO 3
Fine-Tuning and Masked Language Models	Analyze the different models for fine tuning to improve model	Week 9, 10	Quiz-3 problem-solving,	Lecture, Active Learning, Visualization, Concrete	CLO 3

	performance		discussions, and group activities	Examples, Peer Instruction	
Machine Translation, Question Information Retrieval, Automatic Speech Recognition and Text-to-Speech	Design a full phase machine learning based model for language processing	Week 11- 14	Quiz-4 problem-solving, discussions, and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer Instruction	CLO 4
FINAL EXAMINATION					

17. **Teaching-Learning Strategies:**

Active Learning: Encourage students to actively engage with the material through problem-solving, discussions, and group activities.

Visualization: Discrete mathematics often deals with abstract concepts that can be difficult to grasp. Utilize visual aids such as diagrams, graphs, and animations to illustrate key concepts like graph theory, combinatorics, and logic.

Concrete Examples: Relate abstract concepts to real-world applications whenever possible. Show how discrete mathematics is used in computer science.

Peer Instruction: Implement peer instruction techniques where students teach and learn from each other. Encourage peer tutoring, group study sessions, and peer evaluation of problem-solving approaches.

18. Assessment Techniques of each topic of the course:

From week 1 – 7: Two Quizzes, MID
From week 8 – 14: Two Quizzes, MID, Assignment

<u>Part C – Assessment and Evaluation</u>

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignment in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 50)	Tests (25)	Assignments (10)	Quizzes (20)	External Participation in Curricular/Co-Curricular Activities (10)
Remember				
Understand				
Apply			**10**	
Analyze			**10**	
Evaluate				
Create		**10**		

SMEB- Semester Mid & End Exanimation (70 Marks)

Bloom's Category	Mid	Final
Remember		
Understand	**10**	
Apply	**10**	**10**
Analyze		**20**
Evaluate		
Create		**20**

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Jurafsky, David, and James H. Martin. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition. 2nd Edition (2010) Pearson Education Inc.

Reference Books & Materials

2. James Allen. Natural Language Understanding. 2nd Edition (2010) Pearson Education Inc.

Course Outline – Computer Graphics

Part A – Introduction

1.	**Course No. / Course Code**	**:** CSE 423
2.	**Course Title**	**:** Computer Graphics
3.	**Course Type**	**:** Optional Course
4.	**Level/Term and Section**	**:** 4^{th} Year
5.	**Academic Session**	**:** Fall 23
6.	**Course Instructor**	**:** Md Mahedi Hassan
7.	**Pre-requisite (If any)**	**:**
8.	**Credit Value**	**:** 3.00
9.	**Contact Hours**	**:** 3.00
10.	**Total Marks**	**:** 100
11.	**Course Objectives and Course Summary**	**:**

The objectives of this course are:

- To identify and explain the core concepts of computer graphics leading to the ability to understand contemporary terminology, progress, issues, and trends.
- To apply graphics programming techniques to design, and create computer graphics scenes.
- To create effective OpenGL programs to solve graphics programming issues, including 3D transformation

This course provides a comprehensive introduction to computer graphics. Focuses on fundamental concepts and techniques, and their cross-cutting relationship to multiple problem domains in graphics (rendering, animation, geometry, imaging). Topics include: Introduction to the basic concepts, 2-D and 3-D modeling and transformations, viewing transformations, projections, rendering techniques. Students will use a standard computer graphics API to reinforce concepts and study fundamental computer graphics algorithms.

12. **Course Learning Outcomes: at the end of the Course, the Student will be able to –**

CLO 1	**Interpret** the mathematical foundation of the concepts of computer graphics: parametric curves and surfaces, order of continuity
CLO 2	**Explain** the core concepts of computer graphics, including, modeling, object transformation, viewing transformation, projection, perspective, homogeneous coordinates, object coordinates, camera coordinates, world coordinates
CLO 3	**Apply** various algorithms for clipping, hidden surface removal, scan conversion, color models, lighting and shading models, textures, and animation.
CLO 4	**Identify** a typical graphics pipeline and apply graphics programming techniques to design and create interactive computer graphics applications including 3D transformation, object modeling, color modeling, lighting, textures, etc.

13. **Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):**

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	1	Understand	Lecture, Multimedia	Written Exams
CLO2	1	Understand	Lecture, Multimedia	Written Exams
CLO3	1	Apply	Lecture, Multimedia	Written Exams
CLO4	5	Analyze, Evaluate, Create	Lecture, Multimedia	Assignment, Viva

Part B – Content of the Course

14. **Course Content:** Introduction, 2D Modeling Transformation, 3D Modeling Transformation, 3D Viewing, Projection, Viewing Transformation Continuity, Curves, Graphics Hardware, Scan Conversion, Scan Conversion Algorithms, Texture Mapping, Hidden Surface Removal, Introduction to Clipping, Clipping Algorithms, Fractals, Introduction to Illumination, Illumination Models, Illumination Models, Shading Models, Shading Models, Introduction to Ray Tracing, Ray Tracing Algorithms

15. **Alignment of topics of the courses with CLOs:**

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	**Modeling Transformations**	**CLO2, CLO4**
2	**Viewing and Projection**	**CLO2**
3	**Curves**	**CLO1**
4	**Scan Conversion**	**CLO3, CLO4**
5	**Rendering**	**CLO3, CLO4**

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Introduction, 2D Modeling Transformation	Graphics Pipeline, Model View Transform	Week 1	Practice, Assignment, Quiz	Lecture, Multimedia	CLO2, CLO4
3D Modeling Transformation	Model View Transform	Week 2	Practice, Assignment, Quiz	Lecture, Multimedia	CLO2, CLO4
3D Viewing, Projection	Model View Transform, Projective Transform	Week 3	Practice, Assignment, Quiz	Lecture, Multimedia	CLO2, CLO4
Projection, Viewing Transformation	Projective Transform, Viewing Mechanism of Camera	Week 4	Practice, Assignment, Quiz	Lecture, Multimedia	CLO2
Continuity, Curves	Curved Surfaces in Computer Graphics	Week 5	Practice, Assignment, Quiz	Lecture	CLO1
Graphics Hardware, Scan Conversion	Rendering	Week 6	Practice, Assignment, Quiz	Lecture, Multimedia	CLO3
Scan Conversion Algorithms	Rendering	Week 7	Practice, Assignment, Quiz	Lecture, Multimedia	CLO3
MID-TERM EXAMINATION					
Texture Mapping	Rendering	Week 8	Practice, Assignment, Quiz	Lecture, Multimedia	CLO3, CLO4
Hidden Surface Removal, Introduction to Clipping	Rendering	Week 9	Practice, Assignment, Quiz	Lecture, Multimedia	CLO3
Clipping Algorithms, Fractals	Rendering	Week 10	Practice, Assignment, Quiz	Lecture, Multimedia	CLO3, CLO1
Introduction to Illumination, Illumination Models	Lighting and Shading	Week 11	Practice, Assignment, Quiz	Lecture, Multimedia	CLO3, CLO4
Illumination Models, Shading Models	Lighting and Shading	Week 12	Practice, Quiz	Lecture, Multimedia	CLO3, CLO4
Shading Models, Introduction to Ray Tracing	Lighting and Shading	Week 13	Practice, Assignment	Lecture, Multimedia	CLO3

Ray Tracing Algorithms	Advanced Graphics Algorithms	Week 14	Group Discussion	Lecture, Multimedia	CLO3
FINAL EXAMINATION					

17. Teaching-Learning Strategies:

- **Active Learning and Discussions**
- **Problem-Based Learning**
- **Case-Based Learning**
- **Simulations and Role-Playing**

18. Assessment Techniques of each topic of the course:

SL. No	**Topics / Content**	**Assessment Techniques**
1	**Modeling Transformations**	Quiz, Mid Exam
2	**Viewing and Projection**	Quiz, Mid Exam, Final Exam
3	**Curves**	Quiz, Mid Exam, Final Exam
4	**Scan Conversion**	Quiz, Assignment, Final Exam
5	**Rendering**	Final Exam

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester, 2 class tests will be taken for midterm and 2 class tests will be taken for final term. 1 makeup class test will be taken. Students are strongly recommended not to miss any class tests.

Assignment: For the assignment, a very simple 2D/3D world designed using any graphics toolkit taught in the corresponding lab will be submitted by the individual student. The student must be able to explain his work to the course instructor while displaying the project and face a viva regarding the project.

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 50)	**Tests (20)**	**Assignments (10)**
Remember		
Understand	**5**	
Apply	**10**	
Analyze	**5**	
Evaluate		
Create		**10**

SMEB- Semester Mid & End Exanimation (70 Marks)

Bloom's Category	Mid (20)	Final (50)
Remember		**3**
Understand		**13**
Apply	**6**	**23**
Analyze	**4**	**9**
Evaluate	**10**	**2**
Create		

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 20%
2. Assignment 10%
3. Term Examination 50%
4. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Zhigang Xiang, Roy A. Plastock, Schaum's Outline of Theory and Problems of Computer Graphics, 2nd Edition (2020), Mcgraw Hill Education

Reference Books & Materials

2. Hearn, Baker, Carithers, Computer Graphics with OpenGL, Fourth Edition (2014), Pearson Education Limited

Course Outline – Pattern Recognition

Part A – Introduction

1.	**Course No. / Course Code**	**:** CSE 425
2.	**Course Title**	**:** Pattern Recognition
3.	**Course Type**	**:** Optional Course
4.	**Level/Term and Section**	**:** 4th year 2nd semester
5.	**Academic Session**	**:** Fall 2023
6.	**Course Instructor**	**:** Durjoy Mistry
7.	**Prerequisite (If any)**	**:** Nill
8.	**Credit Value**	**:** 1.50
9.	**Contact Hours**	**:** 3.00
10.	**Total Marks**	**:** 100
11.	**Course Objectives and Course Summary**	**:**

The Pattern Recognition course delves into advanced techniques and methodologies essential for understanding and applying pattern recognition algorithms across diverse domains. Through a blend of theoretical concepts and hands-on projects, students gain a deep comprehension of pattern recognition principles and their practical applications. Leveraging cutting-edge tools and frameworks, such as TensorFlow and scikit-learn, students engage in tasks ranging from image and speech recognition to natural language processing and beyond. By the end of the course, students emerge equipped with the skills to tackle real-world challenges in pattern recognition, paving the way for rewarding career opportunities in fields like artificial intelligence, machine learning, and data analysis.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	Develop a comprehensive **understanding** of fundamental pattern recognition concepts and algorithms.
CLO 2	**Apply** advanced machine learning techniques, including deep learning and neural networks, to analyze and recognize patterns in various data sets.
CLO 3	Utilize Python libraries and frameworks such as TensorFlow and scikit-learn to **create** solution for real life problems using pattern recognition models effectively.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	1	1/Understand	Lecture, Multimedia	Quiz, Assignment, Written Examination
CLO2	2	1/Apply	Lecture, Multimedia	Quiz, Viva, Assignment, Written Examination
CLO3	3	1/ Create	Lecture, Multimedia, Illustrations	Quiz, Assignment, Written Examination

Part B – Content of the Course

14. Course Content:

Introduction: The Pattern Recognition course offers an immersive exploration into the intricate realm of identifying and analyzing patterns within data, employing advanced machine learning techniques. With a strong emphasis on practical application, students will delve deep into fundamental principles while mastering cutting-edge methodologies. From grasping the basics to implementing sophisticated algorithms, participants will navigate through a diverse array of pattern recognition concepts, including deep learning and neural networks. Through hands-on projects and utilization of powerful Python libraries like TensorFlow and scikit-learn, students will develop the skills necessary to extract valuable insights from complex datasets effectively. By the culmination of the course, students will emerge equipped with a robust understanding of pattern recognition principles, empowering them to tackle real-world challenges in fields such as artificial intelligence, machine learning, and data analysis.

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Feature Extraction and Representation	CLO 1, CLO 2
2	Classification algorithms	CLO 3
3	Clustering Techniques	CLO 3

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Week	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Introduction to Pattern Recognition	- Understand the basic concepts of pattern recognition	Week 1	- Lecture: Overview of pattern recognition concepts and applications	Lecture, Presentation	CLO 1
Feature	- Learn about	Week 2	- Practical:	Hands-on Coding	CLO 2

Extraction and Representation	feature extraction techniques		Implement PCA for feature extraction using Python		
Classification Algorithms	- Understand various classification algorithms	Week 3	- Mini-project: Implement k-NN and Decision Trees algorithms for classification using a sample dataset	Project Work, Coding	CLO 2
Clustering Techniques	- Explore clustering methods	Week 4	- Practical: Perform K-means clustering on a dataset	Hands-on Activity	CLO 2
Evaluation Metrics	- Learn about evaluation metrics for pattern recognition	Week 5	- Discussion: Compare and analyze different evaluation metrics for classification and clustering algorithms	Discussion, Analysis	CLO 2
Deep Learning for Pattern Recognition	- Introduce deep learning techniques for pattern recognition	Week 6	- Lab Session: Implement a basic neural network using TensorFlow for image classification	Lab Session, Hands-on Coding	CLO 2
Time Series Analysis	- Understand time series data and analysis techniques	Week 7	- Practical: Analyze and visualize time series data using ARIMA model	Practical Application, Data Analysis	CLO 2
MID-TERM EXAMINATION					
Pattern Recognition in Natural Language Processing	- Apply pattern recognition in NLP	Week 8	- Project: Develop a sentiment analysis system using pattern recognition techniques on textual data	Project Work, Application Development	CLO 2
Feature Selection Techniques	- Learn about feature selection methods	Week 9	- Reading: Review articles on feature selection	Reading, Research	CLO 2

			techniques		
Pattern Recognition in Image Processing	- Explore pattern recognition techniques in image processing	Week 10	- Lab Session: Implement image recognition using CNNs in TensorFlow	Lab Session, Hands-on Coding	CLO 2
Anomaly Detection	- Introduce anomaly detection techniques	Week 11	- Practical: Implement anomaly detection algorithms on a dataset	Hands-on Activity	CLO 3
Pattern Recognition in Biometrics	- Apply pattern recognition in biometric systems	Week 12	- Seminar: Present research papers on biometric pattern recognition systems	Seminar, Research Presentation	CLO 3
Transfer Learning in Pattern Recognition	- Understand transfer learning concepts and its application	Week 13	- Project: Implement transfer learning techniques on a pattern recognition task	Project Work, Application Development	CLO 3
Project Presentation	- Demonstrate understanding through project presentation	Week 14	- Final Project Presentation: Students present their pattern recognition projects	Presentation, Demonstration	CLO 3
FINAL EXAMINATION					

17. Teaching-Learning Strategies:

Strategies	Topics
Active Learning, Coding and Discussions	Feature Extraction and Representation
Collaborative project work	Classification algorithms
Collaborative project work	Clustering Techniques

18. Assessment Techniques of each topic of the course:

Assessment Type	% weight	CO1	CO2	CO3	CO4

Final Project Demonstration and Documentation	60%	5	5	10	40
Mid Term Exam	20%	2	10	3	5
Class performance (Assignment, Problem solving session)	30%	3	15	2	10
Total	**100%**	**10**	**45**	**10**	**35**

Part C – Assessment and Evaluation

1. **Assessment Strategy**

   Class Tests: Altogether 4 class tests will be taken during the semester, 2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests on the same CLO, best 1 class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

   Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignments in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

   CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category	**Class Tests (30)**
Remember	
Understand	10
Apply	10
Analyze	10
Evaluate	
Create	

SMEB- Semester Mid & End Examination (70 Marks)

Bloom's Category	Mid (20)	Final (50)
Remember	2	5
Understand		
Apply	10	20
Analyze	3	5
Evaluate		
Create	5	20

2. **Evaluation Policy**

   Grades will be calculated as per the university grading structure and individual students will be evaluated based on the following criteria with respective weights.

   1. Class Tests 30%
   2. Term Examination 50%
   3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

3. **Text Book**
   a. **Recent Trends in Image Processing and Pattern Recognition**
      i. 6th International Conference, RTIP2R 2023, Derby, UK, December 7–8, 2023, Revised Selected ... in Computer and Information Science, 2026)

Course Outline – Bioinformatics

Part A – Introduction

1. **Course No. / Course Code** : CSE 427
2. **Course Title** : Bioinformatics
3. **Course Type** : Theory
4. **Level/Term and Section** : 4th year 2nd semester
4. **Academic Session** :
5. **Course Instructor** :
6. **Pre-requisite (If any)** :
7. **Credit Value** : 3.0
8. **Contact Hours** : 3.0
9. **Total Marks** : 100
10. **Course Objectives and Course Summary:**

    Course Objectives: This course will provide an overview of computation and analysis for the collection and interpretation of biological data. The objectives of the course are to attain a basic knowledge of molecular biology, an understanding of bioinformatics algorithms, and an ability to analyze solutions to bioinformatics problems.

Course Content: Molecular biology basics: DNA, RNA, genes, and proteins; Genome rearrangements; DNA sequence alignments; Gene prediction; Local and Global Alignment; DNA sequencing, genome sequencing, protein sequencing, spectrum graphs; Combinatorial pattern matching: Database Search, Rapid String Matching, BLAST, FASTA; Genome Assembly: Consensus-alignment-overlap, Graph-based assembly; Expression Analysis, Clustering and classification; Evolutionary/Phylogenetic trees; statistical and machine learning methods in bioinformatics.

11. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Understand** the basic concepts of molecular biology
CLO 2	**Use** the genome sequence alignment algorithms
CLO 3	**Apply** Statistical and machine learning methods in bioinformatics
CLO 4	**Discover** ancestor using phylogenetic tree

12. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	a	1/Understand	Lecture, Classwork, Assignments	Quiz, Written exam
CLO2	b	1/Understand	Lecture, Classwork, Assignments	Quiz, Written exam
CLO3	b	1/ Apply	Lecture, Classwork, Assignments	Quiz, Written exam
CLO4	d	1/ Apply	Lecture, Classwork, Assignments	Quiz, Written exam

Part B – Content of the Course

13. **Course Content:** Molecular biology basics: DNA, RNA, genes, and proteins; Genome rearrangements; DNA sequence alignments; Gene prediction; Local and Global Alignment; DNA sequencing, genome sequencing, protein sequencing, spectrum graphs; Combinatorial pattern matching: Database Search, Rapid String Matching, BLAST, FASTA; Genome Assembly: Consensus-alignment-overlap, Graph-based assembly; Expression Analysis, Clustering and classification; Evolutionary/Phylogenetic trees; statistical and machine learning methods in bioinformatics.

14. Alignment of topics of the courses with CLOs:

SL. No	**Topics / Content**	**Course Learning Outcome (CLO)**

1	Molecular biology basics: DNA, RNA, genes, and proteins;	Understand the basic concepts of molecular biology
2	Genome rearrangements; DNA sequence alignments; Gene prediction; Local and Global Alignment; DNA sequencing, genome sequencing, protein sequencing, spectrum graphs;	Use the genome sequence alignment algorithms
3	statistical and machine learning methods in bioinformatics. Combinatorial pattern matching: Database Search, Rapid String Matching, BLAST, FASTA; Clustering and classification; statistical and machine learning methods in bioinformatics.	Apply Statistical and machine learning methods in bioinformatics
4	Consensus-alignment-overlap, Graph-based assembly; Expression Analysis, Evolutionary/Phylogenetic trees;	Discover ancestor using phylogenetic tree

15. Class Schedule/Lesson Plan/Weekly plan:

Topics	**Specific Outcome(s)**	**Time Frame**	**Suggested Activities**	**Teaching Strategy(s)**	**Alignment with CLO**
Molecular biology basics: DNA, RNA, genes, and proteins; Genome rearrangements;		Week 1		Lecture, Multimedia	CLO1
Review of molecular biology methods		Week 2		Lecture, Multimedia	CLO1
Introduction to DNA and protein databases, data storage, file formats, information retrieval		Week 3		Lecture, Multimedia	CLO1
Molecular biology databases: Database queries, sequence retrieval, Creation of restriction endonuclease maps		Week 4		Lecture, Multimedia	CLO2
DNA sequence alignments; Gene prediction; Local and Global Alignment		Week 5		Lecture, Multimedia	CLO2
DNA sequence alignments; Gene prediction; Local and Global Alignment		Week 6		Lecture, Multimedia	CLO2
Gene prediction; Local and Global Alignment; DNA sequencing, genome sequencing, protein sequencing, spectrum graphs;		Week 7		Lecture, Multimedia	CLO2
MID-TERM EXAMINATION					
Combinatorial pattern		Week 8		Lecture,	CLO3

matching: Database Search, Rapid String Matching				Multimedia	
BLAST		Week 9		Lecture, Multimedia	CLO3
FASTA		Week 10		Lecture, Multimedia	CLO3
Genome Assembly: Consensus-alignment-overlap		Week 11		Lecture, Multimedia	CLO4
Graph-based assembly; Expression Analysis, Clustering and classification		Week 12		Lecture, Multimedia	CLO4
Evolutionary/Phylogenetic trees		Week 13		Lecture, Multimedia	CLO4
statistical and machine learning methods in bioinformatics.		Week 14		Lecture, Multimedia	CLO4
FINAL EXAMINATION					

16. Teaching-Learning Strategies:

17. Assessment Techniques of each topic of the course:

Part C – Assessment and Evaluation

18. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester, 2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignment in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 50)	**Tests (20)**	**Assignments (10)**
Remember		
Understand	**20**	
Apply		**10**
Analyze		
Evaluate		
Create		

SMEB- Semester Mid & End Exanimation (70 Marks)

Bloom's Category	**Mid**	**Final**
Remember		
Understand	**20**	**20**
Apply		**30**
Analyze		
Evaluate		
Create		

19. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

<u>Part D – Learning Resources</u>

20. Text Book

1. Bioinformatics Algorithms an active approach by Phillip Compeau & Pavel Pevzner

Reference Books & Materials

2. Neil C. Jones and Pavel A. Pevzner. An introduction to bioinformatics algorithms
3. Li and Graur – Fundamentals of Molecular Evolution

Course Outline – Cryptography and Network Security

Part A – Introduction

1.	**Course No. / Course Code**	**:** CSE 429
1.	**Course Title**	**:** Cryptography and Network Security
2.	**Course Type**	**:** Optional course
3.	**Level/Term and Section**	**:** 4th year
4.	**Academic Session**	: Fall 2023
5.	**Course Instructor**	: Sourav Saha
6.	**Pre-requisite (If any)**	:
7.	**Credit Value**	: 3.0
8.	**Contact Hours**	:
9.	**Total Marks**	: 100

10. Course Objectives and Course Summary:

This is a course on computer security and cryptographic algorithms. The following components are covered in the course: (a) Overview of computer security concepts (b) Computer security technology and principles, ©Software security and trusted systems, (d) Management issues, (e) Cryptographic algorithms, and (f) Network security.

11. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	Describe cryptographic concepts, including encryption, decryption, and key management.
CLO 2	Recognize various cryptographic algorithms, protocols, and their applications in securing networks.
CLO 3	Understand the operation of different types of cryptographic primitives, such as symmetric and asymmetric encryption, hash functions, and digital signatures.
CLO 4	Apply cryptographic techniques to protect data confidentiality, integrity, and authenticity in network communications.
CLO 5	Design and implement secure network architectures, protocols, and countermeasures against common security threats.

12. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	**Corresponding PLOs (Appendix-1)**	**Bloom's Taxonomy Domain/Level (Appendix-2)**	**Delivery Methods and Activities**	**Assessment Tools**
CLO 1	Remember	- Remember	Lecture, Multimedia,	Quiz, Written Examination

			Written Examination	
CLO 2	Analyze	Analyze	Lecture, Group Discussion	Quiz, Written Examination
CLO 3	Understand	Understand	Lecture, Problem Solving, Group Discussion	Quiz, Presentation, Viva, Written Examination
CLO 4	Apply	Apply	Problem Solving	Quiz, Assignment, Written Examination

Part B – Content of the Course

13. Course Content:

Overview of Computer Authentication, Access Control, Database and Cloud Security, Malicious Software (Trojans, Phishing, Spyware), Denial-of-Service Attacks, Intrusion Detection, Firewalls and Intrusion Prevention Systems, **Software Security and Trusted Systems:** Buffer Overflow, Software Security, Operating System Security, Trusted Computing and Multilevel Security, **Management Issues:** IT Security Management and Risk Assessment, IT Security Controls, Plans and Procedures, Physical and Infrastructure Security, Human Resources Security, Security Auditing, Legal and Ethical Aspects **Cryptographic Algorithms:** Symmetric Encryption and Message Confidentiality, Public-Key Cryptography and Message Authentication, **Network Security:** Internet Security Protocols and Standards, Internet Authentication Applications, Wireless Network Security Concepts, **Computer Security Technology and Principles:** Cryptographic Tools, User

14. Alignment of topics of the courses with CLOs:

SL. No	**Topics / Content**	**Course Learning Outcome (CLO)**
1	Introduction to Cryptography and Security Principles	CLO 1
2	Cryptographic Algorithms and Protocols	CLO 2
3	Authentication and Access Control	CLO 3
4	Network Security Technologies	CLO 4
5	Applied Cryptography and Secure Network Design	CLO 5

15. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Introduction to Cryptograp	Understanding basic cryptographic concepts, such as encryption,	Week 1	Lectures, Discussions, Interactive	Lecture, Active Learning	CLO1, CLO2

hy	decryption, keys, and algorithms.		Exercises		
Symmetric Cryptography	Exploring symmetric key encryption algorithms like DES, AES, and their applications.	Week 2-3	Hands-on Encryption and Decryption Exercises	Practical Application, Problem-solving	CLO1, CLO2, CLO3
Asymmetric Cryptography	Understanding asymmetric key encryption algorithms like RSA, Diffie-Hellman, and their uses.	Week 4-5	Key Exchange Simulation, Encryption/Decryption Demonstrations	Simulation, Visualizations	CLO1, CLO2, CLO3
Cryptographic Hash Functions	Exploring hash functions, their properties, and applications in data integrity verification.	Week 6	Hashing Workshops, Data Integrity Check Activities	Hands-on, Group Activities	CLO2, CLO3, CLO4
Public Key Infrastructure (PKI)	Understanding PKI components like digital certificates, Certificate Authorities (CA), and trust models.	Week 7	PKI Setup Simulation, Certificate Issuance Role-plays	Simulation, Role-playing	CLO1, CLO2, CLO3
Digital Signatures	Learning about digital signatures, their importance in authentication, and verification processes.	Week 8	Digital Signature Creation and Verification Exercises	Hands-on, Practical Application	CLO2, CLO3, CLO4
Cryptanalysis Techniques	Exploring various cryptanalysis methods such as brute force, frequency analysis, and chosen-plaintext attacks.	Week 9-10	Cryptanalysis Challenges, Code-breaking Workshops	Problem-solving, Challenges	CLO2, CLO3, CLO4
Network Security Basics	Understanding network security fundamentals, including threats, vulnerabilities, and defense mechanisms.	Week 11	Network Security Case Studies, Threat Analysis Activities	Case Studies, Analysis	CLO1, CLO2, CLO3
Secure Communic	Exploring secure communication	Week 12	Secure Protocol Simulation,	Simulation, Hands-on	CLO1, CLO2,

ation Protocols	protocols like SSL/TLS, SSH, and their implementations.		Protocol Implementation Tasks		CLO3
Cryptographic Applications in Networks	Applying cryptographic techniques in network protocols and services like VPNs, secure email, and secure file transfer.	Week 13	Cryptography in Action: VPN Setup, Secure Email Setup	Practical Application, Hands-on	CLO1, CLO2, CLO3
Network Traffic Analysis	Learning methods for analyzing network traffic, including packet capture, protocol analysis, and intrusion detection.	Week 14	Network Traffic Analysis Projects, Packet Sniffing Labs	Project-based Learning, Lab Exercises	CLO1, CLO2, CLO3, CLO4
Final Examination					

16. Teaching-Learning Strategies:

Teaching and Learning Strategy	**Description**
Active Learning and Discussions	Promote active engagement with cryptographic concepts through discussions and group activities. Encourage students to participate in problem-solving sessions.
Problem-Based Learning	Foster problem-solving skills by presenting students with real-world cryptographic challenges and scenarios.
Case-Based Learning	Present case studies of cryptographic incidents or network security breaches, allowing students to analyze situations and propose solutions.
Simulations and Role-Playing	Utilize simulations and role-playing exercises to simulate cryptographic protocols, network attacks, and defense scenarios.

17. Assessment Techniques of each topic of the course:

<u>Part C – Assessment and Evaluation</u>

18. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignments in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 30)	Tests (20)	Assignments (10)
Remember	5	
Understand	5	
Apply	5	
Analyze	5	
Evaluate		5
Create		5

SMEB- Semester Mid & End Examination (70 Marks)

Bloom's Category	Mid (20)	Final (50)
Remember	5	5
Understand	5	10
Apply	5	10
Analyze	5	10
Evaluate		5
Create		10

19. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75

70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

20. Text Book

1. Computer Security: Principles and Practice (3rdedition), Stallings and Brown, Pearson
2. Security in Computing (5^{th} edition), Pfleeger, Pfleeger and Margulies, Pearson
3. Cryptography Theory and Practice (3^{rd} edition), Stinson, Chapman & Hall/CRC

Course Outline – Digital Forensics

Part A – Introduction

1. **Course No. / Course Code** : CSE 431
2. **Course Title** : Digital Forensics
3. **Course Type** : Optional course
4. **Level/Term and Section** : 4th year
5. **Academic Session** : Fall 2023
6. **Course Instructor** : Sourav Saha
7. **Pre-requisite (If any)** :
8. **Credit Value** : 3.0
9. **Contact Hours** :
10. **Total Marks** : 100
11. **Course Objectives and Course Summary:**

This course presents an overview of the principles and practices of digital investigation. The objective of this class is to emphasize the fundamentals and importance of digital forensics. Students will learn different techniques and procedures that enable them to perform a digital investigation. This course focuses mainly on the analysis of physical storage media and volume analysis. It covers the major phases of digital investigation such as preservation, analysis and acquisition of artifacts that reside in hard disks and random access memory. The objective of this class is to emphasize the importance of digital forensics, and to prepare students to conduct a digital investigation in an organized and systematic way. This course will provide theoretical and practical knowledge, as well as current research on Digital Forensics. Upon completion of the course, students can apply open-source forensics tools to perform digital investigation and understand the underlying theory behind these tools.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	Understand
CLO 2	Apply
CLO 3	Examine
CLO 4	Create

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	1	1/Understand	Lecture, Multimedia	Quiz, Written Examination
CLO2	3	1/Apply	Lecture, Problem Analysis	Written Examination
CLO3	4	1/Analyze	Lecture, Problem Analysis	Quiz, Written Examination
CLO4	2	1/Apply	Lecture, Problem Analysis and implementation	Quiz, Assignment, Written Examination

Part B – Content of the Course

14. Course Content:

Overview of digital investigation and digital evidence • Data Acquisition of physical storage devices • Study of file systems with a main focus on Microsoft Windows & Linux Systems • File System Analysis & file recovery • File carving & document analysis • Information hiding & steganography • Time, registry & password recovery • Email & database forensics • Memory acquisition

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Implementing digital forensics involves applying acquired knowledge and tools to collect, analyze, and interpret digital evidence effectively in real-world scenarios.	**CLO1**
2	Identify the differences between various forensic tools and different operating systems.	**CLO2**

3	Develop knowledge regarding File System Analysis, File Recovery, File carving & Document analysis.	**CLO3**
4	Analyze disk images, recover deleted files and extract information hiding & Steganography.	**CLO4**

16. Class Schedule/Lesson Plan/Weekly plan:

Topics / Content	**Specific Outcome(s)**	**Time Frame**	**Suggested Activities**	**Teaching Strategy(s)**	**Alignment with CLO**
Introduction to Digital Forensics	Implement digital forensics involving collection, analysis, and interpretation of digital evidence	Week - 1	Lecture, Discussion, Case studies	Explain foundational concepts and set the stage for the course objectives	CLO1
Forensic Investigation Process	Identify differences between forensic tools and operating systems	Week - 2	Lecture, Hands-on exercises, Simulation	Demonstrate practical aspects of investigation process and tool usage	CLO2
Digital Evidence and File Systems	Develop knowledge in File System Analysis, File Recovery, File carving & Document analysis	Week - 3	Lecture, Lab sessions, Case studies	Analyze file system artifacts and apply forensic techniques	CLO3
Data Acquisition and Imaging	Analyze disk images, recover deleted files and extract information hiding & Steganography	Week-4	Demonstration, Lab exercises, Hands-on practice with forensic tools	Practice using forensic tools for data acquisition and imaging	CLO4
Forensic Analysis Techniques	Develop expertise in analyzing digital evidence using various forensic techniques	Week-5	Workshop, Analysis exercises, Case studies	Apply forensic analysis techniques to investigate digital evidence	CLO1
Network Forensics	Apply network forensic techniques to investigate network-based incidents	Week 6	Lecture, Hands-on exercises, Network simulation	Explore network traffic analysis and identify potential threats	CLO2
Mobile Device Forensics	Perform mobile device forensics to extract and analyze digital evidence	Week - 7	Lecture, Lab sessions with mobile forensics tools	Conduct hands-on examination of mobile devices and analyze mobile	CLO3

	from smartphones			data	
Memory Forensics	Conduct memory forensics to retrieve volatile data and investigate memory-based attacks	Week - 8	Demonstration, Lab exercises, Memory dump analysis	Explore memory analysis techniques and identify potential evidence stored in volatile memory	CLO4
Malware Analysis and Reverse Engineering	Analyze and reverse engineer malware to understand its behavior and impact	Week 9	Lecture, Malware analysis lab, Reverse engineering exercises	Analyze and dissect malware samples to identify malicious activities	CLO1
Cloud Forensics	Investigate digital evidence stored in cloud environments using cloud forensic techniques	Week 10	Lecture, Hands-on exercises using cloud forensic tools	Understand the complexities of conducting forensic investigations in cloud environments	CLO2
Cybercrime Investigations	Apply digital forensics skills to investigate cybercrimes and cyber incidents	Week 11	Case studies, Guest lectures from law enforcement	Explore real-world cybercrime cases and investigative strategies	CLO3
Legal Aspects of Digital Forensics	Understand legal procedures and regulations related to presenting digital evidence in court	Week 12	Lecture, Mock court scenarios, Legal case analysis	Prepare for legal challenges and requirements in digital forensic investigations	CLO4
Incident Response and Forensic Reporting	Develop incident response skills and prepare forensic reports based on investigative findings	Week 13	Simulation exercises, Incident response scenarios, Report writing exercises	Learn how to effectively respond to security incidents and document findings	CLO1
Capstone Project and Final Examination	Apply acquired knowledge and skills to a comprehensive project and prepare for final assessment	Week 14	Capstone project presentation, Final examination review	Showcase proficiency in digital forensics through project implementation and examination	CLO2

17. Teaching-Learning Strategies:

Teaching and Learning	Description

Strategy	
Active Learning	Engage students through interactive activities such as case studies, simulations, and hands-on labs. Encourage participation and critical thinking.
Problem-Based Learning (PBL)	Present real-world digital forensic scenarios or case studies where students must analyze and solve forensic challenges. Foster critical thinking and problem-solving skills.
Use of Forensic Tools and Software	Provide hands-on experience with forensic tools and software used in digital investigations. Allow students to practice using tools for data acquisition, analysis, and reporting.
Collaborative Learning	Promote teamwork and collaboration through group projects and discussions. Encourage peer learning and knowledge sharing.
Guest Lectures and Industry Experts	Invite guest speakers from law enforcement, cybersecurity firms, or digital forensics experts to share insights and industry perspectives.
Role-Playing and Mock Scenarios	Conduct role-playing exercises and mock scenarios to simulate forensic investigations and incident response situations.

18. Assessment Techniques of each topic of the course:

Part C – Assessment and Evaluation

Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignments in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 30)	Tests (20)	Assignments (10)
Remember		
Understand		
Apply		
Analyze		
Evaluate		
Create		

SMEB- Semester Mid & End Examination (70 Marks)

Bloom's Category	Mid(20)	Final(50)
Remember	5	5
Understand	5	10
Apply	5	10
Analyze	5	10
Evaluate		5
Create		10

Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

Class Tests 30%
Term Examination 50%
Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

<u>Part D – Learning Resources</u>

Text Book

Digital Evidence and Computer Crime: Forensic Science, Computers, and the Internet, 3rd Edition Author: Eoghan Casey Publisher: Academic Press ISBN: 9780123742681

The Art of Memory Forensics Authors: Michael Hale Ligh, Andrew Case, Jamie Levy, AAron Walters Publisher: Wiley ISBN: 1118825098

File System Forensic Analysis (1st Ed.) Author: Brian Carrier Publisher: Addison-Wesley, 2005 ISBN: 0321268172

Course Outline – Blockchain and Distributed Security

Part A – Introduction

1. **Course No. / Course Code** : CSE 433
2. **Course Title** : Blockchain and Distributed Security
3. **Course Type** : Optional Course
4. **Level/Term and Section** : 4th Year 2nd Semester
5. **Academic Session** : Fall 24
6. **Course Instructor** : Fabliha Haque
7. **Prerequisite (If any)** : Computer and Cyber Security (CSE 403), Data Structures and Algorithms II (CSE 207)
8. **Credit Value** : 1.5
9. **Contact Hours** : 3.0
10. **Total Marks** :100
11. **Course Objectives and Course Summary** :

Blockchain technology and distributed security have been hailed as a turning point in scaling information technology services at a global level. Although the digital currency Bitcoin is the best-known Blockchain application today, the technology is set to play a much broader role in cyber security innovation. This course is an introduction to the design and analysis of blockchain systems and distributed ledgers and is meant to be taught in parallel to the Introduction to Modern Cryptography course.
The concept of blockchain will be covered in detail together with the supporting cryptographic technology. Questions that will be covered are why it works and what problems it can solve.

This course will cover Introduction to blockchain, distributed ledger, Transactions, Digital Signatures. The consensus layer. Basic Properties. Proof of Work.Robust Transaction Ledgers. Properties and Objectives. Permissioned, permissionless ledgers.Privacy Issues. Anonymity, Pseudonymity, Unlinkability. Zero-Knowledge Proofs.Scalability Issues. Byzantine agreement protocols.Blockchain as a platform. Smart Contracts.Secure multiparty computation techniques and their application to blockchain protocols. Alternative techniques to proof of work for blockchain protocols, proof of stake/space.Game theoretic analysis of blockchain protocols.Name and object registries. Reputation systems. Policy issues related to blockchain.

12. **Course Learning Outcomes: at the end of the Course, the Student will be able to –**

CLO 1	**Understand what is a blockchain and a distributed ledger.**
CLO 2	**Develop or extend the ability to think critically about cybersecurity.**
CLO 3	**Understand the challenges of scaling information technology services across organizational barriers and at a global level.**
CLO 4	**Analyze the security of basic cryptographic primitives like hash functions and digital signatures.**

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	1	1/Understand	Lecture, Problem Analysis, and Implementation.	Quiz, Written exam
CLO2	5	1/Apply	Lecture, Problem Analysis, and Implementation.	Quiz, Written exam
CLO3	3	1/Analyze	Lecture, Problem Analysis, and Implementation.	Quiz, Written exam
CLO4	2	1/Analyze	Lecture, Problem Analysis, and Implementation.	Quiz, Written Exam

Part B – Content of the Course

14. Course Content:

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Introduction to blockchain, distributed ledger, Transactions, Digital Signatures. The consensus layer. Basic Properties. Proof of Work.Robust Transaction Ledgers. Properties and Objectives. Permissioned, permissionless ledgers.	CLO1, CLO2
2	Privacy Issues. Anonymity, Pseudonymity, Unlinkability. Zero-Knowledge Proofs. Scalability Issues. Byzantine agreement protocols. Blockchain as a platform. Smart Contracts.	CLO1, CLO2, CLO3
3	Secure multiparty computation techniques and their application to blockchain protocols. Alternative techniques to proof of work for blockchain protocols, proof of stake/space.Game theoretic analysis of blockchain protocols.Name and object registries. Reputation systems. Policy issues related to blockchain.	CLO1, CLO3, CLO4

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Blockchain Overview Blockchain Building Blocks Blockchain Commercial Use Cases Blockchain Military Cyber Operations Use Cases Blockchain Challenges		Week 1		Live Lecture, Multimedia	CLO1, CLO2
Distributed Consensus Protocols and Algorithms		Week 2		Live Lecture, Multimedia	CLO1, CLO2
Overview of Attack Surfaces in Blockchain, CT1		Week 3-4		Live Lecture, Multimedia	CLO2, CLO3
ProvChain: Blockchain-based Cloud Data Provenance		Week 5-6		Live Lecture, Multimedia	CLO1, CLO3
CT 2, Review on the Mid semester syllabus		Week 7			
MID-TERM EXAMINATION					
Blockchain-based Solution to Automotive Security and Privacy		Week 8		Live/Recorded video Lecture, Problem Solving	CLO2, CLO3
Blockchain-based Dynamic Key Management for IoT-Transportation Security Protection		Week 9		Live/Recorded video Lecture, Problem Solving	CLO2, CLO3
Blockchain-enabled Information Sharing Framework for Cybersecurity		Week 10		Live/Recorded video Lecture, Problem Solving, Group Discussion	CLO4
CT 3, Block Cloud Security Analysis		Week 11		Live/Recorded video Lecture,	CLO2, CLO3

				multimedia	
Permissioned and Permissionless Blockchains		Week 12		Live/Recorded video Lecture, multimedia	CLO2, CLO3
Private Blockchain Configurations for Improved IoT Security		Week 13		Live/Recorded video Lecture, Case study	CLO3, CLO4
CT 4, Review on the full syllabus		Week 14			
FINAL EXAMINATION					

17. Teaching-Learning Strategies:

18. Assessment Techniques of each topic of the course:

<u>Part C – Assessment and Evaluation</u>

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignments in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category Marks (out of 50)	**Tests (25)**	**Assignments (10)**	**Quizzes (5)**	**External Participation in Curricular/Co-Curricular Activities (10)**
Remember				
Understand				
Apply				
Analyze				
Evaluate				
Create				

SMEB- Semester Mid & End Examination (50 Marks)

Bloom's Category	**Mid**	**Final**
Remember	**5**	**5**
Understand	**5**	**10**
Apply	**5**	**10**
Analyze	**5**	**10**
Evaluate		**5**
Create		**10**

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual students will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Blockchain for Distributed Systems Security
   Sachin Shetty (Editor), Charles A. Kamhoua (Editor), Laurent L. Njilla (Editor)

2. Bitcoin and Cryptocurrency Technologies by Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder. http://bitcoinbook.cs.princeton.edu

3. The Bitcoin Backbone Protocol: Analysis and Applications, Juan Garay and Aggelos Kiayias and Nikos Leonardos. https://eprint.iacr.org/2014/765

Option - II

Hardware and Systems Development

Course Outline – Computer Peripherals and Embedded Systems

Part A – Introduction

1. **Course No. / Course Code** : CSE 435
2. **Course Title** : Computer Peripherals and Embedded Systems
3. **Course Type** : Core Course
4. **Level/Term and Section** : 7th Semester (4th Year/1st Semester)
5. **Academic Session** : Fall '24
6. **Course Instructor** : A S Zaforullah Momtaz (ZAM)
7. **Prerequisite (If any)** : CSE 315
8. **Credit Value** : 3.0
9. **Contact Hours** : 3.0
10. **Total Marks** : 100
11. **Course Objectives and Course Summary:**

The objectives of the course are as follows:

a. Introduce the basics of Peripheral and Interfacing.
b. Explain several peripheral devices and sensors.
c. Introduce Embedded Programming and the hardware configuration of Embedded System boards
d. Explain high level methods in Peripheral and Interfacing (e.g., IoT, Edge Computing, HCI, BCI, etc.)

This course will cover the Interfacing basics. Students will learn about the interfacing components (e.g., Mini systems, sensors etc.). This course covers Arduino Environment Programming, Basic I/Os, RAM, ROM, HDD, USB Keyboard, Mouse, 2D & 3D Printers, 2D & 3D Scanners, Computer Cards: Sound, Graphics, LAN. IoT, HCI, Edge Computing, BCI, Dependable computing

12. **Course Learning Outcomes: at the end of the Course, the Student will be able to –**

CLO 1	**Understand** the characteristics and internal architecture of embedded systems.
CLO 2	**Examine** programming, testing, and debugging approaches and tools to develop and verify embedded systems.
CLO 3	**Analyze and apply** the concepts of real-time operating systems to design embedded systems.
CLO 4	**Design** the concepts of edge computing.
CLO 5	**Design** different types of devices that bridge the gap between human and computer interface.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	1	1/Understand	Lecture, Problem Analysis, and Implementation.	Quiz, Written exam
CLO2	5	1/Apply	Lecture, Problem Analysis, and Implementation.	Quiz, Written exam
CLO3	3	1/Analyze	Lecture, Problem Analysis, and Implementation.	Quiz, Written exam
CLO4	2	1/Analyze	Lecture, Problem Analysis, and Implementation.	Quiz, Written Exam
CLO5	5	1/Analyze	Lecture, Problem Analysis, and Implementation.	Quiz, Written Exam

Part B – Content of the Course

14. Course Content:

This is a core course in the Bachelor of Computer Science and Engineering Program which will help the students to understand the core of hardware engineering in the CSE program. This knowledge is very important for the Robotics and Embedded system.

15. Course Contents: Interfacing Basics: Interfacing components and their characteristics. Storage devices: RAM, ROM, Cache memory, Hard disk drive, CD, DVD, Blue Ray, and Flash memory. **Controllers:** Programmable interrupt controller and DMA controller. Computer Ports: Parallel, Serial, USB, and FireWire. Basic I/O: I/O systems & I/O devices. **Converters:** Programmable peripheral interface, Interface to A/D and D/A converter. **Input devices:** Keyboard, Mouse, Touchpad, Webcam, Barcode reader, Thumb scanner, 2D **scanners:** Flatbed, Sheet-fed, Handheld, Drum; 3D scanner. **Output devices**: 2D monitors: LCD, TFT and LED; 3D monitor; 2D printers: Dot Matrix, Inkjet, LASER; 3D printer; CNC. **Computer cards**: Graphics, Sound, and LAN; Interfacing Components: Transistor, MOSFET, and Chips; Bridge Circuits: Relay and Opto-isolator; Motors: DC, Stepper, Servo; Solenoids.

16. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Peripheral Basic	CLO1, CLO2, CLO4
2	Data Input/Output Systems Basics	CLO1, CLO3, CLO4
3	Interfacing Principles: ADC, Actuators, Motors, Sensors, Types of Processors	CLO1, CLO3, CLO4

17. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Course outline Guidelines, Introduction to Peripheral & Interfacing, Introduction to Transducers	CLO1, CLO2	Week 1		Live Lecture, Multimedia	Slide, Book, Class Lecture
Description of Different Types of Transducers, Introduction to Optocouplers	CLO 2, CLO 3	Week 2		Live Lecture, Multimedia	Slide, Book, Class Lecture
Introduction to Relays	CLO 2, CLO 3	Week 3		Live Lecture, Multimedia	Slide, Book, Class Lecture
Solid State Relays, Temperature Control Systems, CT 1	CLO 5	Week 4		Live Lecture, Multimedia	Slide, Book, Class Lecture
Introduction to Sensors	CLO 1	Week 5		Live Lecture, Multimedia	Slide, Book, Class Lecture
Detailed Description of Ultrasonic Sensor	CLO 3, CLO 4	Week 6		Live Lecture, Multimedia	Slide, Book, Class Lecture
CT 2, Review on the Mid semester syllabus		Week 7			
MID-TERM EXAMINATION					
Half Adder/ Subtractor Programming	CLO 3	Week 8		Live/Recorded video Lecture, Problem Solving	Class lecture, Youtube videos
Full Adder/ Subtractor Programming	CLO 3	Week 9		Live/Recorded video Lecture, Problem Solving	Class lecture, Youtube videos
Function Implementation in Arduino	CLO 4	Week 10		Live/Recorded video Lecture, Problem	Class lecture and Slide (If provided)

				Solving, Group Discussion	
CT 3, Primary memory	CLO 2	Week 11		Live/Recorded video Lecture, multimedia	Slide
Secondary Memory	CLO 2	Week 12		Live/Recorded video Lecture, multimedia	Slide
Servo motor with Arduino, Edge Computing	CLO 5	Week 13		Live/Recorded video Lecture, Case study	Arduino.cc and google scholar
CT 4, Review on the full syllabus	--	Week 14			
FINAL EXAMINATION					

18. Teaching-Learning Strategies:

19. Assessment Techniques of each topic of the course:

Part C – Assessment and Evaluation

20. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignments in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as an assignment.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category Marks (out of 30)	**Tests (22.5)**	**Assignments (7.5)**		**Quizzes (0)**	**External Participation in Curricular/Co-Curricular Activities (0)**
Remember					
Understand					
Apply					
Analyze	22.5	7.5			
Evaluate					
Create					

SMEB- Semester Mid & End Examination (50 Marks)

Bloom's Category	**Mid**	**Final**
Remember		
Understand		
Apply	**8**	**20**
Analyze	**12**	**30**
Evaluate		
Create		

21. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

22. Text Book

1. Programming Arduino: Getting Started with Sketches by Simon Monk
2. Arduino: A Technical Reference: A Handbook for Technicians, Engineers, and Makers by J. M. Hughes
3. Arduino Cookbook by Michael Margolis

4. Computer Peripherals by Barry Wilinson

Reference Books & Materials

5. www.arduino.cc
6. Microprocessors and Interfacing By Dauglas V Hall

Course Outline – Robotics

Part A – Introduction

1. **Course No. / Course Code:** CSE 437
2. **Course Title:** Robotics
3. **Course Type:** Core Course
4. **Level/Term and Section:** 7th Semester (4th Year/1st Semester)
5. **Academic Session:** Fall '24
6. **Course Instructor:** A S Zaforullah Momtaz (ZAM)
7. **Prerequisite (If any):** CSE 315
8. **Credit Value:** 3.0
9. **Contact Hours:** 3.0
10. **Total Marks:** 100
11. **Course Objectives and Course Summary:**

The objectives of the course are as follows:

a. Introduce the basics of Peripheral and Interfacing.
b. Explain several peripheral devices and sensors.
c. Introduce Embedded Programming and the hardware configuration of Embedded System boards
d. Explain high level methods in Peripheral and Interfacing (e.g., IoT, Edge Computing, HCI, BCI, etc.)

This course will cover the Interfacing basics. Students will learn about the interfacing components (e.g., Mini systems, sensors etc.). This course covers Arduino Environment Programming, Basic I/Os, RAM, ROM, HDD, USB Keyboard, Mouse, 2D & 3D Printers, 2D & 3D Scanners, Computer Cards: Sound, Graphics, LAN. IoT, HCI, Edge Computing, BCI, Dependable computing

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Understand** the characteristics and internal architecture of embedded systems.
CLO 2	**Examine** programming, testing, and debugging approaches and tools to develop and verify embedded systems.
CLO 3	**Analyze and apply** the concepts of real-time operating systems to design embedded systems.
CLO 4	**Design** the concepts of edge computing.
CLO 5	**Design** different types of devices that bridge the gap between human and computer interface.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	**Corresponding PLOs (Appendix-1)**	**Bloom's taxonomy domain/level (Appendix-2)**	**Delivery methods and activities**	**Assessment Tools**
CLO1	1	1/Understand	Lecture, Problem Analysis, and Implementation.	Quiz, Written exam
CLO2	5	1/Apply	Lecture, Problem Analysis, and Implementation.	Quiz, Written exam
CLO3	3	1/Analyze	Lecture, Problem Analysis, and Implementation.	Quiz, Written exam
CLO4	2	1/Analyze	Lecture, Problem Analysis, and Implementation.	Quiz, Written Exam

CLO5	5	1/Analyze	Lecture, Problem Analysis, and Implementation.	Quiz, Written Exam

Part B – Content of the Course

14. Course Content:
This is a core course in the Bachelor of Computer Science and Engineering Program which will help the students to understand the core of hardware engineering in the CSE program. This knowledge is very important for the Robotics and Embedded system.

15. Course Contents: Interfacing Basics: Interfacing components and their characteristics. Storage devices: RAM, ROM, Cache memory, Hard disk drive, CD, DVD, Blue Ray, and Flash memory. **Controllers:** Programmable interrupt controller and DMA controller. Computer Ports: Parallel, Serial, USB, and FireWire. Basic I/O: I/O systems & I/O devices. **Converters:** Programmable peripheral interface, Interface to A/D and D/A converter. **Input devices:** Keyboard, Mouse, Touchpad, Webcam, Barcode reader, Thumb scanner, 2D **scanners:** Flatbed, Sheet-fed, Handheld, Drum; 3D scanner. **Output devices**: 2D monitors: LCD, TFT and LED; 3D monitor; 2D printers: Dot Matrix, Inkjet, LASER; 3D printer; CNC. **Computer cards**: Graphics, Sound, and LAN; Interfacing Components: Transistor, MOSFET, and Chips; Bridge Circuits: Relay and Opto-isolator; Motors: DC, Stepper, Servo; Solenoids.

16. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Peripheral Basic	CLO1, CLO2, CLO4
2	Data Input/Output Systems Basics	CLO1, CLO3, CLO4
3	Interfacing Principles: ADC, Actuators, Motors, Sensors, Types of Processors	CLO1, CLO3, CLO4

17. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Course outline Guidelines, Introduction to Peripheral & Interfacing, Introduction to Transducers	CLO1, CLO2	Week 1		Live Lecture, Multimedia	Slide, Book, Class Lecture
Description of Different Types of Transducers, Introduction to Optocouplers	CLO 2, CLO 3	Week 2		Live Lecture, Multimedia	Slide, Book, Class Lecture
Introduction to Relays	CLO 2, CLO 3	Week 3		Live Lecture, Multimedia	Slide, Book, Class Lecture
Solid State Relays, Temperature Control Systems, CT 1	CLO 5	Week 4		Live Lecture, Multimedia	Slide, Book, Class Lecture
Introduction to Sensors	CLO 1	Week 5		Live Lecture, Multimedia	Slide, Book, Class Lecture
Detailed Description of Ultrasonic Sensor	CLO 3, CLO 4	Week 6		Live Lecture, Multimedia	Slide, Book, Class Lecture
CT 2, Review on the Mid semester syllabus		Week 7			
MID-TERM EXAMINATION					
Half Adder/ Subtractor Programming	CLO 3	Week 8		Live/Recorded video Lecture,	Class lecture, Youtube videos

				Problem Solving	
Full Adder/ Subtractor Programming	CLO 3	Week 9		Live/Recorded video Lecture, Problem Solving	Class lecture, Youtube videos
Function Implementation in Arduino	CLO 4	Week 10		Live/Recorded video Lecture, Problem Solving, Group Discussion	Class lecture and Slide (If provided)
CT 3, Primary memory	CLO 2	Week 11		Live/Recorded video Lecture, multimedia	Slide
Secondary Memory	CLO 2	Week 12		Live/Recorded video Lecture, multimedia	Slide
Servo motor with Arduino, Edge Computing	CLO 5	Week 13		Live/Recorded video Lecture, Case study	Arduino.cc and google scholar
CT 4, Review on the full syllabus	--	Week 14			
FINAL EXAMINATION					

18. Teaching-Learning Strategies:

19. Assessment Techniques of each topic of the course:

Part C – Assessment and Evaluation

20. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignments in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as an assignment.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category **Marks (out of 30)**	**Tests (22.5)**	**Assignments (7.5)**	**Quizzes (0)**	**External Participation in Curricular/Co-Curricular Activities (0)**
Remember				
Understand				
Apply				
Analyze	22.5	7.5		
Evaluate				
Create				

SMEB- Semester Mid & End Examination (50 Marks)

Bloom's Category	**Mid**	**Final**
Remember		
Understand		
Apply	**8**	**20**
Analyze	**12**	**30**
Evaluate		
Create		

21. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

22. Text Book

1. Programming Arduino: Getting Started with Sketches by Simon Monk
2. Arduino: A Technical Reference: A Handbook for Technicians, Engineers, and Makers by J. M. Hughes

3. Arduino Cookbook by Michael Margolis
4. Computer Peripherals by Barry Wilinson

Reference Books & Materials

5. www.arduino.cc
6. Microprocessors and Interfacing By Dauglas V Hall

Course Outline – Internet of Things

Part A – Introduction

1.	**Course No. / Course Code**	**:** CSE 439
2.	**Course Title**	**:** Internet of Things
3.	**Course Type**	**:** Optional
4.	**Level/Term and Section**	**:** 4th year 2nd Semester
5.	**Academic Session**	**:** Fall 2023
6.	**Course Instructor**	**:**
7.	**Prerequisite (If any)**	**:**
8.	**Credit Value**	**:** 3
9.	**Contact Hours**	**:** 3
10.	**Total Marks**	**:** 100

11. Course Objectives and Course Summary:

The primary objective of this Internet of Things (IoT) course is to provide students with a comprehensive understanding of the principles, techniques, and applications of IoT technology. Upon successful completion of this course, students will be equipped to:

Understand IoT Fundamentals: Students will grasp the core concepts of IoT, including architectures, communication protocols, and sensor networks. They will gain insights into the diverse ecosystem of IoT devices, sensors, and actuators, as well as the underlying technologies enabling connectivity and data exchange.

Develop IoT Solutions: Through practical experience, students will learn to design, implement, and optimize IoT solutions using various hardware platforms and development tools. They will gain proficiency in programming languages such as Python and utilize industry-standard IoT platforms and frameworks for rapid prototyping and deployment.

Apply IoT Technologies: Students will learn how to apply IoT technologies to solve real-world problems across different domains. They will explore a wide range of applications including smart cities, healthcare monitoring, environmental sensing, industrial automation, and wearable devices. By leveraging IoT sensors and data analytics techniques, students will develop innovative solutions to address societal challenges and enhance operational efficiency.

The course will offer a comprehensive introduction to IoT, covering topics such as sensor networks, IoT architectures, data management, and security considerations. Students will engage in hands-on exercises, projects, and case studies, gaining practical experience in developing end-to-end IoT solutions. By the end of the course, students will be well-prepared to leverage IoT technology to create impactful solutions in various domains.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	Understand the basic concepts of IoT and understand the application areas of IOT.
CLO 2	Identify different contexts and appropriate sensors in each context.
CLO 3	Analyze the IoT devices in various industrial applications
CLO 4	Design IoT Services in various fields of the modern world.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	**CLO Statements:** Upon successful completion of the course, students should be able to:	**Corresponding PLOs (Appendix-1)**	**Bloom's taxonomy domain/level (Appendix-2)**	**Delivery methods and activities**	**Assessment Tools**
CLO1	Explain the foundational principles and theories behind Internet of Things (IoT), including IoT architectures and protocols.	a	1/Understand	Lecture, Classwork, Assignments	Quiz, Written exam
CLO2	Describe the mathematical concepts underlying IoT technologies, such as data acquisition, transmission, and processing.	a	1/Understand	Lecture, Classwork, Assignments	Quiz, Written exam
CLO3	Apply data preprocessing techniques, such as data cleaning, normalization, and feature engineering, to IoT datasets.	b	1/Apply	Lecture, Classwork, Assignments	Quiz, Written exam
CLO4	Implement IoT architectures and solutions using hardware components and software frameworks like Arduino, Raspberry Pi, etc	c	1/Apply	Lecture, Classwork, Assignments	Quiz, Written exam

14. **Part B – Content of the Course**

15. **Course Content:** Introduction to IoT concepts and applications, IoT architectures and protocols, Sensor networks and communication protocols, Edge computing, cloud integration, and hardware components, Implementing deep learning models. Data acquisition, transmission, processing in IoT, IoT applications: smart cities, healthcare monitoring, IoT applications: environmental sensing, security, IoT applications: industrial automation, data analytics, IoT integration with AI and machine learning

16. **Alignment of topics of the courses with CLOs:**

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Introduction to IoT concepts and applications	CLO1
2	IoT architectures and protocols	CLO1
3.	Sensor networks and communication protocols	CLO1
4.	Edge computing and cloud integration	CLO2
5.	Hardware components for IoT devices	CLO2
6.	Transfer learning and pre-trained models.	CLO2
7.	IoT applications in smart cities	CLO3
8.	IoT applications in healthcare monitoring	CLO3
9.	IoT security considerations and protocols	CLO4

17. **Class Schedule/Lesson Plan/Weekly plan:**

Topics	Specific Program Outcome (PO) (s)	Time Frame	Suggested Activities	Teaching Strategy (s)	Alignment with CLO
Introduction to IoT concepts and applications	a	Week 1	Assignment on basic understanding	Lecture, Multimedia	CLO1
IoT architectures and protocols	**a**	Week 2		Lecture, Multimedia	CLO1
Sensor networks and communication protocols **CT1: Class Test 1**	**a**	Week 3	Practical session: Implementing regression models with Scikit-learn.	Lecture, Multimedia	CLO1

Edge computing, cloud integration, and hardware componentsImplementing deep learning models.	**a**	Week 4-5		Lecture, Multimedia	CLO2
Data acquisition, transmission, processing in IoT	**b**	Week 6-7	Practical session: SVM implementations.	Lecture, Multimedia	CLO3
IoT applications: smart cities, healthcare monitoring **CT1: Class Test 2**	**c**	Week 8-9	Practical session: Clustering with Scikit-learn.	Lecture, Multimedia	CLO3
Review Class					
MID-SEMESTER EXAMINATION					
IoT applications: environmental sensing, security	**c**	Week 10, 11	Practical session: Building ensemble models.	Lecture, Multimedia	CLO4
IoT applications: industrial automation, data analytics **CT3: Class Test 3**	**c**	Week 12, 13	Practical session: Building a CNN with TensorFlow or PyTorch.	Lecture, Multimedia	CLO4
IoT integration with AI and machine learning, **Review Class**	**c**	Week 14	Implementing an RNN for sequence data.	Lecture, Multimedia	CLO3
FINAL EXAMINATION					

18. Teaching-Learning Strategies:

Final Exam	50%	5	20	5	20
Mid Term Exam	20%	2	10	3	5
Class performance (Class Test, Assignment, Problem solving session)	30%	3	15	2	10
Total	**100%**	**10**	**45**	**10**	**35**

19. Assessment Techniques of each topic of the course:

SL. No.	Topic	Assessment Tools
1	IoT architecutres and protocols	Quiz, Written exam
2	Mathematical concepts underlying IoT technologies	Quiz, Written exam
3	Data Preprocessing	Quiz, Written exam
4	Hardware and Software Frameworks	Quiz, Written exam

Part C – Assessment and Evaluation

20. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignment in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category	Class Tests (30)
Remember	
Understand	10
Apply	10
Analyze	10
Evaluate	
Create	

MEB- Semester Mid & End Examination (70 Marks)

Bloom's Category	Mid (20)	Final (50)
Remember	2	5
Understand		
Apply	10	20
Analyze	3	5
Evaluate		
Create	5	20

21. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25

60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

22. Text Book

1. Arora, Renu and Sood S.K, Fundamentals of Entrepreneurship and Small Business, 1't Edition (2003), Kalyani Publishers, New 'Delhi, India'.

Reference Books & Materials

2. Barringer, Bruce R. and Ireland Duane R., Entrepreneurship Successfully Lunching New Ventures. 3'd Edition (2010) Pearson Education Inc., New Delhi, India
3. Others

Course Outline – Embedded Systems

Part A – Introduction

1.	**Course No. / Course Code**	**:** CSE 441
2.	**Course Title**	**:** Embedded Systems
3.	**Course Type**	**:** Optional Course
4.	**Level/Term and Section**	**:** 4th Year 1st Semester
5.	**Academic Session**	**:** Fall 24
6.	**Course Instructor**	**:** Musfequa Rahmman
7.	**Prerequisite (If any)**	**:** CSE 315
8.	**Credit Value**	**:** 3.0
9.	**Contact Hours**	**:** 3.0
10.	**Total Marks**	**:** 100
11.	**Course Objectives and Course Summary**	**:**

The objectives of the course are as follows:.

a. Introduce the fundamentals of embedded systems.
b. Explore various components and peripherals used in embedded systems.
c. Provide an understanding of embedded programming and hardware configuration.
d. Discuss advanced concepts like real-time operating systems and edge computing.

This course will cover the basics of embedded systems, including microcontrollers, sensors, actuators, and communication protocols, arduino environment programming, basic I/Os, RAM, ROM, HDD, usb keyboard, mouse, 2D & 3D printers, 2D & 3D scanners, computer cards: sound, graphics, LAN. IoT, HCI, edge computing, BCI, dependable computing. It will also delve into programming techniques and real-world applications.

Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Understand** the architecture and characteristics of embedded systems.
CLO 2	**Examine** programming, testing, and debugging approaches and tools to develop and verify embedded systems.
CLO 3	**Analyze and apply** the concepts of real-time operating systems to design embedded systems.
CLO 4	**Design** embedded systems considering the principles of edge computing.

12. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	1	1/Understand	Lecture, Problem Analysis, and Implementation.	Quiz, Written exam
CLO2	5	1/Apply	Lecture, Problem Analysis, and Implementation.	Quiz, Written exam
CLO3	3	1/Analyze	Lecture, Problem Analysis, and Implementation.	Quiz, Written exam
CLO4	2	1/Analyze	Lecture, Problem Analysis, and Implementation.	Quiz, Written Exam

Part B – Content of the Course

13. Course Content:

14. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Introduction to Embedded Systems	CLO1, CLO2
2	Microcontroller Architecture and Programming	CLO1, CLO2, CLO3
3	Sensors and Actuators Interfacing	CLO1, CLO3, CLO4

15. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO

Introduction to Embedded Systems, Microcontroller Basics		Week 1		Live Lecture, Multimedia	CLO1, CLO2
Introduction to Microcontroller Architecture, Programming Basics		Week 2		Live Lecture, Multimedia	CLO1, CLO2
Sensor Interfacing: Analog and Digital Sensors, CT1		Week 3-4		Live Lecture, Multimedia	CLO2, CLO3
Actuator Interfacing: Motors, LEDs		Week 5-6		Live Lecture, Multimedia	CLO1, CLO3
CT 2, Review on the Mid semester syllabus		Week 7			
MID-TERM EXAMINATION					
Real-time Operating Systems Concepts		Week 8		Live/Recorded video Lecture, Problem Solving	CLO2, CLO3
Subtractor Programming		Week 9		Live/Recorded video Lecture, Problem Solving	CLO2, CLO3
Function Implementation in Arduino		Week 10		Live/Recorded video Lecture, Problem Solving, Group Discussion	CLO4
CT 3, Primary memory		Week 11		Live/Recorded video Lecture, multimedia	CLO2, CLO3
Secondary Memory		Week 12		Live/Recorded video Lecture, multimedia	CLO2, CLO3
Servo motor with Arduino, Edge Computing		Week 13		Live/Recorded video Lecture, Case study	CLO3, CLO4
CT 4, Review on the full syllabus		Week 14			
FINAL EXAMINATION					

16. Teaching-Learning Strategies:

17. Assessment Techniques of each topic of the course:

<u>Part C – Assessment and Evaluation</u>

18. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignments in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as an assignment.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category Marks (out of 30)	**Tests (22.5)**	**Assignments (7.5)**	**Quizzes (0)**	**External Participation in Curricular/Co-Curricular Activities (0)**
Remember				
Understand				
Apply				
Analyze	22.5	7.5		
Evaluate				
Create				

SMEB- Semester Mid & End Examination (50 Marks)

Bloom's Category	**Mid**	**Final**
Remember		
Understand		
Apply	**8**	**20**
Analyze	**12**	**30**
Evaluate		
Create		

19. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50

65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

20. Text Book

1. Embedded Systems: Introduction to Arm® Cortex™-M Microcontrollers by Jonathan W. Valvano
2. Arduino: A Technical Reference: A Handbook for Technicians, Engineers, and Makers by J. M. Hughes
3. Arduino Cookbook by Michael Margolis
4. Computer Peripherals by Barry Wilinson

Reference Books & Materials

5. www.arduino.cc
6. Microprocessors and Interfacing By Dauglas V Hall

Course Outline – Human Computer Interaction

Part A – Introduction

1. **Course No. / Course Code** : CSE 443
2. **Course Title** : Human Computer Interaction
3. **Course Type** : Optional
4. **Level/Term and Section** : 4th year 4th semester
5. **Academic Session** : Fall 2023
6. **Course Instructor** : Nadeem Ahmed
7. **Pre-requisite (If any)** : Nil
8. **Credit Value** : 3
9. **Contact Hours** : 3
10. **Total Marks** : 100
11. **Course Objectives and Course Summary:** HCI is a multidisciplinary field integrating theories and methodologies from the fields of cognitive psychology, design, and many other areas with computer science. Here, students will be taught about the fundamental concepts of human-computer interaction and designing based on users preferences by working on interactive design projects.
12.
13. **Course Learning Outcomes: at the end of the Course, the Student will be able to –**

CLO 1	**Understand** core theories, models and methodologies from the field of HCI.

CLO 2	**Identify** usability of interactive systems and its effect on the quality of people's relationship.
CLO 3	**Analyze** interactive design and design process.
CLO 4	**Design** effective and usable graphical computer interfaces.

14. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO 1	1	1/Understand	Lecture, multimedia, Problem Solving,	Quiz, Written exam Assignment
CLO 2	2	1/Identify	Lecture, Problem Solving, Group discussion	Written exam
CLO 3	2	1/Analyze	Lecture, Problem Solving,	Quiz, Written exam
CLO 4	3	1/Create	Lecture, Group discussion	Quiz, Assignment, Written Examination

Part B – Content of the Course

15. Course Content:

Humans, computers, HCI development process, interaction paradigms, doing observational studies, requirements analysis, GUI architecture and tools, universal design, paper prototyping, models, Heuristic evaluation, Dialog based UI, CSCW, Usability testing, Other assessment methods, Motivation for Usability, Olympic Message System

16. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	The human, The computer	CLO 1
2	The interaction, Paradigms	CLO 2
3	Interaction design basics, process, rules, support, evaluation techniques	CLO 3
4	Universal design, user support, cognitive models, issues, stakeholder requirements, communication and collaboration models, task analysis, dialog notations and design, models of the system, modeling rich interaction	CLO 4

17. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
The human: Input-output channels, memory, thinking process, emotion, psychology and design of interactive systems.	Understand the basics of human computer interactions and design principles	Week 1 & 2	problem-solving, discussions, and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer Instruction	CLO 1
The computer: Text entry devices, positioning, pointing, drawing, display devices, virtual reality, 3D interaction physical controls, sensors, special devices.	Understand the different devices, 3D systems, sensors relation related to HCI	Week 2 & 3	problem-solving, discussions, and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer Instruction	CLO 1
The interaction: Models of interaction, styles, framework, ergonomics, WIMP interface, engagement	Identify the HCI interaction models, ergonomics, interface, interactivity and engagement	Week 4 & 5	Quiz 1, problem-solving, discussions, and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer Instruction	CLO 2
Paradigms: Paradigms for interaction-time sharing, video display units, toolkits,	Identify the different paradigms for HCI	Week 6	problem-solving, discussions, and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer Instruction	CLO 2
Interaction design basics Design process, user focus, navigation design, screen design, prototyping	Analyze the different design processes and prototypes.	Week 7	Quiz 2, problem-solving, discussions, and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer Instruction	CLO 3
MID-TERM EXAMINATION					
Design rules Support usability, standards,	Understand the HCI standards, standards,	Week 8	problem-solving, discussions,	lectures, Active Learning, Visualization,	CLO 1

guidelines, golden rules heuristics, patterns	guidelines, rules and heuristics patterns.		and group activities	Concrete Examples, Peer Instruction	
Implementation support and evaluation techniques Working systems, programming the application, toolkits, interface managements, evaluation-goals, expert analysis, methods	Analyze the implementation support system and different evaluation techniques	Week 9,10	problem-solving, discussions, and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer Instruction	CLO 3
Universal design, user support, cognitive models, issues, stakeholder requirements, communication and collaboration models, task analysis, dialog notations and design, models of the system, modeling rich interaction	Design a full interactive system for user	Week 11 – 14	problem-solving, discussions, and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer Instruction	CLO 4
FINAL EXAMINATION					

18. Teaching-Learning Strategies:

Active Learning: Encourage students to actively engage with the material through problem-solving, discussions, and group activities.

Visualization: Discrete mathematics often deals with abstract concepts that can be difficult to grasp. Utilize visual aids such as diagrams, graphs, and animations to illustrate key concepts like graph theory, combinatorics, and logic.

Concrete Examples: Relate abstract concepts to real-world applications whenever possible. Show how discrete mathematics is used in computer science.

Peer Instruction: Implement peer instruction techniques where students teach and learn from each other. Encourage peer tutoring, group study sessions, and peer evaluation of problem-solving approaches.

19. Assessment Techniques of each topic of the course:

SL. No.	Topic	Assessment Tools
1	The human, The computer	Quiz, Written exam, Assignment
2	The interaction, Paradigms	Written exam
3	Interaction design basics, process, rules, support, evaluation techniques	Quiz, Written exam
4	Universal design, user support, cognitive models, issues, stakeholder requirements, communication and collaboration models, task analysis, dialog notations and design, models of the system, modeling rich interaction	Quiz, Assignment, Written, Examination

Part C – Assessment and Evaluation

20. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. CT1, best of CT2 and CT3, best of CT4 and (Average marks on Assignment) will be considered. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment:

Problem-solving assignments (written) will be given throughout the semester. Average marks obtained in all given assignments will be considered as another CT. Late submission will result in a 50% deduction in the score.

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 50)	**Tests (20)**	**Assignments (10)**
Remember		
Understand		
Apply	**10**	
Analyze	**10**	
Evaluate		
Create		**10**

SMEB- Semester Mid & End Exanimation (70 Marks)

Bloom's Category	Test
Remember	
Understand	**5**
Apply	**15**
Analyze	**25**
Evaluate	
Create	**25**

21. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

22. Text Book

1. Human Computer Interaction, 3rd Edition, Alan Dix. (Mandatory text).

Reference Books & Materials

2. The Wiley Handbook of Human Computer Interaction,Kent L. Norman and Jurek Kirakowski.
3. Introduction to Human Factors Engineering (2nd Edition), Wickens, Lee, Liu, and Gordon-Becker.

Course Outline – Quantum Computing

Part A – Introduction

1. **Course No. / Course Code** : CSE 445
2. **Course Title** : Quantum Computing
3. **Course Type** : Optional course
4. **Level/Term and Section** : 4th year

5.	**Academic Session**	**:**
6.	**Course Instructor**	**:**
7.	**Pre-requisite (If any)**	**:** MTH 103 Math II: Linear Algebra; CSE 205 Data Structures
8.	**Credit Value**	**:** 3.0
9.	**Contact Hours**	**:**
10.	**Total Marks**	**:** 100
11.	**Course Objectives and Course Summary**	**:**

The objectives of this course are to:

1. Teach the basic concepts of quantum computing and apply them to solve real world problems.
2. Teach the inner workings of a few fundamental quantum computing algorithms.
3. Demonstrate simple quantum protocols.
4. Show how quantum error correction is performed.

This course is a study and introduction to the area of quantum computing. Quantum computation is an emerging topic whose objective is to develop atomic-scale computers that harness the parallelism of the universe's quantum mechanical rules. Quantum computing is rapidly becoming a reality and has the potential to revolutionize computation within the next two decades. Quantum algorithms, quantum error correction, and quantum cryptography are covered in this course. This course will equip students with the knowledge necessary to comprehend why quantum computers can break certain public key cryptosystems, the engineering hurdles involved in constructing a physical quantum computing device, and the level of security provided by quantum cryptography devices. No prior knowledge of quantum theory is required.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Understand** the basic principles of quantum computing.
CLO 2	**Apply** the knowledge of several basic quantum computing algorithms.
CLO 3	**Examine** the fundamental differences between conventional computing and quantum computing.
CLO 4	**Create** new classes of problems that can be expected to be solved well by quantum computers, and thus write reports to develop solutions.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	**Corresponding PLOs (Appendix-1)**	**Bloom's taxonomy domain/level (Appendix-2)**	**Delivery methods and activities**	**Assessment Tools**
CLO1	1	1/Understand	Lecture, Multimedia	Quiz, Written Examination
CLO2	3	1/Apply	Lecture, Problem Analysis	Written Examination
CLO3	4	1/Analyze	Lecture, Problem Analysis	Quiz, Written Examination

CLO4	2	1/Apply	Lecture, Problem Analysis and implementation	Quiz, Assignment, Written Examination

Part B – Content of the Course

14. Course Content:

Quantum Theory : Brief history; The postulates of quantum theory; **Quantum logic:** Basic definitions of quantum logic: quantum bit, quantum gate, garbage outputs, constant inputs, power, delay, quantum cost, quantum gate calculation complexity; Quantum bit string comparator; Quantum full-adder and subtractor; Quantum multiplexer and demultiplexer; **Quantum circuits:** Quantum adders circuits; Quantum multiplier accumulator; The quantum circuit model; Simple quantum protocols; Superdense coding, **Quantum algorithms:** Deutsch's algorithm; Grover's algorithm for searching; Open quantum systems; Quantum error correction.

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Quantum theory	**CLO1, CLO3, CLO4**
2	Quantum logic	**CLO2, CLO3**
3	Quantum circuits	**CLO2, CLO3**
4	Quantum Algorithms	**CLO2,CLO4**

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Program Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
brief history of quantum computing	PLO1	Week 1	Discussion	Lecture, multimedia, group discussion	CLO1
The postulates of quantum theory	PLO1	Week 2	Report on "postulates of quantum theory"	Lecture, multimedia, active learning	CLO1
Quantum logic; Basic definitions of quantum logic: quantum bit, quantum gate, garbage outputs, constant inputs	PLO1	Week 3	Solve elementary quantum logic problems	Lecture, multimedia, Problem solving	CLO2, CLO3
power, delay, quantum cost, quantum gate	PLO1,PLO3	Week 4	Discussion, hand-on practice	Lecture, multimedia, problem	CLO2

calculation complexity				solving	
Quantum bit string comparator; Quantum full-adder and subtractor;	PLO1,PLO3	Week 5	Discussion, hand-on practice	Lecture, multimedia, problem solving, home work	CLO2
Quantum multiplexer and demultiplexer;	PLO1,PLO3	Week 6	Discussion, hand-on practice	Lecture, multimedia, problem solving	CLO2, CLO3
Review class		Week 7	Discussion	Lecture	
MID-TERM EXAMINATION					
Quantum adders circuits; Quantum multiplier accumulator;	PLO1, PLO2	Week 8	Discussion, hand-on practice	Lecture, multimedia, problem solving, home work	CLO2, CLO3
The quantum circuit model	PLO1	Week 9	Discussion, circuit drawing practice, circuit simulation	Lecture, multimedia, problem solving	CLO2
Simple quantum protocols, Superdense coding	PLO1	Week 10	Report on quantum protocols	Lecture, multimedia, homework	CLO2
Deutsch's algorithm	PLO3, PLO2	Week 11	Algorithm simulation	Lecture, multimedia, simulation, problem solving	CLO2, CLO4
Grover's algorithm for searching, Open quantum systems	PLO3, PLO2	Week 12	Algorithm simulation, Discussion	Lecture, multimedia, visualization, homework	CLO4
Quantum error correction	PLO4	Week 13	Discussion	Lecture, simulation, multimedia	CLO1
Review class		Week 14	Discussion	Lecture	
FINAL EXAMINATION					

17. Teaching-Learning Strategies:

Strategies	**Topics**
Active Learning and Discussions	Quantum theory

Problem-Based Learning	Quantum logic
Case-Based Learning	Quantum circuits
Simulations and Role-Playing	Quantum algorithms

18. Assessment Techniques of each topic of the course:

SL. No	Topics / Content	Assessment Techniques
1	Quantum theory	Mid Term Exam
2	Quantum logic	Mid-Term Exam, Quiz-01
3	Quantum logic	Mid-Term Exam, Quiz-02, Final Exam
4.	Quantum circuits	Quiz-03, Final Exam
5.	Quantum circuits	Quiz-04, Final Exam
6.	Quantum algorithms	Final Exam

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignments in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 30)	Tests (20)	Assignments (10)
Remember	6.67	
Understand	6.67	
Apply	6.67	
Analyze		
Evaluate		5
Create		5

SMEB- Semester Mid & End Examination (70 Marks)

Bloom's Category	Mid(20)	Final(50)
Remember	**5**	**5**
Understand	**5**	**10**
Apply	**5**	**10**
Analyze	**5**	**10**
Evaluate		**5**
Create		**10**

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Quantum Computing: A pathway to quantum logic design by Hafiz Md. Hasan Babu

Reference Books & Materials

2. Preskill, J. Notes on Quantum Computation.
3. Peres, Asher. Quantum Theory: Concepts and Methods. New York, NY: Springer, 1993. ISBN: 9780792325499.

Course Outline – Digital System Design

Part A – Introduction

1. **Course No. / Course Code** : CSE 447
2. **Course Title** : Digital System Design
3. **Course Type** : Elective
4. **Level/Term and Section** : 4^{th} year
5. **Academic Session** :
6. **Course Instructor** :
7. **Pre-requisite (If any)** :
8. **Credit Value** : 3.00
9. **Contact Hours** :
10. **Total Marks** : 100

11. **Course Objectives and Course Summary:** This is a core course of Bachelor of Computer Science and Engineering Program which will help the students for understanding the Computer Architecture and Peripheral & Interfacing in the CSE program. This knowledge is very important for the Robotics and Embedded system.

12. **Course Learning Outcomes: at the end of the Course, the Student will be able to –**

CLO 1	**Apply** digital system design principles and descriptive techniques.
CLO 2	**Analyze** functional building blocks and control and timing concepts of digital systems.
CLO 3	**Develop** a complex digital system design in a hierarchical fashion using top-down and bottom-up design approaches.
CLO 4	**Utilize** programmable devices such as FPGAs and PLDs to implement digital system designs.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	1	1/Apply	Lecture, multimedia	Written Examination, Assignment
CLO2	2	1/Analyze	Lecture, Group discussion	Quiz, Written Examination
CLO3	4	1/Understand 1/Apply 2/Imitation	Lecture, Problem Solving, Group discussion	Quiz, Presentation, Viva, Written Examination
CLO4	5	1/Apply 1/Understand 2/Manipulation 2/Imitation	Problem Solving	Quiz, Assignment, Written Examination

<u>Part B – Content of the Course</u>

1. **Course Content:** A brief study on total digital system ALU, memory, register, control unit design, study on simple processor design, SAP 1, SAP 2, SAP 3 Architecture. Introduction to combinational logic, and designing different simple circuits using combinational logic.

2. **Alignment of topics of the courses with CLOs:**

SL. No	Topics / Content	Course Learning Outcome (CLO)
1		
2		
3		

2. **Class Schedule/Lesson Plan/Weekly plan:**

Topics	**Specific Outcome(s)**	**Time Frame**	**Suggested Activities**	**Teaching Strategy(s)**	**Alignment with CLO**

		Week 1			
		Week 2			
		Week 3			
		Week 4			
		Week 5			
		Week 6			
		Week 7			
MID-TERM EXAMINATION					
		Week 8			
		Week 9			
		Week 10			
		Week 11			
		Week 12			
		Week 13			
		Week 14			
FINAL EXAMINATION					

3. **Teaching-Learning Strategies:**
4. **Assessment Techniques of each topic of the course:**

<u>Part C – Assessment and Evaluation</u>

5. **Assessment Strategy**

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignment in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category Marks (out of 50)	**Tests (25)**	**Assignments (10)**	**Quizzes (5)**	**External Participation in Curricular/Co-Curricular Activities (10)**
Remember				
Understand				
Apply				
Analyze				
Evaluate				
Create				

SMEB- Semester Mid & End Exanimation (50 Marks)

Bloom's Category	Mid	Final
Remember		
Understand		
Apply		
Analyze		
Evaluate		
Create		

6. **Evaluation Policy**

   Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

   1. Class Tests 30%
   2. Term Examination 50%
   3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

7. **Text Book**
   1. Digital Logic and Computer Design- M. Morris Mano
   2. Digital Computer Electronics- Malvino- Brown

Course Outline – Topics of Current Interest

Part A – Introduction

1. **Course No. / Course Code** : CSE 451
2. **Course Title** : Topics of Current Interest
3. **Course Type** : Optional Course
4. **Level/Term and Section** : 4th Year
5. **Academic Session** : Fall 23
6. **Course Instructor** : Md Mahedi Hassan
7. **Pre-requisite (If any)** :
8. **Credit Value** : 3.0

9. Contact Hours : 3.0

10. Total Marks : 100

11. Course Objectives and Course Summary :

The objectives of this course are to

- **Provide** knowledge and understanding on principles of Pattern recognition and Machine Learning.
- **Introduce** the concept of different types of classification and recognition algorithm.
- **Learn** the regression and classification algorithm.
- **Enable** the student to gain application of different types pattern recognition tasks.
- **Emphasize** the design and implement of different types pattern recognition algorithms.

This course prepares students for connecting learning algorithms to a broad variety of real-life issues in Science and Engineering. It also prepares students for future endeavors as Data Scientists, Knowledge Workers, Decision Makers and numerous prospective professions to be named.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Understand** the objectives and basic terminologies of Machine Learning (ML)
CLO 2	**Explain** the theoretical and mathematical concepts of data preprocessing, ML models, Perceptron, Artificial Neural Networks (ANN), and searching and optimization algorithms
CLO 3	**Apply** the data preprocessing techniques and ML algorithms with proper parameter and hyperparameter tuning
CLO 4	**Design** multi-layer Neural Networks employing back propagation in for solve real world problems
CLO 5	**Analyze** the outcomes of the models using different performance metrics and the effect of parameters and hyperparameters on the models

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO 1	1	Understand	Lecture, Multimedia	Written Exam
CLO 2	1	Understand	Lecture, Multimedia	Written Exam
CLO 3	1	Apply	Lecture, Multimedia	Written Exam
CLO 4	3	Create	Lecture, Multimedia	Assignment
CLO 5	2	Evaluate	Lecture, Multimedia	Written Exam

Part B – Content of the Course

14. Course Content:

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	**Classification and Regression**	**CLO1, CLO2, CLO3**
2	**Clustering**	**CLO1, CLO2**
3	**Principal Component Analysis (PCA)**	**CLO1, CLO2, CLO3**
4	**Ensemble Learning**	**CLO1, CLO2, CLO3**
5	**Model Evaluation**	**CLO5**
6	**Neural Networks**	**CLO4**
7	**Genetic Algorithm (GA)**	**CLO2**
8	**Optimization Algorithms**	**CLO2**

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Introduction to ML and its classification, understanding datasets		Week 1		Lecture, Multimedia	CLO1
Introduction to supervised learning, classification algorithms, KNN, Support Vector Machine		Week 2		Lecture, Multimedia	CLO2, CLO3
Decision Tree		Week 3		Lecture, Multimedia	CLO2, CLO3
Logistic Regression, Naïve Bayes Algorithm		Week 4		Lecture, Multimedia	CLO2, CLO3
Clustering Algorithms, Introduction to Ensemble Learning, Random Forest Classifier, AdaBoost Classifier		Week 5		Lecture, Multimedia	CLO2
Voting Classifier, PCA		Week 6		Lecture, Multimedia	CLO2, CLO3
Data preprocessing techniques, performance evaluation of models		Week 7		Lecture, Multimedia, Group Discussions	CLO3, CLO5
MID-TERM EXAMINATION					
Theory and mathematical examples related to GA		Week 8		Lecture, Multimedia	CLO2
Particle Swarm		Week 9		Lecture,	COL3

Optimization (PSO), Ant Colony Optimization (ACO)				Multimedia	
Introduction to Neurons, logic function implementation using Neurons		Week 10		Lecture, Multimedia, Group Discussion	CLO4, CLO1
Introduction to single and multi-layer Neural Networks, Feed-Forward Neural Networks, Activation Functions		Week 11		Lecture, Multimedia	CLO4
Training of Feed-Forward Neural Network with Back-Propagation		Week 12		Lecture, Multimedia	CLO4
Convolutional Neural Networks (CNN)		Week 13		Lecture, Multimedia	CLO4
Neural Networks for Sequential / Time Series data		Week 14		Lecture, Multimedia	CLO4
FINAL EXAMINATION					

17. Teaching-Learning Strategies:

18. Assessment Techniques of each topic of the course:

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester, 2 class tests will be taken for midterm and 2 class tests will be taken for final term. 1 makeup class test will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The topic or case studies will be given as assignment to the individual during the class which they have to prepare at home and will submit on or before the due date. Late submissions will cost 25% deduction of marks per day and after 3 days of the deadline, no submission will be accepted.

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 30)	Tests (20)	Assignments (10)
Remember		
Understand	**5**	
Apply	**10**	
Analyze	**5**	
Evaluate		

Create		**10**

SMEB- Semester Mid & End Exanimation (70 Marks)

Bloom's Category	**Mid**	**Final**
Remember		
Understand	**4**	**9**
Apply	**16**	**21**
Analyze		**10**
Evaluate		**10**
Create		

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 20%
2. Assignment 10%
3. Term Examination 50%
4. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

<u>Part D – Learning Resources</u>

21. Text Book

1. Christopher M. Bishop, Pattern Recognition and Machine Learning, 2016, Springer

Reference Books & Materials

2. Tom M. Mitchell, Introduction to Machine Learning, 1st Edition (1997), McGraw-Hill Education

Option-I Lab

<u>Course Outline – CSE 412</u>

1. Course Code : CSE 412

2. Course Title : Artificial Intelligence and Expert Systems Lab

3.	**Course Type**	**:** Core Course
4.	**Level/Term and Section**	**:** 4th year 1st Semester
5.	**Academic Session**	**:** Fall 23
6.	**Course Instructor**	**:** Dr. Nasima Begum (DNB), Associate Professor
7.	**Prerequisite (If any)**	**:** CSE 205, CSE 207
8.	**Credit Value**	**:** 3.0
9.	**Contact Hours**	**:** 3.0
10.	**Total Marks**	**:** 100

11. Course Objectives and Course Summary:

The objectives of this course are to:

1. Teach basic AI programming tools and how to apply them in solving problems.
2. Introduce the concept of different types of search strategy for problem solving.
3. Emphasize the design and implementation of multi-agent problems to simulate the real-world scenario.
4. Implementation of different ML models to solve various real-life problems.

Artificial Intelligence and Expert Systems Lab course is required for the student to be able to design and develop intelligent agents to solve real life problems. This is a required course in the CSE program.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLOs	Statements
CLO1	**Develop and analyze** different Knowledge Base (KB) with logical reasoning to solve different problems of complex relationship structure with logical reasoning, forward backward chaining
CLO2	**Solve** different problems using heuristics and adversarial search algorithms
CLO3	**Implement** different ANN and Machine Learning models to solve various real-life problems

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	**CLO Statements:** Upon successful completion of the course, students should be able to:	**Corresponding PLOs (Appendix-1)**	**Bloom's taxonomy domain/level (Appendix-2)**	**Delivery methods and activities**	**Assessment Tools**
CLO 1	**Develop and analyze** different Knowledge Base (KB) with	3	2/Manipulation	Live Lecture, Multimedia, Problem Solving	Lab Exam, Assignment, Report

	logical reasoning to solve different problems of complex relationship structure with logical reasoning, forward backward chaining				
CLO 2	**Solve** different problems using heuristics and adversarial search algorithms	3, 10	2/Manipulation	Live Lecture, Multimedia, Problem Solving	Assignment, Report, Oral Exam
CLO 3	**Implement** different ANN and Machine Learning models to solve various real-life problems	4, 10	2/Articulation	Live Lecture, Multimedia, Problem Solving	Project, Report Presentation, Oral Exam

Part B – Content of the Course

14. Course Content:

Laboratory works based on CSE 407.

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Introduction to knowledgebase, expert systems	**CLO1**
2	Uninformed Search, informed search, genetic algorithm, heuristic Search, game theory	**CLO2**
3	Propositional and first order logic, fuzzy logic	**CLO3**

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Program Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Goal of AI Lab, Discuss Course Outline, Introduction to Prolog programming software	3	Week 1	Lecture, multimedia, Required software installation	Lecture, multimedia, Required software installation	CLO1
Prolog data object, list, operators and functions	3	Week 2	Lab task, Problem solving	Lecture, multimedia, lab task	CLO1
Uninformed Search (BFS, DFS, UCS, IDS)		Week 3	Lecture, multimedia, Case Study	AIMA: ch 3, Lecture Slides	CLO2
Informed Search (Best-First, Greedy Best-First, A*, Heuristics)		Week 4-5	Lecture, multimedia, Case Study	AIMA: ch 3, Lecture Slides	CLO2
CT-2					
Local Search, Genetic Algorithm		Week 6	Lecture, multimedia,, Problem Solving	AIMA: ch 4, Lecture Slides	CLO2
Adversarial Search, Game Theory		Week 6-7	Lecture, multimedia, Case Study	AIMA: ch 5, Lecture Slides	CLO2
CT-3					
Mid Term Exam					
KRR, Fuzzy Logic	Week 8-9		Lecture, multimedia	AIMA: ch 7-8, Lecture Slides	CLO3
Understand probabilistic reasoning, Interpret Bayesian Rule, basics of Markov Model	Week 10-11		Lecture, multimedia, Problem Solving	AIMA: ch 13-14, Lecture Slides	CLO4
CT-4					
Intro to Artificial	Week 12		Lecture,	AIMA: ch	CLO5

Neural Networks and different Learning Techniques		multimedia, Case Study	18, Lecture Slides	
Intro to multilayer Neural Networks and different problems	Week 13	Lecture, multimedia, problem solving	AIMA: ch 18, Lecture Slides	CLO5
Review Class	Week 14	Lectures, multimedia	AIMA all ch, Lecture Slides	All CLOs
Final Exam				

17. Teaching-Learning Strategies:

18. Assessment Techniques of each topic of the course:

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 5 class tests may be taken during the semester, 2 class tests will be taken for midterm and 3 class tests will be taken for final term. 3 out of 5 class tests will be considered. CT1, best of CT2 & CT3, and CT4, CT5 will be considered. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: Assignment (written and/or presentation.) will be given throughout the semester. Late submission will result in a 50% deduction in score. Students will have to do the presentation on the given topic as an assignment.

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 30)	Tests (20)	Assignments (10)
Remember		
Understand		
Apply	**20**	**10**
Analyze		
Evaluate		
Create		

SMEB- Semester Mid & End Examination (70 Marks)

Bloom's Category	Test
Remember	14
Understand	
Apply	42
Analyze	14
Evaluate	
Create	

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual students will be evaluated based on the following criteria with respective weights.

1. Assessment 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. AIMA = Artificial Intelligence: A Modern Approach, 4th Edition, Stuart J. Russell and Peter Norvig, Pearson.

2. AIMA = Artificial Intelligence: A Modern Approach, 3rd Edition, Stuart J. Russell and Peter Norvig, Pearson.

3. Artificial Intelligence-by Patrick Henry Winston

Course Outline – Machine Learning Lab

Part A – Introduction

1.	**Course No. / Course Code**	: CSE 414
2.	**Course Title**	: Machine Learning Lab
3.	**Course Type**	: Optional
4.	**Level/Term and Section**	: 4th Year 2nd Semester
5.	**Academic Session**	: Fall 2023
6.	**Course Instructor**	:
7.	**Pre-requisite (If any)**	:
8.	**Credit Value**	: 1.5
9.	**Contact Hours**	: 3.0

10. Total Marks : 100

11. Course Objectives and Course Summary :

The objectives of this course are to:
The primary objective of this Machine Learning Foundations course is to equip students with a solid understanding of the fundamental concepts, algorithms, and applications of machine learning. Upon successful completion of this course, students will be able to:

Gain the Fundamental Concepts: Grasp the core principles of machine learning including supervised and unsupervised learning, model evaluation, and the bias-variance trade-off.

Learn Machine Learning Models: Gain hands-on experience in designing, implementing, and tuning machine learning models using Python and popular libraries such as NumPy, Pandas, Scikit-learn, and TensorFlow or PyTorch.

Apply Machine Learning Algorithms: Become proficient in applying various machine learning algorithms, including linear regression, logistic regression, decision trees, random forests, support vector machines (SVM), neural networks, and clustering techniques. This course will introduce and provide hands-on exercise in the field of Machine Learning (ML). Students will learn algorithms that underpin many popular Machine Learning techniques, as well as develop an understanding of the practical usage of these algorithms. The hands-on exercise will build students' ability to analyze solutions to real-world problems such as classification, future behavior prediction of a system, recommendation systems, and decision making. The hands-on exercise will help students to learn and utilize different ML libraries and frameworks such as TensorFlow, Keras, Pandas, Numpy, Matplotlib, and Scikit Learn. The use of different integrated development environments (IDE) such as Pycharm, Anaconda, or Google Colaboratory will help students to design, build and use simulation-based ML algorithms or models.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Demonstrate** the concept associated with ML.
CLO 2	**Examine t**he concept of learning algorithms.
CLO 3	**Design** the methodologies of ML techniques and the steps to optimize it.
CLO 4	**Develop** the Machine learning models with the modern simulation tools, i.e., Google Colab, Spyder, Jupyter Notebook etc.
CLO5	**Analyze** the outcome of result and performance of the algorithms and the parameters associated with the algorithms.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	**CLO Statements:** Upon successful completion of the course, students should be able to:	**Correspondi ng PLOs (Appendix-1)**	**Bloom's taxonomy domain/level (Appendix-2)**	**Delivery methods and activities**	**Assessment Tools**
CLO1	**Demonstrate** the concept	c	1/Apply	Lecture,	Lab

	associated with ML.			Practice sessions	evaluation, assignments, presentation
CLO2	**Examine** the concept of learning algorithms	c	1/Apply	Lecture, Practice sessions	Lab evaluation, assignments, presentation
CLO3	**Design** the methodologies of ML techniques and the steps to optimize it.	c	1/Apply	Lecture, Practice sessions	Lab evaluation, assignments, presentation
CLO4	**Develop** the Machine learning models with the modern simulation tools, i.e., Google Colab, Spyder, Jupyter Notebook etc.	c	1/Apply	Lecture, Practice sessions	Lab evaluation, assignments, presentation
CLO5	**Analyze** the outcome of results and performances of the algorithms and the parameters associated with the algorithms	c	1/Apply	Lecture, Practice sessions	Lab evaluation, assignments, presentation

Part B – Content of the Course

14. Course Content:

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Overview of machine learning, data mining, and statistical pattern recognition. Types of machine learning (supervised, unsupervised, reinforcement learning). Applications and challenges in machine learning.	**CLO1**
2	Mathematical foundations underlying major machine learning algorithms, including but not limited to linear regression, logistic regression,	**CLO2**

	decision trees, and neural networks.	
3	Appropriate data preprocessing, feature engineering, and data splitting techniques to prepare datasets for machine learning	**CLO3**
4	Practical session with implementations.	**CLO4**
5	Practical session with implementations.	**CLO5**

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Program Outcome (PO) (s)	Time Frame	Suggested Activities	Teaching Strategy (s)	Alignment with CLO
Overview of machine learning, data mining, and statistical pattern recognition. Types of machine learning (supervised, unsupervised, reinforcement learning). Applications and challenges in machine learning.		Week 1	Assignment on basic understanding	Lecture, Multimedia	CLO1
Data cleaning, normalization, and transformation. Feature selection and dimensionality reduction. Handling missing data and outliers.		Week 2	Practice problems	Lecture, Multimedia	CLO1
Linear regression: simple and multiple regression analysis. Polynomial regression and model evaluation metrics. **Lab Test 1**		Week 3	Practical session: Implementing regression models with Scikit-learn.	Lecture, Multimedia	CLO1
Logistic regression, K-Nearest Neighbors (KNN). Decision Trees and Random Forests. Model evaluation: confusion matrix, accuracy, precision, recall, F1-score.		Week 4	Practice problems	Lecture, Multimedia	CLO2

Linear SVM for classification. Kernel SVM for nonlinear data.		Week 5	Practical session: SVM implementation	Lecture, Multimedia	CLO3
K-Means clustering, hierarchical clustering. DBSCAN and cluster evaluation metrics. **Lab Test 2**		Week 6	Practical session: Clustering with Scikit-learn.	Lecture, Multimedia	CLO3
Lab Mid					
Bagging, boosting, and stacking. Random Forests and AdaBoost. Principal Component Analysis (PCA). t-Distributed Stochastic Neighbor Embedding (t-SNE).		Week 7, 8	Practical session: Building ensemble models.	Lecture, Multimedia	CLO4
Introduction to neural networks, perceptrons. Deep learning frameworks overview (TensorFlow, PyTorch). Building a simple neural network. Convolutional Neural Networks (CNN) Understanding convolutions and pooling. Applications of CNNs in image recognition and classification. **Lab Test 3**		Week 9, 10	Practical session: Building a CNN with TensorFlow or PyTorch.	Lecture, Multimedia	CLO5
Introduction to RNNs and the problem of long-term dependencies. Long Short-Term Memory (LSTM) networks.		Week 11, 12	Implementing an RNN for sequence data.	Lecture, Multimedia	CLO3
Introduction to NLP applications: sentiment analysis, text classification. **Lab Test 4**		Week 13, 14	NLP with Python's NLTK or SpaCy.	Lecture, Multimedia	CLO5
Lab Final Examination					

17. Teaching-Learning Strategies:

18. Assessment Techniques of each topic of the course:

Part C – Assessment and Evaluation

19. Assessment Strategy

Lab exams: Altogether 4 to 6 lab exams may be taken during the semester. 3 out of 4/4 out of 5/5 out of 6 lab exams may be considered depending on the number of lab exams taken. No makeup lab exam will be taken. Students are strongly recommended not to miss any lab exams.

Assignment: Assignment (Written and/or presentation.) will be given throughout the semester. Late submission will result in a 50% deduction in score. Students will have to do the presentation on the given topic as an assignment.

CIE- Continuous Internal Evaluation (60 Marks)

Bloom's Category Marks (out of 50)	**Tests (40)**	**Assignments (20)**
Remember		
Understand		
Apply	**40**	**20**
Analyze		
Evaluate		
Create		

SMEB- Semester Mid & End Exanimation (40 Marks)

Bloom's Category	**Mid**	**Final**
Remember		
Understand		
Apply	**40**	
Analyze		
Evaluate		
Create		

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual students will be evaluated based on the following criteria with respective weights.

Lab Tests 40%
Term Examination 40%
Continuous Evaluation 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point

80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Machine Learning" by Tom M. Mitchell

2. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron

3. Introduction to Machine Learning with Python: A Guide for Data Scientists" by Andreas C. Müller & Sarah Guido

Course Outline – Deep Learning Lab

Part A – Introduction

1. **Course No. / Course Code** : CSE 416
2. **Course Title** : Deep Learning Lab
3. **Course Type** : Optional
4. **Level/Term and Section** : 4th year 2nd Semester
5. **Academic Session** : Fall 2023
6. **Course Instructor** :
7. **Prerequisite (If any)** :
8. **Credit Value** : 1.5
9. **Contact Hours** : 1.5
10. **Total Marks** : 100
11. **Course Objectives and Course Summary** :

The primary objective of this Deep Learning Foundations course is to provide students with a comprehensive understanding of the principles, techniques, and applications of deep learning. Upon successful completion of this course, students will be equipped to:

Understand Deep Learning Fundamentals: Grasp the core concepts of deep learning, including neural network architecture, activation functions, optimization algorithms, and regularization techniques.

Develop Deep Learning Models: Gain practical experience in designing, implementing, and optimizing deep learning models using Python and industry-standard libraries such as

TensorFlow or PyTorch. Students will become proficient in handling large-scale datasets and implementing advanced architectures such as convolutional neural networks (CNNs) and recurrent neural networks (RNNs).

Apply Deep Learning Algorithms: Learn how to apply deep learning algorithms to various tasks such as image classification, object detection, natural language processing (NLP), and sequence generation. Students will explore cutting-edge techniques including transfer learning, attention mechanisms, and reinforcement learning in the context of deep learning.

The course will offer a comprehensive introduction to deep learning, covering topics such as data preprocessing, model training, evaluation, and deployment. Students will gain hands-on experience through practical exercises and projects, enabling them to tackle real-world problems using state-of-the-art deep learning techniques.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	Differentiate between the objectives and terminologies associated with Deep Learning
CLO 2	Explain the basic concepts of Deep Learning algorithms
CLO 3	Apply the techniques and algorithms of Deep Learning on various datasets
CLO 4	Design the methodologies of Deep Learning techniques and the optimization steps
CLO 5	Analyze the outcome of results and performances of the algorithms and the parameters associated with the algorithms

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	**CLO Statements:** Upon successful completion of the course, students should be able to:	**Corresponding PLOs (Appendix-1)**	**Bloom's taxonomy domain/level (Appendix-2)**	**Delivery methods and activities**	**Assessment Tools**
CLO1	**Explain** the foundational principles and theories behind deep learning, including neural network architecture, activation functions, and optimization algorithms.	a	1/Understand	Lecture, Classwork, Assignments	Quiz, Written exam
CLO2	**Describe** the mathematical concepts underlying deep learning algorithms, such as backpropagation, gradient descent, and regularization techniques.	a	1/Understand	Lecture, Classwork, Assignments	Quiz, Written exam

CLO3	**Apply** data preprocessing techniques, such as normalization, scaling, and augmentation, to prepare datasets for deep learning tasks.	b	1/Apply	Lecture, Classwork, Assignments	Quiz, Written exam
CLO4	**Implement** various deep learning architectures, including convolutional neural networks (CNNs) and recurrent neural networks (RNNs), using Python and frameworks like TensorFlow or PyTorch.	c	1/Apply	Lecture, Classwork, Assignments	Quiz, Written exam

14. <u>Part B – Content of the Course</u>

15. Course Content:

16. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Introduction to deep learning concepts and applications.	CLO1
2	Neural network architecture: perceptrons, activation functions, optimization algorithms (e.g., gradient descent).	CLO1
3.	Deep learning frameworks and libraries (e.g., TensorFlow, PyTorch).	CLO1
4.	Convolutional neural networks (CNNs) for image recognition tasks.	CLO2
5.	Recurrent neural networks (RNNs) for sequence modeling and time series analysis.	CLO2
6.	Transfer learning and pre-trained models.	CLO2
7.	Data preprocessing techniques for deep learning tasks (e.g., normalization, augmentation).	CLO3
8.	Implementing deep learning models using Python and deep learning libraries.	CLO4

17. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific ProgramOutcome (PO) (s)	Time Frame	Suggested Activities	Teaching Strategy (s)	Alignment with CLO
Introduction to deep learning concepts and applications. Neural network architecture: perceptrons, activation functions, optimization algorithms.		Week 1	Assignment on basic understanding	Lecture, Multimedia	CLO1
Deep learning frameworks and libraries (e.g., TensorFlow, PyTorch). Convolutional neural networks (CNNs) for image recognition tasks.		Week 2		Lecture, Multimedia	CLO1
Recurrent neural networks (RNNs) for sequence modeling and time series analysis. Transfer learning and pre-trained models.		Week 3	Practical session: Implementing regression models with Scikit-learn.	Lecture, Multimedia	CLO1
Data preprocessing techniques for deep learning tasks (e.g., normalization, augmentation). Implementing deep learning models.		Week 4		Lecture, Multimedia	CLO2
Linear SVM for classification. Kernel SVM for nonlinear data. K-Means clustering, hierarchical clustering.		Week 5	Practical session: SVM implementations.	Lecture, Multimedia	CLO3
DBSCAN and cluster evaluation metrics. Bagging, boosting, and stacking. Random Forests and AdaBoost.		Week 6	Practical session: Clustering with Scikit-learn.	Lecture, Multimedia	CLO3
Review Class		Week 7			
MID-SEMESTER EXAMINATION					

Principal Component Analysis (PCA). t-Distributed Stochastic Neighbor Embedding (t-SNE).		Week 8, 9	Practical session: Building ensemble models.	Lecture, Multimedia	CLO4
Introduction to neural networks, perceptrons. Deep learning frameworks overview (TensorFlow, PyTorch). Building a simple neural network. Convolutional Neural Networks (CNNs). Understanding convolutions and pooling.		Week 10, 11,	Practical session: Building a CNN with TensorFlow or PyTorch.	Lecture, Multimedia	CLO4
Applications of CNNs in image recognition and classification. Introduction to RNNs and the problem of long-term dependencies. Long Short-Term Memory (LSTM) networks. Implementing an RNN for sequence data. Text preprocessing and representation.		Week 12	Implementin g an RNN for sequence data.	Lecture, Multimedia	CLO3
Introduction to NLP applications: sentiment analysis, text classification. NLP with Python's NLTK or SpaCy.		Week 13, 14	NLP with Python's NLTK or SpaCy.	Lecture, Multimedia	CLO4
Review Class		Week 14		Lecture, Multimedia	
		FINAL EXAMINATION			
Topics	**Specific ProgramO utcome (PO) (s)**	**Time Frame**	**Suggested Activities**	**Teaching Strategy (s)**	**Alignment with CLO**

Overview of machine learning, data mining, and statistical pattern recognition. Types of machine learning (supervised, unsupervised, reinforcement learning). Applications and challenges in machine learning.		Week 1	Assignment on basic understandin g	Lecture, Multimedia	CLO1

18. Teaching-Learning Strategies:

19. Assessment Techniques of each topic of the course:

Assessment Type	**% weight**	**CO1**	**CO2**	**CO3**	**CO4**
Final Project Demonstration and Documentation	60%	5	5	10	40
Mid Term Exam	20%	2	10	3	5
Class performance (Assignment, Problem solving session)	30%	3	15	2	10
Total	**100%**	**10**	**45**	**10**	**35**

20. Assessment Techniques of each topic of the course:

Part C – Assessment and Evaluation

21. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignment in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

22. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

23. Text Book

1. Arora, Renu and Sood S.K, Fundamentals of Entrepreneurship and Small Business, 1't Edition (2003), Kalyani Publishers, New 'Delhi, India'.

Reference Books & Materials

2. Barringer, Bruce R. and Ireland Duane R., Entrepreneurship Successfully Lunching New Ventures. 3'd Edition (2010) Pearson Education Inc., New Delhi, India
3. Others

Course Outline – Data Science and Applications Lab

Part A – Introduction

1. **Course No. / Course Code** : CSE 418
2. **Course Title** : Data Science and Applications Lab
3. **Course Type** : Optional
4. **Level/Term and Section** : 4th Year 2nd Semester
5. **Academic Session** : Fall 2023
6. **Course Instructor** :
7. **Pre-requisite (If any)** :
8. **Credit Value** : 3.0
9. **Contact Hours** : 3.0
10. **Total Marks** : 100
11. **Course Objectives and Course Summary :**

The objectives of this course are to:

The primary objective of this Course is to equip students with the theoretical knowledge, practical skills, and ethical understanding necessary to effectively analyze, interpret, and communicate data-driven insights across a variety of domains. Upon successful completion of this course, students will be able to:

Understand the core principles of data science, including data processing, analysis, and visualization, along with the mathematical and statistical underpinnings of data science methodologies.

Apply machine learning algorithms and statistical models to solve real-world problems, using leading data science tools and programming languages, primarily Python.
Develop skills for effectively communicating complex data insights to both technical and non-technical audiences, and foster collaboration within diverse teams for successful project execution.

3. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Describe** a comprehensive understanding of the data science lifecycle, including data collection, preprocessing, analysis, and visualization.
CLO 2	**Interpret** the mathematical and statistical foundations underlying data science algorithms and techniques.
CLO 3	**Apply** techniques for data cleaning, preprocessing, and transformation to prepare datasets for analysis.
CLO 4	**Implement** machine learning algorithms using Python libraries (e.g., Pandas, NumPy, Scikit-learn, TensorFlow) to solve real-world data science problems.
CLO5	**Evaluate** data modeling and clustering techniques.

4. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	**CLO Statements:** Upon successful completion of the course, students should be able to:	**Corresponding PLOs (Appendix-1)**	**Bloom's taxonomy domain/level (Appendix-2)**	**Delivery methods and activities**	**Assessment Tools**
CLO1	**Describe** a comprehensive understanding of the data science lifecycle, including data collection, preprocessing, analysis, and visualization.	c	1/Apply	Lecture, Practice sessions	Lab evaluation, assignments, presentation
CLO2	**Interpret** the mathematical and statistical foundations underlying data science algorithms and techniques.	c	1/Apply	Lecture, Practice sessions	Lab evaluation, assignments, presentation
CLO3	**Apply** techniques for data cleaning, preprocessing, and transformation to prepare datasets for analysis.	c	1/Apply	Lecture, Practice sessions	Lab evaluation, assignments, presentation
CLO4	**Implement** machine	c	1/Apply	Lecture,	Lab

	learning algorithms using Python libraries (e.g., Pandas, NumPy, Scikit-learn, TensorFlow) to solve real-world data science problems.			Practice sessions	evaluation, assignments, presentation
CLO5	**Evaluate** data modeling and clustering techniques	c	1/Apply	Lecture, Practice sessions	Lab evaluation, assignments, presentation

<u>Part B – Content of the Course</u>

5. **Course Content:**
   Defining Data Science and role of data scientist. Fundamentals of Data Science,
   Solution to problems using data science, Data Science Topics and Algorithms, Statistics and numerical analysis, data distribution, analyzing data for feature engineering, time/space domain analysis, frequency domain analysis, time-frequency domain analysis, data analysis, processing data for modeling, supervised learning, unsupervised learning, and data clustering, gridsearchCV, and model pipelining, feature selection methods, dimensionality reduction algorithms, an introduction to Python for Data Science, An Introduction to numeric and text data processing methods, Cloud-Based Tools for Data Science, Libraries for Data Science, Getting Started with Jupyter Notebook, Data Visualisation with Matplotlib and Seaborn.
6. **Alignment of topics of the courses with CLOs:**

SL. No	**Topics / Content**	**Course Learning Outcome (CLO)**
1	Defining Data Science and role of data scientist. Fundamentals of Data Science, Solution to problems using data science	**CLO1**
2	Overview of machine learning: supervised vs. unsupervised learning Key concepts: overfitting, underfitting, model evaluation Introduction to machine learning libraries (e.g., Scikit-learn)	**CLO2**
3	Data Science Topics and Algorithms	**CLO3**
4	Practical sessions with implementations.	**CLO4**
5	Practical sessions with implementations.	**CLO5**

7. **Class Schedule/Lesson Plan/Weekly plan:**

Topics	Specific Program Outcome (PO) (s)	Time Frame	Suggested Activities	Teaching Strategy (s)	Alignment with CLO
Overview of Data Science and its significance Key components: Data exploration, modeling, inference, and decision-making Introduction to the data science workflow		Week 1	Assignment on basic understanding	Lecture, Multimedia	CLO1
Data cleaning, normalization, and transformation. Feature selection and dimensionality reduction. Handling missing data and outliers.		Week 2	Practice problems	Lecture, Multimedia	CLO1
Descriptive statistics and probability theory Inferential statistics: hypothesis testing, confidence intervals Statistical significance and p-values **Lab Test 1**		Week 3	Practice problems	Lecture, Multimedia	CLO1
Overview of machine learning: supervised vs. unsupervised learning Key concepts: overfitting, underfitting, model evaluation Introduction to machine learning libraries (e.g., Scikit-learn)		Week 4	Practical session: Implementing regression models with Scikit-learn.	Lecture, Multimedia	CLO2
Linear SVM for classification. Kernel SVM for nonlinear data.		Week 5	Practical session: SVM implementations	Lecture, Multimedia	CLO3
K-Means clustering, hierarchical clustering. DBSCAN and cluster evaluation metrics. **Lab Test 2**		Week 6	Practical session: Clustering with Scikit-learn.	Lecture, Multimedia	CLO3
Lab Mid Exam		Week 7			
Principles of effective data		Week	Practical	Lecture,	CLO4

visualization Introduction to data visualization tools (e.g., Matplotlib, Seaborn, Tableau) Interactive visualizations and dashboards		8, 9	session: Building Visualization & Dashboards	Multimedia	
Introduction to big data concepts and tools (e.g., Hadoop, Spark) Big data processing and analysis techniques **Lab Test 3**		Week 10, 11,	Case studies in big data applications	Lecture, Multimedia	CLO4
Text preprocessing and representation. Introduction to NLP applications: sentiment analysis, text classification. **Lab Test 4**		Week 12, 13	NLP with Python's NLTK or SpaCy.	Lecture, Multimedia	CLO4
Week 14 - Lab Final Examination					

8. **Teaching-Learning Strategies:**
9. **Assessment Techniques of each topic of the course:**

<u>Part C – Assessment and Evaluation</u>

10. **Assessment Strategy**

Lab exams: Altogether 4 to 6 lab exams may be taken during the semester. 3 out of 4/4 out of 5/5 out of 6 lab exams may be considered depending on the number of lab exams taken. No makeup lab exam will be taken. Students are strongly recommended not to miss any lab exams.

Assignment: Assignment (Written and/or presentation.) will be given throughout the semester. Late submission will result in a 50% deduction in score. Students will have to do the presentation on the given topic as an assignment.

CIE- Continuous Internal Evaluation (60 Marks)

Bloom's Category Marks (out of 50)	**Tests (40)**	**Assignments (20)**
Remember		
Understand		
Apply	**40**	**20**
Analyze		
Evaluate		
Create		

SMEB- Semester Mid & End Exanimation (40 Marks)

Bloom's Category	**Mid**	**Final**
Remember		
Understand		
Apply	**40**	
Analyze		
Evaluate		
Create		

11. Evaluation Policy

Grades will be calculated as per the university grading structure and individual students will be evaluated based on the following criteria with respective weights.

Lab Tests	40%
Term Examination	40%
Continuous Evaluation	20%

UAP Grading Policy

Numeric Grade	**Letter Grade**	**Grade Point**
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

12. Text Book

1. Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython" by Wes McKinney
2. An Introduction to Statistical Learning: with Applications in R" by Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani
3. Big Data: A Revolution That Will Transform How We Live, Work, and Think" by Viktor Mayer-Schönberger and Kenneth Cukier

Course Outline – Big Data Analytics Lab

Part A – Introduction

1.	**Course No. / Course Code**	**:** CSE 416
2.	**Course Title**	**:** Big Data Analytics Lab
3.	**Course Type**	**:** Optional Course
4.	**Level/Term and Section**	**:** 4^{th} Year 1^{st} Semester
5.	**Academic Session**	**:** Fall 2023
6.	**Course Instructor**	**:**
7.	**Prerequisite (If any)**	**:** Nil
8.	**Credit Value**	**:** 3.00
9.	**Contact Hours**	**:** 3.00
10.	**Total Marks**	**:** 100
11.	**Course Objectives and Course Summary**	**:**

The objectives of this course are:

1) To provide a solid conceptual understanding of the fundamentals of Big Data.
2) To learn the basic concepts of Big Data.
3) To learn the architecture of Hadoop Cluster and Ecosystem.
4) To learn distributed data storage and processing systems.
5) To learn the fundamental tools used in Big Data.

The summary of this course are to:

Big Data is the hot new buzzword in IT circles. The proliferation of digital technologies with digital storage and recording media has created massive amounts of diverse data, which can be used for marketing and many other purposes. The concept of Big Data refers to massive and often unstructured data, on which the processing capabilities of traditional data management tools result to be inadequate. Big Data can take up terabytes and petabytes of storage space in diverse formats including text, video, sound, images, and more. The course gives an overview of the Big Data phenomenon, focusing then on extracting value from the Big Data using predictive analytics techniques, the main big data tools (Hadoop) focusing on its basic components, the concept of IoT, M2M and IoT communication protocols.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Interpret** the components, tools, and techniques of Big Data
CLO 2	**Classify** the Hadoop model and identify their differences in implementation.
CLO 3	**Explain** how information can be sent via IoT communication protocols and Models.
CLO 4	**Determine** the various IoT levels and their applications and Fields in development sectors.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	5	Understand	Lecture, Multimedia	Quiz, Lab Evaluation, Exam
CLO2	2	Apply	Lecture, Multimedia	Quiz, Lab Evaluation, Exam
CLO3	4	Apply	Lecture, Multimedia	Quiz, Lab Evaluation, Exam
CLO4	1	Analyze	Lecture, Multimedia	Quiz, Lab Evaluation, Exam

Part B – Content of the Course

14. Course Content: Introduction to Big Data, Small Data and Big Data, How Big Data Comes, Types of Big Data, Big Data Characteristics, Big Data Analytics, Big Data Applications Domains, Hadoop, Hadoop Distributed File Systems, Map Reduce, Yet Another Resource Negotiator, Hadoop Cluster and Ecosystem, Apache Sqoop, Apache Hive, Apache Pig, Introduction to IoT, IoT Protocols, Communication Models in IoT: Request & Response Model, Publish-Subscribe Model(Pub-Sub), Push-Pull Model, Exclusive Pair Model, IoT advantages and Disadvantages, Machine to Machine Communication, Software Defined Networking, Network Function Virtualization, Different Types of IoT Level (Level 1 to Level 6).

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Core concepts of big data and big data analytics, including evolution of big data, 5'Vs of big data, life cycle and types of big data analytics.	CLO1
2	Basic components of Hadoop with a special focus on HDFS, MapReduce Approach and can describe the need for YARN including Yarn Components, Architecture and Working flow	CLO2
3	The services of Hadoop ecosystem components such as Apache Sqoop, Apache Flume, Apache Pig & Hive and can distinguish among their functionalities.	CLO1
4	Concept of IoT, elements, characteristics of an IoT ecosystem, IoT Levels and Templates, the concept of M2M, difference between IoT and M2M, SDN, NFV for IoT, M2M Value Chains, IoT Value Chains and being able to demonstrate various IoT communication protocols.	CLO3, CLO4

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
What is big data How is big data different from traditional data sources? / Small data vs Big data Attributes of big data Big data as an opportunity		Week 1	To be Shared in Google Classroom	Lecture, Multimedia	CLO1
Why big data important Use / Applications of big data Key Computing Resources for Big Data. Why big data analytics		Week 2	https://icpc.global/	Lecture, multimedia	CLO2
What is big data analytics Life cycle of big data Analytics Types of big data analytics		Week 3	To be shared in Google Classroom	Lecture, Practice sessions	CLO2
Tools used in big data analytics Big data application domains		Week 4	To be shared in Google Classroom	Lecturer, Multimedia	CLO1, CLO3
Why Hadoop comes (Problems regarding RDBMS and DataWarehouse) What is Hadoop History of Hadoop Examples of commercial distribution company for Hadoop		Week 5	To be shared in Google Classroom	Lecture, multimedia, Practice sessions, Problem solving	CLO1, CLO3
Basic Introduction to Hadoop components Introduction to Masternode, Slavenode & Self healing		Week 6	To be shared in Google Classroom	Lecture, Practice sessions	CLO1, CLO3
MID-TERM EXAMINATION		Week 7	To be shared in Google Classroom	Practice Sessions	CLO1, CLO2, CLO3
What is DFS and HDFS File Block and Replication Rack HDFS Architecture		Week 8	Chapter 7 of required text	Lecture, Practice sessions, Problem Solving	CLO1, CLO4

HDFS File Read Operation HDFS Write Read Operation Rack Awareness					
What is Hadoop MapReduce MapReduce in Nutshell Advantages of MapReduce Hadoop MapReduce Approach with an example Hadoop 1.1		Week 9	Chapter 8 of required text	Lecture, Practice Sessions, Problem Solving	CLO3, CLO4
Limitations of Hadoop 1.1 Need for yarn Hadoop 2.0 Hadoop MapReduce Yarn Components Yarn Architecture Yarn Working flow		Week 10	To be shared in Google Classroom	Lecture, Practice Sessions, Problem Solving	CLO3, CLO4
What is Hadoop Cluster Hadoop Cluster Architecture Size of Hadoop Architecture Single Node and Muti-Node Cluster [Textbook: Chapter-6, Page (175-179)]		Week 11	To be shared in Google Classroom	Lecture, Practice Sessions, Problem Solving	CLO3, CLO4
Communication Protocol in Hadoop Cluster Benefits of Hadoop Cluster Challenges of Hadoop Cluster Hadoop Ecosystem: [Textbook: Chapter-10, Page (264-282)]		Week 12	To be shared in Google Classroom	Lecture, Practice Sessions, Problem Solving	CLO1, CLO4
Concept, Apache sqoop, Apache flume, Apache pig, Apache hive. [Textbook: Chapter-12, Page (325-334)]		Week 13	To be shared in Google Classroom	Problem Solving	CLO1, CLO4
FINAL EXAMINATION		Week 14	To be shared in Google Classroom	Problem Solving	CLO1, CLO3, CLO4

17. Teaching-Learning Strategies:

18. Assessment Techniques of each topic of the course:

Assessment Type	% weight	CO1	CO2	CO3	CO4
Final Exam and Viva	40%	10	10	5	15
Lab Tests	20%	5	5	5	5
Continuous Evaluation: Class performance, Problem Solving Sessions, assignments	40%	10	10	10	10
Total	**100%**	**25**	**25**	**20**	**30**

Part C – Assessment and Evaluation

19. Assessment Strategy

Lab exams: Altogether 4 to 6 lab exams may be taken during the semester. 3 out of 4/4 out of 5/5 out of 6 lab exams may be considered depending on the number of lab exams taken. No makeup lab exam will be taken. Students are strongly recommended not to miss any lab exams.

Assignment: Assignment (Written and/or presentation.) will be given throughout the semester. Late submission will result in a 50% deduction in score. Students will have to do the presentation on the given topic as an assignment.

CIE- Continuous Internal Evaluation (60 Marks)

Bloom's Category Marks (out of 50)	Lab Test (40)	Assignment (20)
Remember		
Understand	**10**	**5**
Apply	**20**	**10**
Analyze	**10**	**5**
Evaluate		
Create		

SMEB- Semester End Examination (40 Marks)

Bloom's Category	Final (40)
Remember	
Understand	**10**
Apply	**15**
Analyze	**15**
Evaluate	
Create	

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual students will be evaluated based on the following criteria with respective weights.

1. Lab Tests 40%
2. Term Examination 40%
3. Continuous Evaluation 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Big Data Science & Analytics: A Hands-on Approach Book by Arshdeep Bahga and Vijay K. Madisetti
2. Internet_of_Things_IoT_Systems_Architectures,_Algorithms,_Methodologies
3. Big-Data Analytics for Cloud, IoT and Cognitive Computing

Reference Books & Materials

1. Internet of things and big data analytics toward next-generation intelligence
2. Handbook of Research on Big Data and the IoT, By Gurjit Kaur and Pradeep Tomar
3. Big Data Analytics for Internet of Things (1st Edition), by Tausifa Jan Saleem (Editor), Mohammad Ahsan Chishti (Editor

Course Outline – Natural Language Processing Lab

Part A – Introduction

1. **Course No. / Course Code** : CSE 422
2. **Course Title** : Natural Language Processing Lab
3. **Course Type** : Optional
4. **Level/Term and Section** : 4th year 2nd semester
5. **Academic Session** : Fall 2023
6. **Course Instructor** : Nadeem Ahmed

7. **Pre-requisite (If any)** : NIL
8. **Credit Value** : 1.5
9. **Contact Hours** : 3.0
10. **Total Marks** : 100

11. Course Objectives and Course Summary:

The Natural Language Processing (NLP) Lab course introduces students to practical applications of NLP techniques through hands-on exercises and projects. Students will learn how to process, analyze, and understand natural language text using various tools and algorithms.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	Understand Fundamental NLP Concepts
CLO 2	Apply NLP Algorithms and Tools
CLO 3	Develop and Evaluate NLP Models

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	1	1/Understand	Lecture, Problem Solving	Lab work and lab test
CLO2	2	1/Apply	Lecture, Multimedia	Lab work and lab test
CLO3	9, 10, 12	1/Create	Lecture, Multimedia	Continuous updates and presentations

<u>Part B – Content of the Course</u>

14. Course Content:

Introduction to NLP Basics, Python Libraries for NLP (NLTK, spaCy), Tokenization and Text Preprocessing, Text Representation (Bag-of-Words, TF-IDF), Feature Engineering for NLP Tasks, Sentiment Analysis, Named Entity Recognition (NER), Part-of-Speech Tagging (POS), Text Generation, Information Retrieval in NLP, Advanced NLP Applications, Hands-on Projects and Exercises.

15. Alignment of topics of the courses with CLOs

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Understand Text Processing Techniques	CLO1
2	Apply Text Processing Techniques with Real World Data	CLO2
3	Develop a real world project with the techniques	CLO3

16. Class Schedule/Lesson Plan/Weekly plan:

Content	Specific Outcome(s)	Time Frame (Weeks)	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Introduction to NLP and Text Preprocessing	- Understand the fundamentals of NLP	1	- Overview of NLP concepts and applications	Lecture, Discussion	CLO1
	- Learn basic text preprocessing methods (tokenization, stemming)		- Introduction to text preprocessing techniques	Hands-on exercises with Python environment for NLP	CLO2
Text Representation and Feature Extraction	- Implement feature extraction for text classification tasks	2	- Vectorization techniques (Bag-of-Words, TF-IDF)	Hands-on exercises with text vectorization	CLO1, CLO2
Sentiment Analysis and Text Classification	- Perform text classification using supervised learning techniques	3	- Introduction to sentiment analysis	Implement sentiment analysis using NLP libraries	CLO2, CLO3
Named Entity Recognition and Part-of-Speech Tagging	- Implement NER and POS tagging using NLP tools	4	- Overview of NER and POS tagging	Hands-on practice with NER and POS tagging	CLO2, CLO3
Language Modeling and Text Generation	- Implement text generation tasks using NLP models	5	- Introduction to language modeling techniques (N-grams, LSTM)	Building language models for text generation	CLO2, CLO3
Topic Modeling and Document	- Apply topic modeling and	6	- Overview of topic	Implementing topic	CLO2,CLO3

Clustering	clustering to analyze text collections		modeling and clustering techniques	modeling and clustering algorithms	
NLP Applications and Project Showcase	- Demonstrate understanding of NLP concepts through project work	7	- Exploration of NLP applications (chatbots, text summarizati on)	Final project showcase and presentation	CLO2, CLO3

17. Teaching-Learning Strategies:

Active Learning: Encourage students to actively engage with the material through problem-solving, discussions, and group activities.

Visualization: Discrete mathematics often deals with abstract concepts that can be difficult to grasp. Utilize visual aids such as diagrams, graphs, and animations to illustrate key concepts like graph theory, combinatorics, and logic.

Concrete Examples: Relate abstract concepts to real-world applications whenever possible. Show how discrete mathematics is used in computer science.

Peer Instruction: Implement peer instruction techniques where students teach and learn from each other. Encourage peer tutoring, group study sessions, and peer evaluation of problem-solving approaches.

18. Assessment Techniques of each topic of the course:

Assessment Tools
Oral and viva
Lab work and lab test
Lab work and lab test
Lab work and lab test
Continuous updates and presentations

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignment in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category Marks (out of 50)	Tests (25)	Assignments (10)	Quizzes (5)	External Participation in Curricular/Co-Curricular Activities (10)
Remember				
Understand	**20**			
Apply	**30**			
Analyze				
Evaluate				
Create	**50**			

SMEB- Semester Mid & End Exanimation (50 Marks)

Bloom's Category	Mid	Final
Remember		
Understand		
Apply		
Analyze		
Evaluate		
Create		

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Evaluation 30%
2. Mid-Term Examination 20%
3. Project

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Steven Bird, Ewan Klein, Edward Loper., Natural Language Processing with Python, 1't Edition (2009), O'Reilly Media.

Reference Books & Materials

2. Jalaj Thanaki., Python Natural Language Processing: Advanced machine learning and deep learning techniques for natural language processing. Packt Publishing (July 31, 2017)

Course Outline – Computer Graphics Lab

Part A – Introduction

1.	**Course No. / Course Code**	**:** CSE 424
2.	**Course Title**	**:** Computer Graphics Lab
3.	**Course Type**	**:** Optional Course
4.	**Level/Term and Section**	**:** 4^{th} Year
5.	**Academic Session**	**:** Fall 23
6.	**Course Instructor**	**:** Md Mahedi Hassan
7.	**Pre-requisite (If any)**	**:**
8.	**Credit Value**	**:** 1.50
9.	**Contact Hours**	**:** 3.00
10.	**Total Marks**	**:** 100
11.	**Course Objectives and Course Summary**	**:**

The objectives of this course are:

- Provide knowledge and understanding on principles of Computer Graphics.
- Introduce the concept of different types of transformation and projection.
- Emphasize the design and implement of different types computer graphics and animation techniques to simulate the real world.

The goal of this course is to provide an introduction of the application to the theory and practice of computer graphics. The course will assume a good background in programming in C or C++ and a background in mathematics including familiarity with the theory and use of coordinate geometry and of linear algebra.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Understand** the objectives, terminology associated with Computer Graphics.
CLO 2	**Apply** the techniques and algorithms of Computer Graphics and Data Visualization.
CLO 3	**Design** the methodologies of Computer Graphics on data visualization of various geometric objects of both 2D and 3D objects.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO 1	1	Understand	Lecture, Group Discussion	Viva
CLO 2	5	Apply	Lecture, Coding Example, Presentation	Lab Tasks, Projects, Viva
CLO 3	3	Analyze	Group Discussion, Presentation	Projects, Viva

Part B – Content of the Course

14. Course Content:

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Computer Graphics Pipeline	CLO1
2	Modeling Transformation	CLO2, CLO3
3	Illumination	CLO2, CLO3
4	Texture Mapping	CLO2, CLO3
5	Curved Surfaces	CLO2, CLO3

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Introduction to Computer Graphics Pipeline, and OpenGL		Week 1	Classwork	Lecture, Coding Example	CLO1, CLO2, CLO3
Drawing 2D and 3D objects using OpenGL		Week 2	Classwork, assignment	Lecture, Coding Example	CLO2, CLO3
Applying modeling transformations to 3D objects		Week 3	Classwork, assignment	Lecture, Coding Example	CLO2, CLO3
Taking input from the user		Week 4	Classwork	Lecture, Coding Example	CLO2, CLO3
Applying animation on the scene		Week 5	Classwork, assignment	Lecture, Coding	CLO2, CLO3

				Example	
Project idea discussion		Week 6		Group discussion	CLO2, CLO3
Viva		Week 7			CLO1, CLO2, CLO3
MID-TERM EXAMINATION					
Adding illumination and shading to the scene		Week 8		Lecture, Coding Example	CLO2, CLO3
Texturing on objects in the scene		Week 9		Lecture, Coding Example	CLO2, CLO3
Drawing curved surfaces using Bezier Curve drawing algorithm		Week 10		Lecture, Coding Example	CLO2, CLO3
Project update I		Week 11	Presentation		CLO2, CLO3
Project update II		Week 12	Presentation		CLO2, CLO3
Project showcasing, and presentation		Week 13	Presentation		CLO2, CLO3
Viva		Week 14			CLO2, CLO3
FINAL EXAMINATION					

17. **Teaching-Learning Strategies:**
18. **Assessment Techniques of each topic of the course:**

<u>Part C – Assessment and Evaluation</u>

19. **Assessment Strategy**

Class Tests: Altogether 4 class tests may be taken during the semester, 2 class tests will be taken for midterm and 2 class tests will be taken for final term. 1 makeup class test will be taken. Students are strongly recommended not to miss any class tests.

Assignment: For the assignment, a very simple 2D/3D world designed using any graphics toolkit taught in the corresponding lab will be submitted by the individual student. The student must be able to explain his work to the course instructor while displaying the project and face a viva regarding the project.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category Marks (out of 50)	Viva (10)	Lab Tasks (40)
Remember	**5**	
Understand	**5**	
Apply		**40**

Analyze		
Evaluate		
Create		

SMEB- Semester Mid & End Examination (50 Marks)

Bloom's Category	**Project (50)**
Remember	
Understand	
Apply	**15**
Analyze	**10**
Evaluate	**10**
Create	**15**

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 20%
2. Assignment 10%
3. Term Examination 50%
4. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Zhigang Xiang, Roy A. Plastock, Schaum's Outline of Theory and Problems of Computer Graphics, 2nd Edition (2020), Mcgraw Hill Education

Reference Books & Materials

2. Hearn, Baker, Carithers, Computer Graphics with OpenGL, Fourth Edition (2014), Pearson Education Limited

Course Outline – Pattern Recognition Lab

Part A – Introduction

1. **Course No. / Course Code** : CSE 426
2. **Course Title** : Pattern Recognition
3. **Course Type** : Optional Course
4. **Level/Term and Section** : 4th year 2nd semester
5. **Academic Session** : Fall 2023
6. **Course Instructor** :
7. **Prerequisite (If any)** : Nill
8. **Credit Value** : 1.50
9. **Contact Hours** : 3.00
10. **Total Marks** : 100
11. **Course Objectives and Course Summary** :
    The Pattern Recognition course delves into advanced techniques and methodologies essential for understanding and applying pattern recognition algorithms across diverse domains. Through a blend of theoretical concepts and hands-on projects, students gain a deep comprehension of pattern recognition principles and their practical applications. Leveraging cutting-edge tools and frameworks, such as TensorFlow and scikit-learn, students engage in tasks ranging from image and speech recognition to natural language processing and beyond. By the end of the course, students emerge equipped with the skills to tackle real-world challenges in pattern recognition, paving the way for rewarding career opportunities in fields like artificial intelligence, machine learning, and data analysis.

12. **Course Learning Outcomes: at the end of the Course, the Student will be able to –**

CLO 1	Develop a comprehensive **understanding** of fundamental pattern recognition concepts and algorithms.
CLO 2	**Apply** advanced machine learning techniques, including deep learning and neural networks, to analyze and recognize patterns in various data sets.
CLO 3	Utilize Python libraries and frameworks such as TensorFlow and scikit-learn to **create** solutions for real life problems using pattern recognition models effectively.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	1	1/Understand	Lecture, Multimedia	Quiz, Assignment, Written Examination
CLO2	2	1/Apply	Lecture, Multimedia	Quiz, Viva, Assignment, Written Examination
CLO3	3	1/ Create	Lecture, Multimedia, Illustrations	Quiz, Assignment, Written Examination

Part B – Content of the Course

14. Course Content:

Introduction: The Pattern Recognition lab offers an immersive hands-on experience in the realm of identifying and analyzing patterns within data, employing advanced machine learning techniques. With a strong emphasis on practical application, students will delve deep into fundamental principles while mastering cutting-edge methodologies. From grasping the basics to implementing sophisticated algorithms, participants will navigate through a diverse array of pattern recognition concepts, including deep learning and neural networks. Through hands-on projects and utilization of powerful Python libraries like TensorFlow and scikit-learn, students will develop the skills necessary to extract valuable insights from complex datasets effectively. By the end of the lab, students will emerge equipped with a robust understanding of pattern recognition principles, ready to tackle real-world challenges in fields such as artificial intelligence, machine learning, and data analysis.

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Feature Extraction and Representation	CLO 1, CLO 2
2	Classification algorithms	CLO 3
3	Clustering Techniques	CLO 3

16. Class Schedule/Lesson Plan/Weekly plan:

17.

Topics	Specific Outcome(s)	Week	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Introduction to Pattern Recognition	- Understand the basic concepts of pattern recognition	Week 1	- Lecture: Overview of pattern recognition concepts and applications	Lecture, Presentation	CLO 1
Feature Extraction and Representation	- Learn about feature extraction techniques	Week 2	- Practical: Implement PCA for feature extraction using Python	Hands-on Coding	CLO 1
Classification Algorithms	- Understand various classification algorithms	Week 3	- Mini-project: Implement k-NN and Decision Trees algorithms for classification using a sample dataset	Project Work, Coding	CLO 1
Clustering Techniques	- Explore clustering methods	Week 4	- Practical: Perform K-means clustering on a dataset	Hands-on Activity	CLO 1
Evaluation	- Learn about	Week 5	- Discussion: Compare	Discussion,	CLO 2

Metrics	evaluation metrics for pattern recognition		and analyze different evaluation metrics for classification and clustering algorithms	Analysis	
Deep Learning for Pattern Recognition	- Introduce deep learning techniques for pattern recognition	Week 6	- Lab Session: Implement a basic neural network using TensorFlow for image classification	Lab Session, Hands-on Coding	CLO 2
Time Series Analysis	- Understand time series data and analysis techniques	Week 7	- Practical: Analyze and visualize time series data using ARIMA model	Practical Application, Data Analysis	CLO 2
Pattern Recognition in Natural Language Processing	- Apply pattern recognition in NLP	Week 8	- Project: Develop a sentiment analysis system using pattern recognition techniques on textual data	Project Work, Application Development	CLO 2
Lab Midterm	- Assess understanding of topics covered up to week 8	Week 9	- Lab Exam: Evaluate students' comprehension through a midterm exam	Examination, Assessment	CLO 1, CLO 2
Feature Selection Techniques	- Learn about feature selection methods	Week 10	- Reading: Review articles on feature selection techniques	Reading, Research	CLO 3
Pattern Recognition in Image Processing	- Explore pattern recognition techniques in image processing	Week 11	- Lab Session: Implement image recognition using CNNs in TensorFlow	Lab Session, Hands-on Coding	CLO 3
Anomaly Detection	- Introduce anomaly detection techniques	Week 12	- Practical: Implement anomaly detection algorithms on a dataset	Hands-on Activity	CLO 3
Pattern Recognition in Biometrics	- Apply pattern recognition in biometric systems	Week 13	- Seminar: Present research papers on biometric pattern recognition systems	Seminar, Research Presentation	CLO 3
Project Demonstration	- Demonstrate understanding through project presentation	Week 14	- Final Project Presentation: Students present their pattern recognition projects	Presentation, Demonstration	CLO 3

18. Teaching-Learning Strategies:

Strategies	Topics
Active Learning, Coding and Discussions	Feature Extraction and Representation
Collaborative project work	Classification algorithms
Collaborative project work	Clustering Techniques

19. Assessment Techniques of each topic of the course:

Assessment Type	**% weight**	**CO1**	**CO2**	**CO3**	**CO4**
Final Project Demonstration and Documentation	60%	5	5	10	40
Mid Term Exam	20%	2	10	3	5
Class performance (Assignment, Problem solving session)	30%	3	15	2	10
Total	**100%**	**10**	**45**	**10**	**35**

Part C – Assessment and Evaluation

20. Evaluation Policy:

a. **Final Project Demonstration and Documentation: 60%**
   i. The final project will contribute to 60% of the total grade.
   ii. This assessment will include both the demonstration of the final project and the submission of comprehensive documentation.

b. **Midterm Exam: 20%**
   i. A midterm exam will be conducted, contributing 20% to the overall grade.

c. **Class Performance (Assignments, Problem Solving Sessions): 30%**
   i. Class performance, including assignments and participation in problem-solving sessions, will constitute 30% of the total grade.
   ii. Assignments will be given in groups of up to 4 members, and timely submission is mandatory.
   iii. Students will need to present their assignments in class.

UAP Grading Policy

Numeric Grade	**Letter Grade**	**Grade Point**
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

a. Recent Trends in Image Processing and Pattern Recognition

i. 6th International Conference, RTIP2R 2023, Derby, UK, December 7–8, 2023, Revised Selected ... in Computer and Information Science, 2026)

Course Outline – Bioinformatics Lab

Part A – Introduction

1.	**Course No. / Course Code**	: CSE 428
2.	**Course Title**	: Bioinformatics Lab
3.	**Course Type**	: Lab
4.	**Level/Term and Section**	: 4th year 2nd semester
5.	**Academic Session**	:
6.	**Course Instructor**	:
7.	**Pre-requisite (If any)**	:
8.	**Credit Value**	: 1.5
9.	**Contact Hours**	: 3.0
10.	**Total Marks**	: 100

11. Course Objectives and Course Summary: This course will provide hands-on experience regarding bioinformatics analysis. The objectives of the course are to be able to analyze, implement and apply basic bioinformatics algorithms, learn the application of bioinformatics tools, and databases.

Course Content: Genome rearrangements, DNA sequence alignments, gene prediction, dynamic programming, DNA sequencing, genome sequencing, protein sequencing, combinatorial pattern matching, database search, rapid string matching, BLAST, FASTA; genome assembly, graph-based assembly, expression analysis, clustering and classification; statistical and machine learning methods in bioinformatics

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Diminish** important algorithms used in bioinformatics
CLO 2	**Illustrate** several leading bioinformatics tools to solve biological problems
CLO 3	**Explore** the function and organization of bioinformatics databases, and how they support various types of bioinformatics analysis

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	b	1/Analyze	Lecture, Problem	
CLO2	e	1/Apply	Lecture, Problem	
CLO3	e	1/Understand	Lecture, Problem	

<u>Part B – Content of the Course</u>

14. Course Content:

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Genome rearrangements, DNA sequence alignments, Combinatorial pattern matching, Statistical and machine learning methods in bioinformatics	**Diminish** important algorithms used in bioinformatics
2	DNA sequencing, genome sequencing, protein sequencing, BLAST, FASTA, Genome assembly, graph-based assembly, Expression analysis, Clustering and classification	**Illustrate** several leading bioinformatics tools to solve biological problems
3	Database search, BLAST, FASTA, Genome assembly, Expression analysis	**Explore** the function and organization of bioinformatics databases, and how they support various types of bioinformatics analysis

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Introduction to Bioinformatics and Sequence Analysis		Week 1	Lecture, PPT	Written Quiz, short question, Oral Exam	CLO 1
Gene Prediction and DNA Sequencing		Week 2		Written Quiz, short question, Oral Exam	CLO 1
Genome Sequencing and Protein Sequencing		Week 3		Written Quiz, short question, Oral Exam	CLO 2
Combinatorial Pattern Matching and Database Search		Week 4		Written Quiz, short question, Oral Exam	CLO 1
Rapid String Matching and BLAST		Week 5		Written Quiz, short question, Oral Exam	CLO 2
Genome Assembly and Graph-Based Assembly		Week 6		Written Quiz, short question, Oral Exam	CLO 1
Expression Analysis and Clustering		Week 7		Written Quiz, short question, Oral Exam	CLO 2

MID-TERM EXAMINATION				Written Quiz, short question, Oral Exam	CLO 2
Classification Methods in Bioinformatics		Week 8		Written Quiz, short question, Oral Exam	CLO 2
Statistical Methods in Bioinformatics		Week 9		Written Quiz, short question, Oral Exam	CLO 3
Advanced Topics in Bioinformatics		Week 10		Written Quiz, short question, Oral Exam	CLO 3
Project Proposal		Week 11		Written Quiz, short question, Oral Exam	CLO 2
Project Implementation		Week 12		Written Quiz, short question, Oral Exam	CLO 2, CLO3
Project Implementation		Week 13		Written Quiz, short question, Oral Exam	CLO 2, CLO3
Project Presentations and Evaluation		Week 14		Written Quiz, short question, Oral Exam	CLO 2, CLO3
FINAL EXAMINATION					CLO1, CLO 2, CLO3

17. Teaching-Learning Strategies:

18. Assessment Techniques of each topic of the course:

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignment in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

CIE- Continuous Evaluation (100 Marks)

Bloom's Category Marks (out of 50)	**Exercises (50)**	**Assignments (20)**	**Project (30)**
Remember			
Understand	**20**		
Apply	**20**		
Analyze	**10**		
Evaluate			
Create			

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Exercises 50%
2. Assignments 20%
3. Project 30%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Bioinformatics Algorithms an active approach by Phillip Compeau & Pavel Pevzner.

Reference Books & Materials

2. Neil C. Jones and Pavel A. Pevzner. An introduction to bioinformatics algorithms

Course Outline – Cryptography and Network Security Lab

Part A – Introduction

1.	**Course No. / Course Code**	: CSE 430
2.	**Course Title**	: Cryptography and Network Security Lab

3. **Course Type** : Optional Course
4. **Level/Term and Section** :
5. **Academic Session** : Fall 2023
6. **Course Instructor** : Sourav Saha
7. **Prerequisite (If any)** : Nill
8. **Credit Value** : 1.5
9. **Contact Hours** :
10. **Total Marks** : 100
11. **Course Objectives and Course Summary:**

This course teaches fundamental cryptography and computer security topics and analyzes their practical applications. Several threats, attacks, and countermeasures, such as cryptographic protocols, and secure systems/networks, will be implemented. The objective of this course is to make the student learn and implement different encryption techniques along with hash functions, digital signatures, message authentication codes, and secure e-commerce.

12. **Course Learning Outcomes: at the end of the Course, the Student will be able to –**

CLO 1	Develop a comprehensive **understanding** of cryptographic concepts and algorithms.
CLO 2	**Apply** advanced cryptographic techniques, including different cryptographic algorithms
CLO 3	Utilize libraries and frameworks such as to **create** solutions for real life problems.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	1	1/Understand	Lecture, Multimedia	Quiz, Assignment, Written Examination
CLO2	2	1/Apply	Lecture, Multimedia	Quiz, Viva, Assignment, Written Examination
CLO3	3	1/ Create	Lecture, Multimedia, Illustrations	Quiz, Assignment, Written Examination

Part B – Content of the Course

14. Course Content:

Introduction to computer security concepts, security services and mechanisms; **Implement** classical encryption techniques; **Experiment** with block ciphers and the data encryption standard; Block cipher operation; XOR each character of a string with 0 and displays the result; **implement** the DES algorithm logic, Blowfish algorithm logic, Rijndael algorithm logic, RSA algorithm, Diffie-Hellman Key Exchange mechanism using HTML and JavaScript; Calculate the message digest of a text using the SHA-1 and MD5 algorithm; **Experimenting** with Cryptographic hash functions, encryption and signatures; Authentication and key distribution.

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	**Simulate** data encryption standards, and private-key cryptography	CLO 1
2	**Examine** and compare different public-key cryptosystems,	CLO 2
3	**Analyze** and apply different key exchange mechanisms.	CLO 3

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Week	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Introduction to Computer Security	- Understand the basic concepts cryptography	Week 1	- Lecture: Overview of security concepts and applications	Lecture, Presentation	CLO 1
Modular Arithmatic, Euclidean and Extended Euclidean algorithm Prime numbers, Fermat and Euler's Theorem	- Learn about basic math techniques required for cryptographic algorithms	Week 2	- Practical: Implement number theory problem using Python	Hands-on Coding	CLO 1
Implement classical encryption techniques (Caesar Cipher, Hill Cipher)	- Explore basic encryption methods	Week 3	- Practical: Perform caesar cipher and hill cipher on a text	Hands-on Coding	CLO 2
4 Block Ciphers (DES, AES) : Feistal Cipher Structure, Simplifies DES, DES, Double and Triple DES, Block Cipher design Principles, AES,	- Learn about implementation metrics for block ciphers	Week 4	- Practical: Perform DES and AES algorithms	Discussion, Hands on Coding	CLO 2

Modes of Operations					
Public-Key Cryptography : Principles Of Public-Key Cryptography, RSA Algorithm, Key Management, Diffie- Hellman Key Exchange, Elgamal Algorithm	- Learn about implementation metrics for public key cryptography	Week 5	- Practical: Perform hands on activity on the algorithms	Discussion, Hands on practice	CLO 2
Hash and MAC Algorithms : Authentication Requirement, Functions, Message Authentication Code, Hash Functions, Security Of Hash Functions And Macs,	- Learn about Hash and MAC algorithms	Week 6	- Reading, Hands on coding	Discussion, Hands on practice	CLO 3
MD5 Message Digest Algorithm, Secure Hash Algorithm, Digital Signatures	- Explore Hashing algorithms	Week 7	- Reading, Hands on coding	Lab Session, Hands-on Coding	CLO 3
Final Exam					

17. Teaching-Learning Strategies:

Teaching and Learning Strategy	Description	Teaching and Learning Strategy
Active Learning and Discussions	Encourage active participation and discussions during lectures and lab sessions. Allow students to ask questions, share insights, and engage with the material actively.	Active Learning and Discussions
Hands-on Coding and Practical Activities	Provide hands-on coding exercises where students implement cryptographic algorithms using Python or other programming languages. Allow them to experiment and practice concepts.	Hands-on Coding and Practical Activities
Presentation and	Begin each week with a lecture providing an	Presentation and

Overview Lectures	overview of the topic, its importance in computer security, and its practical applications. Utilize presentations to explain key concepts.	Overview Lectures
Reading Assignments and Independent Study	Assign reading materials to supplement lectures and lab sessions. Encourage students to explore additional resources and conduct independent research on specific topics.	Reading Assignments and Independent Study
Discussion and Peer Learning	Facilitate discussions where students can exchange ideas, share their understanding of cryptographic techniques, and collaborate on problem-solving activities during lab sessions.	Discussion and Peer Learning

18. Assessment Techniques of each topic of the course:

Assessment Type	**% weight**	**CO1**	**CO2**	**CO3**
Final Exam & Viva	50%	10	10	30
Mid Term Exam	20%	2	10	8
Class performance (Assignment, Problem solving session)	30%	3	15	12
Total	**100%**	**15**	**35**	**50**

Part C – Assessment and Evaluation

19. Evaluation Policy:

a. **Final Exam: 50%**
   i. The final exam will contribute to 50% of the total grade.
   ii. This assessment will include an exam.
b. **Midterm Exam: 20%**
   i. A midterm exam will be conducted, contributing 20% to the overall grade.
c. **Class Performance (Assignments, Problem Solving Sessions): 30%**
   i. Class performance, including assignments and participation in problem-solving sessions, will constitute 30% of the total grade.
   ii. Assignments will be given in groups of up to 4 members, and timely submission is mandatory.

UAP Grading Policy

Numeric Grade	**Letter Grade**	**Grade Point**
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75

50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

20. Text Book

a. 1. William Stallings: Cryptography and Network Security- Principles And Practice, 5th Edition, Pearson/PHI, 2011.

Course Outline – Digital Forensics Lab

Part A – Introduction

1. **Course No. / Course Code** : CSE 432
2. **Course Title** : Digital Forensics Lab
3. **Course Type** : Optional Course
4. **Level/Term and Section** :
5. **Academic Session** : Fall 2024
6. **Course Instructor** : Sourav Saha
7. **Prerequisite (If any)** : Nill
8. **Credit Value** : 1.5
9. **Contact Hours** :
10. **Total Marks** : 100
11. **Course Objectives and Course Summary** :

This is a basic course designed for students seeking to learn about the field of forensic science. It covers the fundamentals of computer and network security practices that can be used to significantly reduce the security vulnerability of confidential and valuable information on internal networks or the internet. The study and use of different forensic tools for cybercrime investigation will be discussed in this lab. This is required to preserve the integrity of cyber-crime related evidence collected to use effectively in a legal case.

12. **Course Learning Outcomes: at the end of the Course, the Student will be able to –**

CLO 1	**Understand** the basics of Components of Digital Forensics practices
CLO 2	**Study** of computer Forensics and different tools used for forensic investigation
CLO 3	**Implement** Extracting Browser Artifacts
CLO4	**Analysis** and Collect Email Evidence in Victim PC

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	1	1/Understand	Lecture, Multimedia	Quiz, Assignment, Written Examination
CLO2	2	1/Apply	Lecture, Multimedia	Quiz, Viva, Assignment, Written Examination
CLO3	3	1/ Create	Lecture, Multimedia, Illustrations	Quiz, Assignment, Written Examination

Part B – Content of the Course

14. Course Content:

Study of Computer Forensics and different tools used for forensic investigation, Recovering Deleted Files using Forensics Tools, Steps for hiding and extracting any text file behind an image file/ Audio file using Command Prompt, Extracting Exchangeable image file format (EXIF) Data from Image Files using Exifreader Software, Preparing forensic image of the hard drive using EnCase Forensics, Restoring the Evidence Image using EnCase Forensics, Collecting Email Evidence in Victim PC, Extracting Browser Artifacts, Viewing Last Activity of Your PC, Finding Last Connected USB on your system (USB Forensics), Comparison of two Files for forensics investigation by Compare IT software, Live Forensics Case Investigation using Autopsy.

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	**Understand the knowledge of digital forensics**	CLO 1
2	Apply digital forensics logging in the lab	CLO 2
3	Analyze the real world digital forensics scenario	CLO 3

16. Class Schedule/Lesson Plan/Weekly plan:

17.

Topics	Specific Outcome(s)	Week	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Introduction to digital forensics	- Understand the basic concepts digital forensics	Week 1	- Lecture: Overview of digital concepts and applications	Lecture, Presentation	CLO 1
File Systems in different OS	- Learn about files in different OS	Week 2	- Practical: Overview of file system in different OS	Hands-on demonstration	CLO 1
File Analysis	-- Learn to deals	Week 3	- Practical:	Hands-on	CLO 1

	with files on media—deleted files, files in folders, files in other files, all stored on or in some container		Implement number theory problem using Python	Exercise	
Extracting Exchangeable image file format (EXIF)	- Explore EXIF file format	Week 4	- Practical: Perform EXIF file format exploration	Hands-on Exercise	CLO 2
Encase Forensics	- Learn about encase forensics	Week 5	- Practical: Perform Encase Forensics	Discussion, Hands on Exercise	CLO 2
Email Analysis	- Learn about Collecting Email Evidence in Victim PC	Week 6	- Practically learn about email evidence	Discussion, Hands on practice	CLO 3
Network forensics using Network Miner	- Explore Hashing algorithms	Week 7	- Reading,Hands on coding	Lab Session, Hands-on Coding	CLO 3
USB Device Forensics using ● USBDeview ● USB Detective	- Finding Last Connected USB on your system (USB Forensics)	Week 8	-Practical: Work on USB Connected Systems	Lab Session, Hands-on Coding	CLO2
Case Study	- Live Forensics Case Investigation	Week 9	- Practical demonstration on case study	Lab Demonstration	CLO4
	- Demonstrate understanding through final exam and viva	Final Exam			

18. Teaching-Learning Strategies:

Strategies	Topics
Active Learning, Coding and Discussions	
Collaborative project work	
Collaborative project work	

19. Assessment Techniques of each topic of the course:

Assessment Type	% weight	CO1	CO2	CO3
Final Exam & Viva	50%	10	10	30
Mid Term Exam	20%	2	10	8
Class performance (Assignment, Problem solving session)	30%	3	15	12
Total	**100%**	**15**	**35**	**50**

Part C – Assessment and Evaluation

20. Evaluation Policy:

a. **Final Exam: 50%**
   i. The final exam will contribute to 50% of the total grade.
   ii. This assessment will include an exam.

b. **Midterm Exam: 20%**
   i. A midterm exam will be conducted, contributing 20% to the overall grade.

c. **Class Performance (Assignments, Problem Solving Sessions): 30%**
   i. Class performance, including assignments and participation in problem-solving sessions, will constitute 30% of the total grade.
   ii. Assignments will be given in groups of up to 4 members, and timely submission is mandatory.

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

a. File System Forensic Analysis, by Brian Carrier, Addison-Wesley, ISBN 0321268172, 2005.

Course Outline – Blockchain and Distributed Security lab

Part A – Introduction

1.	**Course No. / Course Code**	: CSE 434
2.	**Course Title**	: Blockchain and Distributed Security lab
3.	**Course Type**	: Optional Course
4.	**Level/Term and Section**	: 4th Year 2nd Semester
5.	**Academic Session**	: Fall 24
6.	**Course Instructor**	: Fabliha Haque
7.	**Prerequisite (If any)**	: Computer and Cyber Security (CSE 403), Data Structures and Algorithms II (CSE 207)
8.	**Credit Value**	: 3.0
9.	**Contact Hours**	: 1.5
10.	**Total Marks**	:100

11. Course Objectives and Course Summary :

Blockchain technology and distributed security have been hailed as a turning point in scaling information technology services at a global level. Although the digital currency Bitcoin is the best-known Blockchain application today, the technology is set to play a much broader role in cyber security innovation. This course is an introduction to the design and analysis of blockchain systems and distributed ledgers and is meant to be taught in parallel to the Introduction to Modern Cryptography course.

The concept of blockchain will be covered in detail together with the supporting cryptographic technology. Questions that will be covered are why it works and what problems it can solve.

This course will cover Introduction to blockchain, distributed ledger, Transactions, Digital Signatures. The consensus layer. Basic Properties. Proof of Work.Robust Transaction Ledgers. Properties and Objectives. Permissioned, permissionless ledgers.Privacy Issues. Anonymity, Pseudonymity, Unlinkability. Zero-Knowledge Proofs.Scalability Issues. Byzantine agreement protocols.Blockchain as a platform. Smart Contracts.Secure multiparty computation techniques and their application to blockchain protocols. Alternative techniques to proof of work for blockchain protocols, proof of stake/space.Game theoretic analysis of blockchain protocols.Name and object registries. Reputation systems. Policy issues related to blockchain.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Understand what is a blockchain and a distributed ledger.**
CLO 2	**Develop or extend the ability to think critically about cybersecurity.**
CLO 3	**Understand the challenges of scaling information technology services across organizational barriers and at a global level.**
CLO 4	**Analyze the security of basic cryptographic primitives like hash functions and digital signatures.**

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	1	1/Understand	Lecture, Problem Analysis, and Implementation.	Quiz, Written exam
CLO2	5	1/Apply	Lecture, Problem Analysis, and Implementation.	Quiz, Written exam
CLO3	3	1/Analyze	Lecture, Problem Analysis, and Implementation.	Quiz, Written exam
CLO4	2	1/Analyze	Lecture, Problem Analysis, and Implementation.	Quiz, Written Exam

Part B – Content of the Course

14. Course Content:

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Introduction to blockchain, distributed ledger, Transactions, Digital Signatures. The consensus layer. Basic Properties. Proof of Work.Robust Transaction Ledgers. Properties and Objectives. Permissioned, permissionless ledgers.	CLO1, CLO2
2	Privacy Issues. Anonymity, Pseudonymity, Unlinkability. Zero-Knowledge Proofs.Scalability Issues. Byzantine agreement protocols.Blockchain as a platform. Smart Contracts.	CLO1, CLO2, CLO3
3	Secure multiparty computation techniques and their application to blockchain protocols. Alternative techniques to proof of work for blockchain protocols, proof of	CLO1, CLO3, CLO4

	stake/space.Game theoretic analysis of blockchain protocols.Name and object registries. Reputation systems. Policy issues related to blockchain.	

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Blockchain Overview Blockchain Building Blocks Blockchain Commercial Use Cases Blockchain Military Cyber Operations Use Cases Blockchain Challenges		Week 1		Live Lecture, Multimedia	CLO1, CLO2
Distributed Consensus Protocols and Algorithms		Week 2		Live Lecture, Multimedia	CLO1, CLO2
Overview of Attack Surfaces in Blockchain, CT1		Week 3-4		Live Lecture, Multimedia	CLO2, CLO3
ProvChain: Blockchain-based Cloud Data Provenance		Week 5-6		Live Lecture, Multimedia	CLO1, CLO3
CT 2, Review on the Mid semester syllabus		Week 7			
MID-TERM EXAMINATION					
Blockchain-based Solution to Automotive Security and Privacy		Week 8		Live/Recorded video Lecture, Problem Solving	CLO2, CLO3
Blockchain-based Dynamic Key Management for IoT-Transportation Security Protection		Week 9		Live/Recorded video Lecture, Problem Solving	CLO2, CLO3
Blockchain-enabled Information Sharing Framework for Cybersecurity		Week 10		Live/Recorded video Lecture, Problem Solving, Group	CLO4

				Discussion	
CT 3, Block Cloud Security Analysis		Week 11		Live/Recorded video Lecture, multimedia	CLO2, CLO3
Permissioned and Permissionless Blockchains		Week 12		Live/Recorded video Lecture, multimedia	CLO2, CLO3
Private Blockchain Configurations for Improved IoT Security		Week 13		Live/Recorded video Lecture, Case study	CLO3, CLO4
CT 4, Review on the full syllabus		Week 14			
FINAL EXAMINATION					

17. Teaching-Learning Strategies:

18. Assessment Techniques of each topic of the course:

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignments in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category Marks (out of 50)	**Tests (25)**	**Assignments (10)**	**Quizzes (5)**	**External Participation in Curricular/Co-Curricular Activities (10)**
Remember				
Understand				
Apply				
Analyze				
Evaluate				
Create				

SMEB- Semester Mid & End Examination (50 Marks)

Bloom's Category	**Mid**	**Final**
Remember	**5**	**5**

Understand	**5**	**10**
Apply	**5**	**10**
Analyze	**5**	**10**
Evaluate		**5**
Create		**10**

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual students will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Blockchain for Distributed Systems Security
   Sachin Shetty (Editor), Charles A. Kamhoua (Editor), Laurent L. Njilla (Editor)

2. Bitcoin and Cryptocurrency Technologies by Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder.
   http://bitcoinbook.cs.princeton.edu

3. The Bitcoin Backbone Protocol: Analysis and Applications, Juan Garay and Aggelos Kiayias and Nikos Leonardos. https://eprint.iacr.org/2014/765

Option - II: Hardware and Systems Development Lab

Course Outline – Computer Peripherals and Embedded Systems Lab

Part A – Introduction

1.	**Course No. / Course Code**	**:** CSE 436
2.	**Course Title**	**:** Computer Peripherals and Embedded Systems Lab
3.	**Course Type**	**:** Core Course
4.	**Level/Term and Section**	**:** 7th Semester (4th Year/1st Semester)
5.	**Academic Session**	**:** Fall ‘24
6.	**Course Instructor**	**:** A S Zaforullah Momtaz (ZAM)
7.	**Prerequisite (If any)**	**:** CSE 316
8.	**Credit Value**	**:** 1.50
9.	**Contact Hours**	**:** 3.00
10.	**Total Marks**	**:** 100

11. Course Objectives and Course Summary:

This lab course is IoT-industry knowledge oriented. It will cover the Interfacing basics. Students will learn about the interfacing components (e.g., Mini systems, sensors, Methodologies etc.). It will discuss the Arduino Environment Programming, Basic I/Os, IoT, HCI, Edge Computing, BCI, Dependable computing.

The objectives of the course are to-

1. introduce peripheral and interfacing basics.
2. explain the real world challenges and their solutions related to Peripheral and Interfacing.
3. provide the analogical view of different peripheral methods and techniques.
4. introduce the core of the Arduino/Raspberry Pi environment and provide a hands on experience with several sensors.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Understand** the characteristics and internal architecture of embedded systems.
CLO 2	**Examine** programming, testing, and debugging approaches and tools to develop and verify embedded systems.
CLO 3	**Analyze and apply** the concepts of real-time operating systems to design embedded systems.
CLO 4	**Design** the concepts of edge computing.
CLO 5	**Design** different types of devices that bridge the gap between human and computer interface.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	1	1/Understand	Coding, Multimedia	Quiz, Assignment, Lab Test
CLO2	5	1/Apply	Coding, Multimedia, Problem solving session	Quiz, Viva, Assignment, Lab Test
CLO3	3	1/Analyze	Coding, Multimedia	Quiz, Assignment, Lab Test
CLO4	2	1/Analyze	Coding, Multimedia, Illustrations	Quiz, Assignment, Lab Test
CLO5	5	1/Analyze	Coding, Multimedia, Illustrations	Quiz, Assignment, Lab Test

Part B – Content of the Course

14. Course Content:

Interfacing Basics: Interfacing components and their characteristics. Storage devices: RAM, ROM, Cache memory, Hard disk drive, CD, DVD, Blue Ray, and Flash memory. **Controllers:** Programmable interrupt controller and DMA controller. Computer Ports: Parallel, Serial, USB, and FireWire. Basic I/O: I/O systems & I/O devices. **Converters:** Programmable peripheral interface, Interface to A/D and D/A converter. **Input devices:** Keyboard, Mouse, Touchpad, Webcam, Barcode reader, Thumb scanner, 2D **scanners:** Flatbed, Sheet-fed, Handheld, Drum; 3D scanner. **Output devices**: 2D monitors: LCD, TFT and LED; 3D monitor; 2D printers: Dot Matrix, Inkjet, LASER; 3D printer; CNC. **Computer cards**: Graphics, Sound, and LAN; Interfacing Components: Transistor, MOSFET, and Chips; Bridge Circuits: Relay and Opto-isolator; Motors: DC, Stepper, Servo; Solenoids.

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Peripheral Basic	CLO1, CLO2, CLO4
2	Data Input/Output Systems Basics	CLO1, CLO3, CLO4, CLO5
3	Interfacing Principles: ADC, Actuators, Motors, Sensors, Types of Processors	CLO1, CLO3, CLO4, CLO5

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Environment Setup	22. To Understand the coding environment	Week 1	Lecture	Practice session	CLO1, CLO3
Arduino Programming	23. To Analyze and Apply the knowledge of Hardware Programming	Week 2	Lecture, Problem Solving	Practice session, Coding	CLO2, CLO3, CLO4, CLO5
Arduino Programming	24. To Analyze and Apply the knowledge of Hardware Programming	Week 3	Lecture, Problem Solving	Practice session, Coding	CLO2, CLO3, CLO4, CLO5
Arduino Programming	25. To Analyze and Apply the knowledge of Hardware Programming	Week 4	Lecture, Problem Solving	Lecture, multimedia, Group discussion	CLO2, CLO3, CLO4, CLO5
Arduino Programming	26. To Analyze and Apply the knowledge of Hardware Programming	Week 5	Lecture, Problem Solving	Practice session, Coding, Homework	CLO2, CLO3, CLO4, CLO5
Arduino Programming	27. To Analyze and Apply the knowledge of Hardware Programming	Week 6	Lecture, Problem Solving	Practice session, Coding, Homework	CLO2, CLO3, CLO4, CLO5
Lab Quiz 1	28.	Week 7			
Introducing sensors	29. To Analyze and Apply the knowledge of Sensor Programming	Week 8	Lecture, Problem Solving	Practice session, Coding	CLO2, CLO3, CLO4, CLO5
Introducing sensors	30. To Analyze and Apply the knowledge of Sensor Programming	Week 9	Lecture, Problem Solving	Practice session, Coding	CLO2, CLO3, CLO4, CLO5
Introducing sensors	31. To Analyze and Apply the knowledge of Sensor Programming	Week 10	Lecture, Problem Solving		CLO2, CLO3, CLO4, CLO5
Project idea development and Presentation	To Design a project based on the prior experiments	Week 11	Discussion		CLO2, CLO3, CLO4, CLO5

Lab Quiz 2		Week 12	–		CLO2, CLO3, CLO4, CLO5
Project Update		Week 13	Discussion		CLO2, CLO3, CLO4, CLO5
Project Submission with Presentation		Week 14			

17. Teaching-Learning Strategies:

18. Assessment Techniques of each topic of the course:

Assessment Type	**% weight**	**CO1**	**CO2**	**CO3**	**CO4**
Final Lab Test	40%	5	10	5	20
Lab Assessment (Lab Test, Assignment, Problem solving, Quiz)	60%	10	20	10	20
Total	**100%**	**15**	**30**	**15**	**40**

Part C – Assessment and Evaluation

19. Assessment Strategy

Lab Tests: Altogether 4 lab tests will be taken during the semester, 4 tests will be taken before midterm and 2 class tests will be taken before final term. No makeup lab tests will be taken. Students are strongly recommended not to miss any lab tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignments in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category	**Lab Tests (40)**	**Assignments (20)**
Remember		2
Understand		
Apply		5
Analyze		3
Evaluate		5
Create	40	5

SMEB- Semester Mid & End Examination (70 Marks)

Bloom's Category	Lab Final (40)
Remember	5
Understand	
Apply	10
Analyze	5
Evaluate	
Create	10

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual students will be evaluated based on the following criteria with respective weights.

1. Lab Assessment 60%
2. Lab Final Examination 40%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Programming Arduino: Getting Started with Sketches by Simon Monk
2. Arduino: A Technical Reference: A Handbook for Technicians, Engineers, and Makers by J. M. Hughes
3. Arduino Cookbook by Michael Margolis
4. Computer Peripherals by Barry Wilinson

Reference Books & Materials

5. www.arduino.cc
6. Microprocessors and Interfacing By Dauglas V Hall

Course Outline – Robotics Lab

Part A – Introduction

1. **Course No. / Course Code:** CSE 438
2. **Course Title:** Robotics Lab
3. **Course Type:** Core Course
4. **Level/Term and Section:** 7th Semester (4th Year/1st Semester)
5. **Academic Session:** Fall '24
6. **Course Instructor:** A S Zaforullah Momtaz (ZAM)
7. **Prerequisite (If any):** CSE 316
8. **Credit Value:** 1.50
9. **Contact Hours:** 3.00
10. **Total Marks:** 100

Course Outline – Internet of Things Lab

Part A – Introduction

1. **Course No. / Course Code** : CSE 440
2. **Course Title** : Internet of Things Lab
3. **Course Type** : Optional
4. **Level/Term and Section** : 4th year 2nd Semester
5. **Academic Session** : Fall 2023
6. **Course Instructor** :
7. **Prerequisite (If any)** :
8. **Credit Value** : 1.5
9. **Contact Hours** : 1.5
10. **Total Marks** : 100
11. **Course Objectives and Course Summary** :
    The primary objective of this Internet of Things (IoT) course is to provide students with a comprehensive understanding of the principles, techniques, and applications of IoT technology. Upon successful completion of this course, students will be equipped to:

Understand IoT Fundamentals: Students will grasp the core concepts of IoT, including architectures, communication protocols, and sensor networks. They will gain insights into the diverse ecosystem of IoT devices, sensors, and actuators, as well as the underlying technologies enabling connectivity and data exchange.

Develop IoT Solutions: Through practical experience, students will learn to design, implement, and optimize IoT solutions using various hardware platforms and development tools. They will gain proficiency in programming languages such as Python and utilize industry-standard IoT platforms and frameworks for rapid prototyping and deployment.

Apply IoT Technologies: Students will learn how to apply IoT technologies to solve real-world problems across different domains. They will explore a wide range of applications including smart cities, healthcare monitoring, environmental sensing, industrial automation, and wearable devices. By leveraging IoT sensors and data analytics techniques, students will develop innovative solutions to address societal challenges and enhance operational efficiency.

The course will offer a comprehensive introduction to IoT, covering topics such as sensor networks, IoT architectures, data management, and security considerations. Students will engage in hands-on exercises, projects, and case studies, gaining practical experience in developing end-to-end IoT solutions. By the end of the course, students will be well-prepared to leverage IoT technology to create impactful solutions in various domains.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	Understand the basic concepts of IoT and understand the application areas of IOT.
CLO 2	Identify different contexts and appropriate sensors in each context.
CLO 3	Analyze the IoT devices in various industrial applications
CLO 4	Design IoT Services in various fields of the modern world.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	**CLO Statements:** Upon successful completion of the course, students should be able to:	**Corresponding PLOs (Appendix-1)**	**Bloom's taxonomy domain/level (Appendix-2)**	**Delivery methods and activities**	**Assessment Tools**
CLO1	Explain the foundational principles and theories behind Internet of Things (IoT), including IoT architectures and protocols.	a	1/Understand	Lecture, Classwork, Assignments	Quiz, Written exam
CLO2	Describe the mathematical concepts underlying IoT technologies, such as data acquisition, transmission,	a	1/Understand	Lecture, Classwork, Assignments	Quiz, Written exam

	and processing.				
CLO3	Apply data preprocessing techniques, such as data cleaning, normalization, and feature engineering, to IoT datasets.	b	1/Apply	Lecture, Classwork, Assignments	Quiz, Written exam
CLO4	Implement IoT architectures and solutions using hardware components and software frameworks like Arduino, Raspberry Pi, etc	c	1/Apply	Lecture, Classwork, Assignments	Quiz, Written exam

14. <u>Part B – Content of the Course</u>

15. Course Content:

16. Alignment of topics of the courses with CLOs:

SL. No	**Topics / Content**	**Course Learning Outcome (CLO)**
1	Introduction to IoT concepts and applications	CLO1
2	IoT architectures and protocols	CLO1
3.	Sensor networks and communication protocols	CLO1
4.	Edge computing and cloud integration	CLO2
5.	Hardware components for IoT devices	CLO2
6.	Transfer learning and pre-trained models.	CLO2
7.	IoT applications in smart cities	CLO3
8.	IoT applications in healthcare monitoring	CLO3
9.	IoT security considerations and protocols	CLO4

17. Class Schedule/Lesson Plan/Weekly plan:

Topics	**Specific Program Outcome (PO) (s)**	**Time Frame**	**Suggested Activities**	**Teaching Strategy (s)**	**Alignment with CLO**
Introduction to IoT concepts and applications		Week 1	Assignment on basic understanding	Lecture, Multimedia	CLO1
IoT architectures and protocols		Week 2	Lecture on IoT architectures and protocols	Lecture, Multimedia	CLO1
Sensor networks and communication		Week 3	Practical session: Sensor networks and	Lecture, Multimedia	CLO1

protocols			communication protocols.		
Edge computing, cloud integration, and hardware components Implementing deep learning models.		Week 4	Practical session on Edge computing, cloud integration, and hardware components	Lecture, Multimedia	CLO2
Data acquisition, transmission, processing in IoT		Week 5	Practical session: Data acquisition, transmission, processing in IoT	Lecture, Multimedia	CLO3
IoT applications: smart cities, healthcare monitoring		Week 6	Practical Session on IoT applications: smart cities, healthcare monitoring.	Lecture, Multimedia	CLO3
IoT applications: environmental sensing, security IoT integration with AI and machine learning,		Week 7	Practical session: Building ensemble models.	Lecture, Multimedia	CLO4

18. Teaching-Learning Strategies:

19.

Strategies	**Topics**
Active Learning	Introduction to IoT Concepts and Applications
Active Learning	IoT Protocols and Communication
Project-Based Learning	IoT Device Integration and Sensor Networks
Project-Based Learning	IoT Data Analytics and Cloud Integration

20. Assessment Techniques of each topic of the course:

<u>Part C – Assessment and Evaluation</u>

1. **Evaluation Policy:**
   a. **Final Project Demonstration and Documentation: 60%**
      i. The final project will contribute to 60% of the total grade.
      ii. This assessment will include both the demonstration of the final project and the submission of comprehensive documentation.
   b. **Midterm Exam: 20%**
      i. A midterm exam will be conducted, contributing 20% to the overall grade.
   c. **Class Performance (Assignments, Problem Solving Sessions): 30%**
      i. Class performance, including assignments and participation in problem-solving sessions, will constitute 30% of the total grade.

ii. Assignments will be given in groups of up to 4 members, and timely submission is mandatory.
iii. Students will need to present their assignments in class.

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Arora, Renu and Sood S.K, Fundamentals of Entrepreneurship and Small Business, 1't Edition (2003), Kalyani Publishers, New 'Delhi, India'.

Reference Books & Materials

2. Barringer, Bruce R. and Ireland Duane R., Entrepreneurship Successfully Lunching New Ventures. 3'd Edition (2010) Pearson Education Inc., New Delhi, India
3. Others

Course Outline – Embedded Systems Lab

Part A – Introduction

1. **Course No. / Course Code** : CSE 442
2. **Course Title** : Embedded Systems Lab
3. **Course Type** : Optional Course
4. **Level/Term and Section** : 4th Year 1st Semester
5. **Academic Session** : Fall 24
6. **Course Instructor** : Musfequa Rahmman
7. **Prerequisite (If any)** : CSE 316
8. **Credit Value** : 1.5
9. **Contact Hours** : 3.0
10. **Total Marks** : 100
11. **Course Objectives and Course Summary** :

The objectives of the course are as follows:.

a. Introduce the fundamentals of embedded systems.
b. Explore various components and peripherals used in embedded systems.

c. Provide an understanding of embedded programming and hardware configuration.
d. Discuss advanced concepts like real-time operating systems and edge computing.

This course aims to introduce students to the foundational concepts of embedded systems, covering topics such as microcontroller architecture, sensors, actuators, and programming techniques. By exploring both theoretical principles and practical applications, students will gain the necessary skills to design and implement embedded systems effectively, with a focus on real-time operating systems and edge computing.

Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Understand** the architecture and characteristics of embedded systems.
CLO 2	**Examine** programming, testing, and debugging approaches and tools to develop and verify embedded systems.
CLO 3	**Analyze and apply** the concepts of real-time operating systems to design embedded systems.
CLO 4	**Design and implement** embedded systems considering the principles of edge computing.

12. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	1	1/Understand	Lecture, Discussion, Example analysis	Class work, Problem-solving, Exam
CLO2	5	1/Apply	Lecture, Discussion, Example analysis	Class work, Problem-solving, Presentation, Project
CLO3	3	1/Analyze	Lecture, Practical exercises	Class work, Project
CLO4	12	1/Analyze	Lecture, Practical exercises	Problem-solvingPresentation, Project Discussion

Part B – Content of the Course

13. Course Content:

14. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Introduction to Embedded Systems	CLO1, CLO2
2	Microcontroller Architecture and Programming	CLO1, CLO2, CLO3
3	Sensors and Actuators Interfacing	CLO1, CLO3, CLO4

15. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Introduction to Embedded Systems, Microcontroller Basics		Week 1		Lecture, Multimedia	CLO1, CLO2
Introduction to Microcontroller Architecture, Programming Basics		Week 2		Lecture, Problem Solving	CLO1, CLO2
Sensor Interfacing: Analog and Digital Sensors		Week 3-4		Lecture, Problem Solving	CLO2, CLO3
Actuator Interfacing: Motors, LEDs		Week 5-6		Lecture, Problem Solving	CLO1, CLO3
Lab evaluation - 1		Week 7			
MID-TERM EXAMINATION					
Real-time Operating Systems Concepts		Week 8		Lecture, Problem Solving	CLO2, CLO3, CLO4
Subtractor Programming		Week 9		Lecture, Problem Solving	CLO2, CLO3, CLO4
Function Implementation in Arduino		Week 10		Lecture, Problem Solving, Group Discussion	CLO3, CLO4
Project idea development and Presentation		Week 11		Discussion	CLO1, CLO2, CLO4
Lab evaluation - 2		Week 12			
Servo motor with Arduino, Edge Computing		Week 13		Lecture, Case study	CLO1, CLO2, CLO4
Project Submission with Presentation		Week 14			CLO1, CLO2, CLO4
FINAL EXAMINATION					

16. Teaching-Learning Strategies:

17. Assessment Techniques of each topic of the course:

Part C – Assessment and Evaluation

18. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignments in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as an assignment.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category Marks (out of 30)	**Tests (22.5)**	**Assignments (7.5)**	**Quizzes (0)**	**External Participation in Curricular/Co-Curricular Activities (0)**
Remember				
Understand				
Apply				
Analyze	22.5	7.5		
Evaluate				
Create				

SMEB- Semester Mid & End Examination (50 Marks)

Bloom's Category	**Mid**	**Final**
Remember		
Understand		
Apply	**8**	**20**
Analyze	**12**	**30**
Evaluate		
Create		

19. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25

60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

20. Text Book

1. Embedded Systems: Introduction to Arm® Cortex™-M Microcontrollers by Jonathan W. Valvano
2. Arduino: A Technical Reference: A Handbook for Technicians, Engineers, and Makers by J. M. Hughes
3. Arduino Cookbook by Michael Margolis
4. Computer Peripherals by Barry Wilinson

Reference Books & Materials

5. www.arduino.cc
6. Microprocessors and Interfacing By Dauglas V Hall

Course Outline – Human Computer Interaction Course Lab

Part A – Introduction

1.	**Course No. / Course Code**	: CSE 444
2.	**Course Title**	: Human Computer Interaction Course Lab
3.	**Course Type**	: Optional
4.	**Level/Term and Section**	: 4th year 2nd semester
5.	**Academic Session**	: Fall 2023
6.	**Course Instructor**	: Nadeem Ahmed
7.	**Pre-requisite (If any)**	: NIL
8.	**Credit Value**	: 1.5
9.	**Contact Hours**	: 3.0
10.	**Total Marks**	: 100

11. Course Objectives and Course Summary :

Design Heuristics and Evaluation Learning strategies: designing and running experiments to learn from the users, Persuasive Technology, the psychology of usable things, usability Engineering, know the User, usability benchmarking, goal-oriented interaction design, prototyping, usability, inspection methods, usability testing methods, usability in practice.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	Understand the basic concepts of Human Computer Interaction.

CLO 2	Implement user interfaces according to the standards.
CLO 3	Analyze usability issues in User interfaces.
CLO 4	Analyze design prototypes and running experiments to learn from the users.
CLO 5	Developing paper Prototype, digital prototype or any other tangible prototype according to user requirement and usability testing.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	1	1/Understand	Lecture, Multimedia	Oral and viva
CLO2	2	1/Apply	Lecture, Multimedia	Lab work and lab test
CLO3	3	1/Analyze	Lecture, Problem Solving	Lab work and lab test
CLO4	3	1/Analyze	Lecture, Group discussion	Lab work and lab test
CLO5	9, 10, 12	1/Create	Lecture, Multimedia	Continuous updates and presentations

Part B – Content of the Course

14. Course Content:

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Design Heuristics and Evaluation Learning strategies: designing and running experiments to learn from the users	CLO1
2	Persuasive Technology, the psychology of usable things	CLO2
3	usability Engineering, know the User	CLO3
4	usability benchmarking, goal-oriented interaction design, prototyping, usability	CLO4
5	inspection methods, usability testing methods, usability in practice	CLO5

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Design Heuristics and Evaluation Learning strategies:	Understand the Design Heuristics	Week 1	problem-solving, discussions	Lecture, Active Learning, Visualization,	CLO1

designing and running experiments to learn from the users			, and group activities	Concrete Examples, Peer Instruction	
Persuasive Technology, the psychology of usable things	Apply the Persuasive Technology	Week 2	problem-solving, discussions , and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer Instruction	CLO2
usability Engineering, know the User	Analyze the usability	Week 3	problem-solving, discussions , and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer Instruction	CLO3
usability benchmarking, goal-oriented interaction design, prototyping, usability	Analyze the benchmarking and prototyping models	Week 4	problem-solving, discussions , and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer Instruction	CLO4
inspection methods, usability testing methods, usability in practice	Create a HCL model	Week 5-7	problem-solving, discussions , and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer Instruction	CLO5
FINAL EXAMINATION					

17. Teaching-Learning Strategies:

18. **Active Learning:** Encourage students to actively engage with the material through problem-solving, discussions, and group activities.
19. **Visualization**: Discrete mathematics often deals with abstract concepts that can be difficult to grasp. Utilize visual aids such as diagrams, graphs, and animations to illustrate key concepts like graph theory, combinatorics, and logic.
20. **Concrete Examples**: Relate abstract concepts to real-world applications whenever possible. Show how discrete mathematics is used in computer science.
21. **Peer Instruction**: Implement peer instruction techniques where students teach and learn from each other. Encourage peer tutoring, group study sessions, and peer evaluation of problem-solving approaches.

22. Assessment Techniques of each topic of the course:

Assessment Tools
Oral and viva

Lab work and lab test
Lab work and lab test
Lab work and lab test
Continuous updates and presentations

Part C – Assessment and Evaluation

23. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignment in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category Marks (out of 50)	**Tests (25)**	**Assignments (10)**	**Quizzes (5)**	**External Participation in Curricular/Co-Curricular Activities (10)**
Remember				
Understand	**10**			
Apply	**20**			
Analyze	**30**			
Evaluate				
Create		**40**		

SMEB- Semester Mid & End Exanimation (50 Marks)

Bloom's Category	**Lab Activites**
Remember	
Understand	**10**
Apply	**20**
Analyze	**30**
Evaluate	
Create	**40**

24. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%

3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

25. Text Book

1. Arora, Renu and Sood S.K, Fundamentals of Entrepreneurship and Small Business, 1't Edition (2003), Kalyani Publishers, New 'Delhi, India'.

Reference Books & Materials

2. Barringer, Bruce R. and Ireland Duane R., Entrepreneurship Successfully Lunching New Ventures. 3'd Edition (2010) Pearson Education Inc., New Delhi, India

Course Outline – Quantum Computing Lab

Part A – Introduction

1.	**Course No. / Course Code**	**:** CSE 446
2.	**Course Title**	**:** Quantum Computing Lab
3.	**Course Type**	**:** Optional Course
4.	**Level/Term and Section**	**:** 4th year
5.	**Academic Session**	**:**
6.	**Course Instructor**	**:**
7.	**Pre-requisite (If any)**	**:** None
8.	**Credit Value**	**:** 1.5
9.	**Contact Hours**	**:**
10.	**Total Marks**	**:**
11.	**Course Objectives and Course Summary**	**:**

The objectives of this course are to:

1. grasp the quantum model of computation and basic quantum mechanics principles.

2. Acquire proficiency in basic quantum algorithms and their analysis.

3. Understand the importance of efficient error-suppression in quantum computation.

This course provides students with an overview of the state-of-the-art devices and technologies that exploit Quantum Mechanics to achieve novel or improved functionalities. Equip students with the conceptual and practical tools to model, design, and understand engineered quantum devices, such as quantum computers and quantum-enhanced sensors and amplifiers. Supply students with the skills to design quantum circuits to evaluate basic quantum algorithms. Provide students with hands-on experience in assembling quantum experimental apparatus and making fundamental demonstrations of quantum effects in a laboratory setting. Empower students to become active contributors to the emerging field of quantum technologies.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Understand** the basic concepts of quantum computing in programming.
CLO 2	**Implement** simple quantum algorithms and information channels.
CLO 3	**Analyze** the behavior of basic quantum algorithms.
CLO 4	**Justify** the different simple quantum error-correcting codes.
CLO 5	**Develop** quantum gates and circuits. Prove basic facts about quantum information channels.

Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	1	1/Understand	Lecture, Discussion, Computer demonstration	Lab work and Lab test
CLO2	3	1/Apply	Lecture, Computer demonstration	Lab work and Lab test
CLO3	4	1/Analyze	Lecture, Discussion, Computer demonstration	Lab work and Lab test
CLO4	2	1/Analyze	Lecture, Computer demonstration	Lab work and Lab test
CLO5	5	1/Apply	Lecture, Computer demonstration	Continuous updates and presentations

Part B – Content of the Course

13. Course Content:

Quantum logic; Basic definitions of quantum logic: quantum bit, quantum gate, garbage outputs, constant inputs, power, delay, quantum cost, quantum gate calculation complexity; Quantum bit string comparator; Quantum full-adder and subtractor; Quantum multiplexer and demultiplexer; Quantum adders circuits; Quantum multiplier accumulator; The quantum circuit model; Simple quantum protocols; Superdense coding, Deutsch's algorithm; Grover's algorithm for searching; Open quantum systems; Quantum error correction.

14. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Quantum logic	**CLO1, CLO3, CLO4**
2	Quantum circuit	**CLO1, CLO5**
3	Quantum algorithms	**CLO2, CLO3**

15. Class Schedule/Lesson Plan/Weekly plan:

Topics	**Specific Program Outcome(s)**	**Time Frame**	**Suggested Activities**	**Teaching Strategy(s)**	**Alignment with CLO**
Quantum logic, quantum bit, quantum gate	PLO1	Week 1	Computer simulation, Peer-discussion	Lecture, Multimedia, Active learning	CLO1
garbage outputs, constant inputs	PLO2, PLO4	Week 2	investigation of outputs and inputs in various scenarios	Lecture, Multimedia, Active learning	CLO1
power, delay, quantum cost, quantum gate calculation complexity	PLO2	Week 3	calculation of quantities	Lecture, Multimedia, Active learning	CLO1
Quantum bit string comparator	PLO3	Week 4	implementation	Problem-Based Learning	CLO5
Quantum full-adder and subtractor	PLO3	Week 5	implementation	Problem-Based Learning	CLO5
Quantum multiplexer and demultiplexer	PLO3	Week 6	implementation	Problem-Based Learning	CLO5
Quantum adders circuits	PLO3	Week 7	simulation, implementation	Problem-Based Learning	CLO5

MID-TERM EXAMINATION					
Quantum multiplier accumulator	PLO2, PLO3	Week 8	simulation	Problem-Based Learning	CLO5
The quantum circuit model	PLO1	Week 9	simulation	Case-Based Learning	CLO5
Simple quantum protocols, Superdense coding	PLO1	Week 10	simulation	Simulations and Role-Playing	CLO2
Deutsch's algorithm	PLO3	Week 11	simulation, implementation	Simulations and Role-Playing	CLO2
Grover's algorithm for searching	PLO3	Week 12	simulation, implementation	Simulations and Role-Playing	CLO2
Open quantum systems	PLO1	Week 13	simulation	Simulations and Role-Playing	CLO2
Quantum error correction.	PLO2, PLO4	Week 14	programming	Simulations and Role-Playing	CLO4
FINAL EXAMINATION					

16. Teaching-Learning Strategies:

Strategies	**Topics**
Active Learning and Discussions	Quantum theory
Problem-Based Learning	Quantum logic
Case-Based Learning	Quantum circuits
Simulations and Role-Playing	Quantum algorithms

17. Assessment Techniques of each topic of the course:

SL. No	**Topics / Content**	**Assessment Techniques**
1	Quantum theory	Assignment
2	Quantum logic	Assignment
3	Quantum logic	Assignment
4.	Quantum circuits	Project
5.	Quantum circuits	Project
6.	Quantum algorithms	Project

Part C – Assessment and Evaluation

18. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignment in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of

assignments will be accepted. Students will have to do the presentation on the given topic as assignment.

CIE- Continuous Evaluation (100 Marks)

Bloom's Category Marks (out of 50)	Exercises (50)	Assignments (20)	Project (30)
Remember			
Understand	**20**		
Apply	**20**	**10**	**10**
Analyze	**10**		**10**
Evaluate		**10**	
Create			**10**

19. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

20. Text Book

1. Quantum Computing: A pathway to quantum logic design by Hafiz Md. Hasan Babu

Reference Books & Materials

2. Preskill, J. Notes on Quantum Computation.
3. Peres, Asher. Quantum Theory: Concepts and Methods. New York, NY: Springer, 1993. ISBN: 9780792325499.

Course Outline – Digital System Design Lab

Part A – Introduction

1.	**Course No. / Course Code**	**:** CSE 448
2.	**Course Title**	**:** Digital System Design Lab
3.	**Course Type**	**:** Elective
4.	**Level/Term and Section**	**:** 4^{th} year
5.	**Academic Session**	**:**
6.	**Course Instructor**	**:**
7.	**Pre-requisite (If any)**	**:**
8.	**Credit Value**	**:** 1.50
9.	**Contact Hours**	**:**
10.	**Total Marks**	**:** 100

Course Objectives and Course Summary: This is a core course of Bachelor of Computer Science and Engineering Program which will help the students for understanding the Computer Architecture and Peripheral & Interfacing in the CSE program. This knowledge is very important for the Robotics and Embedded system. A brief study on total digital systems.

11. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Analyze** functional building blocks and control and timing concepts of digital systems.
CLO 2	**Design** complex digital system design in a hierarchical fashion using top-down and bottom-up design approaches.
CLO 3	**Implementation** of digital system.

12. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	**Corresponding PLOs (Appendix-1)**	**Bloom's taxonomy domain/level (Appendix-2)**	**Delivery methods and activities**	**Assessment Tools**
CLO1	1		Based on theory class	Implementation, Assignment and report.
CLO2	2		Group discussion	Implementation, report, viva.
CLO3	4		Problem Solving, Group discussion	Quiz, Presentation, Viva, Written Examination and lab setup test.

Part B – Content of the Course

13. **Course Content:** Based on theory course CSE 443

14. Alignment of topics of the courses with CLOs:

SL. No	**Topics / Content**	**Course Learning Outcome (CLO)**
1		
2		

3		

15. Class Schedule/Lesson Plan/Weekly plan:

Topics	**Specific Outcome(s)**	**Time Frame**	**Suggested Activities**	**Teaching Strategy(s)**	**Alignment with CLO**
		Week 1			
		Week 2			
		Week 3			
		Week 4			
		Week 5			
		Week 6			
		Week 7			
MID-TERM EXAMINATION					
		Week 8			
		Week 9			
		Week 10			
		Week 11			
		Week 12			
		Week 13			
		Week 14			
FINAL EXAMINATION					

16. Teaching-Learning Strategies:

17. Assessment Techniques of each topic of the course:

<u>Part C – Assessment and Evaluation</u>

18. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignment in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category Marks (out of 50)	**Tests (25)**	**Assignments (10)**	**Quizzes (5)**	**External Participation in Curricular/Co-Curricular Activities (10)**
Remember				
Understand				
Apply				
Analyze				
Evaluate				
Create				

SMEB- Semester Mid & End Exanimation (50 Marks)

Bloom's Category	**Mid**	**Final**
Remember		
Understand		
Apply		
Analyze		
Evaluate		
Create		

19. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

20. Text Book

1. Digital Logic and Computer Design- M. Morris Mano
2. Digital Computer Electronics- Malvino- Brown

Course Outline – Design and Testing of VLSI Lab

Part A – Introduction

1.	**Course No. / Course Code**	**:** CSE 450
2.	**Course Title**	**:** Design and Testing of VLSI Lab
3.	**Course Type**	**:** Optional, Sessional
4.	**Level/Term and Section**	**:** 4^{th} Year 1^{st} Semester
5.	**Academic Session**	**:** Fall 2023
6.	**Course Instructor**	**:** Syeda Fatima Fayruj
7.	**Pre-requisite (If any)**	**:** N/A
8.	**Credit Value**	**:** 0.75
9.	**Contact Hours**	: 3.00
10.	**Total Marks**	**:**

11. **Course Objectives and Course Summary:** This is a Laboratory course based on the content of the Theory course EEE 445: Design and Testing of VLSI. Course Objectives
 • To provide hands-on training on design techniques of Design and Testing of VLSI emphasizing fundamentals as well as new paradigms that need to master in today's industry
 • To provide hands-on training on simulation techniques used for schematics and layout design.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Apply** the physics-based knowledge of Semiconductor device to design circuit to process Analog signals to do useful operation.
CLO 2	**Analyze** the operation of integrated circuits (ICs) based on the underlying physics and control theory.
CLO 3	**Design** solid-state integrated circuits such that specified performance characteristics are attained.
CLO 4	**Use** circuit simulation tools to verify theoretical prediction of circuit performance using very complex but realistic device model

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1				
CLO2				
CLO3				
CLO4				
CLO5				

Part B – Content of the Course

14. Course Content:

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1		
2		
3		

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Introductory class and overview of the course.		Week 1	Discussion	Lectures	
Study of the basic current-versus voltage curve, threshold voltage of the MOS transistor in the process technology library (pdk)		Week 2	Lab-tasks, Report	Lectures, Lab demonstrations	CLO1
Design a CMOS inverter.		Week 3	Lab-tasks, Report	Lectures, Lab demonstrations	CLO2
MID-TERM EXAMINATION					
Full custom design of a NAND and NOR gate.		Week 4	Lab-tasks, Report	Lectures, Lab demonstrations	CLO2
Calculate the DC and AC voltages and currents for a circuit and verify your answers with AC analysis simulation by Cadence system.		Week 5	Lab-tasks, Report	Lectures, Lab demonstrations	CLO3, CLO4
Overview of the course and discussion on its practical impact in today's industry.		Week 6	Lab-tasks, Report	Interactive discussions	
Final Evaluation		Week 7	Lab-tasks, Report	Evaluation	
FINAL EXAMINATION					

17. Teaching-Learning Strategies:

18. Assessment Techniques of each topic of the course:

- Attendance will be recorded in every class
- Report on each laboratory experiment will be evaluated
- Continuous assessment will be done in the form of in-class lab performance.

• A lab test will be conducted at the end of the laboratory experiments.

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignment in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category Marks (out of 50)	**Tests (25)**	**Assignments (10)**	**Quizzes (5)**	**External Participation in Curricular/Co-Curricular Activities (10)**
Remember				
Understand				
Apply				
Analyze				
Evaluate				
Create				

SMEB- Semester Mid & End Exanimation (50 Marks)

Bloom's Category	**Mid**	**Final**
Remember		
Understand		
Apply		
Analyze		
Evaluate		
Create		

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Performance 30%
2. Final Evaluation 50%
3. Mid-Term Evaluation 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

Design of Analog CMOS Integrated Circuits by Behzad Razavi. McGraw Hill International Edition 2001

Reference Books & Materials

1. Supplementary materials like slides and lab manuals will be shared with the class on a need basis.
   N.B. Besides going through relevant topics of the textbook, it is strongly advised that the students follow the class lectures and discussions regularly for a thorough understanding of the topics.
2. Others

Course Outline – Topics of Current Interest Lab

Part A – Introduction

1. **Course No. / Course Code** : CSE 452
2. **Course Title** : Topics of Current Interest Lab
3. **Course Type** : Optional Course
4. **Level/Term and Section** : 4th Year
5. **Academic Session** : Fall 23
6. **Course Instructor** : Md Mahedi Hassan
7. **Pre-requisite (If any)** :
8. **Credit Value** : 3.0
9. **Contact Hours** : 3.0
10. **Total Marks** : 100
11. **Course Objectives and Course Summary** :

The objectives of this course are to

- **Provide** knowledge and understanding on principles of Pattern recognition and Machine Learning.

- **Introduce** the concept of different types of classification and recognition algorithm.
- **Learn** the regression and classification algorithm.
- **Enable** the student to gain application of different types pattern recognition tasks.
- **Emphasize** the design and implement of different types pattern recognition algorithms.

This course prepares students for connecting learning algorithms to a broad variety of real-life issues in Science and Engineering. It also prepares students for future endeavors as Data Scientists, Knowledge Workers, Decision Makers and numerous prospective professions to be named.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO 1	**Understand** the objectives and basic terminologies of Machine Learning (ML)
CLO 2	**Explain** the theoretical and mathematical concepts of data preprocessing, ML models, Perceptron, Artificial Neural Networks (ANN), and searching and optimization algorithms
CLO 3	**Apply** the data preprocessing techniques and ML algorithms with proper parameter and hyperparameter tuning
CLO 4	**Design** multi-layer Neural Networks employing back propagation in for solve real world problems
CLO 5	**Analyze** the outcomes of the models using different performance metrics and the effect of parameters and hyperparameters on the models

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	**Corresponding PLOs (Appendix-1)**	**Bloom's taxonomy domain/level (Appendix-2)**	**Delivery methods and activities**	**Assessment Tools**
CLO 1	1	Understand	Lecture, Multimedia	Written Exam
CLO 2	1	Understand	Lecture, Multimedia	Written Exam
CLO 3	1	Apply	Lecture, Multimedia	Written Exam
CLO 4	3	Create	Lecture, Multimedia	Assignment
CLO 5	2	Evaluate	Lecture, Multimedia	Written Exam

Part B – Content of the Course

14. Course Content:

15. Alignment of topics of the courses with CLOs:

SL. No	**Topics / Content**	**Course Learning Outcome (CLO)**
1	Classification and Regression	CLO1, CLO2, CLO3

2	Clustering	CLO1, CLO2
3	Principal Component Analysis (PCA)	CLO1, CLO2, CLO3
4	Ensemble Learning	CLO1, CLO2, CLO3
5	Model Evaluation	CLO5
6	Neural Networks	CLO4
7	Genetic Algorithm (GA)	CLO2
8	Optimization Algorithms	CLO2

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Introduction to ML and its classification, understanding datasets		Week 1		Lecture, Multimedia	CLO1
Introduction to supervised learning, classification algorithms, KNN, Support Vector Machine		Week 2		Lecture, Multimedia	CLO2, CLO3
Decision Tree		Week 3		Lecture, Multimedia	CLO2, CLO3
Logistic Regression, Naïve Bayes Algorithm		Week 4		Lecture, Multimedia	CLO2, CLO3
Clustering Algorithms, Introduction to Ensemble Learning, Random Forest Classifier, AdaBoost Classifier		Week 5		Lecture, Multimedia	CLO2
Voting Classifier, PCA		Week 6		Lecture, Multimedia	CLO2, CLO3
Data preprocessing techniques, performance evaluation of models		Week 7		Lecture, Multimedia, Group Discussions	CLO3, CLO5
MID-TERM EXAMINATION					
Theory and mathematical examples related to GA		Week 8		Lecture, Multimedia	CLO2
Particle Swarm Optimization (PSO), Ant Colony Optimization (ACO)		Week 9		Lecture, Multimedia	COL3
Introduction to Neurons, logic function implementation using Neurons		Week 10		Lecture, Multimedia, Group Discussion	CLO4, CLO1
Introduction to single and		Week 11		Lecture,	CLO4

multi-layer Neural Networks, Feed-Forward Neural Networks, Activation Functions				Multimedia	
Training of Feed-Forward Neural Network with Back-Propagation		Week 12		Lecture, Multimedia	CLO4
Convolutional Neural Networks (CNN)		Week 13		Lecture, Multimedia	CLO4
Neural Networks for Sequential / Time Series data		Week 14		Lecture, Multimedia	CLO4
FINAL EXAMINATION					

17. Teaching-Learning Strategies:

18. Assessment Techniques of each topic of the course:

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester, 2 class tests will be taken for midterm and 2 class tests will be taken for final term. 1 makeup class test will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The topic or case studies will be given as assignment to the individual during the class which they have to prepare at home and will submit on or before the due date. Late submissions will cost 25% deduction of marks per day and after 3 days of the deadline, no submission will be accepted.

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 30)	Tests (20)	Assignments (10)
Remember		
Understand	**5**	
Apply	**10**	
Analyze	**5**	
Evaluate		
Create		**10**

SMEB- Semester Mid & End Exanimation (70 Marks)

Bloom's Category	Mid	Final
Remember		
Understand	**4**	**9**
Apply	**16**	**21**
Analyze		**10**
Evaluate		**10**
Create		

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 20%
2. Assignment 10%
3. Term Examination 50%
4. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Christopher M. Bishop, Pattern Recognition and Machine Learning, 2016, Springer

Reference Books & Materials

2. Tom M. Mitchell, Introduction to Machine Learning, 1st Edition (1997), McGraw-Hill Education

PART D: GRADING/EVALUATION

20. Grading/Evaluation

Grades will be calculated as University Grants Commission of Bangladesh (UGC) grading scale and individual students will be evaluated based on the following criteria with respective weights.

Assessment of Courses

The total performance of a student in a given course is based on a scheme of continuous assessments, which may be different for theoretical courses, lab courses and project work. Project will be evaluated by presentation, viva and paper submitted by the students. On the other hand, the distribution of marks for a theoretical and lab course will be as follows:

Type of Course	Assessment Type	Weight (%)
Theoretical Course	Continuous Assessment	30
	Mid Semester Examination	20
	Semester Final Examination	50
Lab Course	Continuous Assessment	50

	Lab Exam /Project /Assignment /Presentation/	50

(i) Assessment: Marks for assessment will be given by the course teacher through class tests, quizzes, assignments, presentation, class performance, class attendance etc. Course teacher will publish assessment marks in the last week of class.
(ii) Mid Semester Examination: Mid semester examination will be held according to the academic calendar published by the university at the beginning of a semester. The classes will remain suspended during the mid-semester examination and the exam is to be completed within one week.
(iii) Semester Final Examination: Semester final examination will start after one week's recess as preparatory leave at the end of regular classes for a semester. The time duration of each examination will be 3 hours. A student is required to attend at least 70% of the classes held for every course in order to sit for the semester final examination.

a. Grading Scale

Each letter grade is equivalent to a numerical value and grade point. Letter grades and their corresponding grade points are as follows:

Sl. No.	Numerical Grade	Letter Grade	Grade Point
1	80% or above	A+	4
2	75% to less than 80%	A	3.75
3	70% to less than 75%	A-	3.5
4	65% to less than 70%	B+	3.25
5	60% to less than 65%	B	3
6	55% to less than 60%	B-	2.75
7	50% to less than 55%	C+	2.5
8	45% to less than 50%	C	2.25
9	40% to less than 45%	D	2
10	Less than 40%	F	0
11	Incomplete	I	-
12	Satisfactory	S	-
13	Unsatisfactory	U	-

Exemption: Means credits earned for equivalent course(s) by a student in other universities/academic institutions.

b. Grades

Grade 'F': If a student fails to achieve at least 40% mark in a course he/she will get 'F' grade in that course. Absence in the final examination held at the end of each academic semester will also result in 'F' grade.
Grade 'I': Grade 'I' means incomplete work. Grade 'I' may be given to a candidate when he/she fails to appear at the semester final examination for reasons beyond his/her control. Grade 'I' shall be converted to the actual grade obtained by the students in repeat examination. Otherwise grade 'I' shall be converted to an 'F' grade. If necessary, in case of project work/thesis/internship, the final result may be published by providing I grade.

Grade 'S': Grade 'S' means satisfactory. According to the syllabus there are two types of 'S' grades. Type A - 'S' is given when a course is extended to two consecutive semesters and grade 'S' is given in the first semester to mean satisfactory progression. Type B - 'S' is given after satisfactory completion of a non-credit course.
Grade 'U': Grade 'U' means unsatisfactory performance of a non-credit course.

c. Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA)

A student's performance is evaluated by the number of credits that he/she has completed satisfactorily and the weighted average of the grade points that he/she has achieved. The Grade point average (GPA) is computed by the following formula:

$$\text{GPA} = \frac{\sum (\text{Grade Points} \times \text{Credits})}{\sum \text{Earned Credits}}$$

The grade points are points against letter grades A+, A, A-, B+, B, B-, C+, C, C- and D. Credits are for those courses attempted at this university only.

d. Course Withdrawal

After completing the course registration for a particular semester, students can withdraw from any registered course by consulting with their advisor within two weeks from starting the classes.

e. Incomplete (I) courses

Grade 'I' means incomplete work. Grade 'I' may be given to a candidate when he/she fails to appear at the semester final examinations only for reasons beyond his/her control. Grade 'I' shall be converted to the actual grade obtained by the students in repeat examination. Otherwise grade 'I' shall be converted to a 'F' grade. If necessary, in case of project work/thesis/internship, the final result may be published by providing I grade.

f. Policy for Semester

Students have to complete all the courses as offered in eight consecutive semesters. However, if any student fails in one or more courses in any semester, he/she can complete it in the next semester along with other regular courses.

g. Grades Improvement

The provision for improvement of grades applies only to those who obtained a grade C+ or lower in any course. Such candidates may be allowed to improve their grades by surrendering the earlier grade obtained by him or her. A student will be allowed to improve a maximum of two courses. A student may apply for such provisions any time during his/her study period in the university but not beyond two weeks after the publication of his/her last semester results. As for the improvement of any grade (up to 'A-' grade), the incumbent student may be allowed to repeat only one time for a particular course.
Re-evaluation of Answer Script: Re-evaluation of the final examination answer scripts may be permissible. A candidate can apply for re-evaluation of any answer script for the final examination to the Controller of Examinations through their advisor and Head of the Department on payment of 700 taka only per script within 7 working days from the publication of the final results. No such application will be entertained after that period. No such re-evaluation will be allowed for sessional/laboratory courses.

h. Policy for Semester Drop/ Retaking/ Back-log Courses

After completing registration by paying registration fees, students can drop the semester by filling the semester drop application provided by university authority within two weeks from the commencement of classes. Students will submit their application along with the recommendations of the respective advisor and Head of the Department to the Registrar office.

i. Others

Policy for Repeat Examinations

- A student of an undergraduate program will be allowed to appear for repeat examinations in case he/she fails three theory courses or less or not exceeding 10 credit hours (including the credit hours of the expelled course(s)). The respective department will arrange such examinations. There is also a provision of repeat examinations for the students of graduate programs.
- Candidates willing to take such repeat examinations must apply to the respective Head of the Department through Advisors stating their willingness to appear for the said examination with receipt of payment 3000 taka per course.
- Repeat examination on theory courses will be held on 50 percent of marks for each course and the marks for class assessment and mid semester examination will be carried over. There shall be no repeat examination for sessional or laboratory courses. The maximum grade to be awarded for a candidate in a repeat examination will be 'B' (equivalent to 60%).

The following grade system will be followed in repeat examination

S. No	Marks	Grade
1	60% and above	B
2	55% to less than 60%	B -
3	50% to less than 55%	C +
4	45% to less than 50%	C
5	40% to less than 45%	D
6	Less than 40%	F

Disciplines in Examinations

Department of Computer Science and Engineering, UAP maintains very strict discipline for the smooth conduct of examinations. The following activities by the examinee shall constitute an offence or misconduct. Students are liable to be punished according to the UAP rules if they are found to have committed any such offence mentioned as follows:

Offences	Punishment
1. Any verbal communication between one another.	Warned twice and deduction of 5-15 marks or seizure of answer script and question for up to 20 minutes depending on the nature and extent of the offence, as decided by the invigilator (CI).
2. Appearing at the examination without Admit Cards. 3. Possessing objectionable/illegal/incriminating papers or question paper, materials, electronic gadgets or devices, books, bags, subject related text in any part of body etc.	Cancellation of the particular examination.
4. Refusing to hand over/throwing out of reach/swallowing/erasing objectionable/illegal/incriminating papers or question papers, materials, electronic gadgets or devices, books, bags, subject related text in any part of body etc. 5. Writing on objectionable/illegal/incriminating papers or question papers, materials, electronic gadgets or devices, books, bags, subject related text in any part of body etc. and copying from them. 6. Copying from objectionable/illegal/incriminating papers or question papers, materials, electronic gadgets or devices, books, bags, subject related text in any part of body etc. clothes, handwritten/printed/cell phone or photocopied materials etc. 7. Writing anything on the wall, desk, bench, clothes, blackboard, floor or in any part of the body and copying from these writings.	Cancellation of all examinations of the concerned semester
8. Changing or exchanging registration number/Answer Script/ question paper between examinees.	Cancellation of all examinations of the concerned semester
9. Misbehaving with intimidating, abusing or taunting the invigilators on duty or anybody concerned with the conduct of examination. 10. Impeding/creating obstruction or disturbance in smooth holding /conducting of examination, or preventing others to take the examination or provocation examinees to leave the examination hall.	Expulsion for two semesters. These two semesters will be the concerned semester and the next one
11. Assaulting or attempting to assault invigilators or any person concerned with the examinations in or outside the examination hall/premises.	Expulsion from the university

12. Trying to smuggle in or out any Answer/Question papers or adding such smuggled Answer Script / sheet with the original Answer Script.	Expulsion for two semesters. These two semesters will be the concerned semester and the next one
13. Having the handwriting of two different people in the same Answer Script.	Cancellation of the all examinations for the concerned semester
14. Taking a seat illegally in an unauthorized place in lieu of his/her marked seat/room and refusing to move to his/her authorized place or room.	Expulsion for two semesters. These two semesters will be the concerned semester and the next one
15. Changing /substituting a cover or inside page of the Answer Script of the university. 16. Writing something objectionable and/or irrelevant things in the Answer Script to the invigilator.	Cancellation of the all examinations for the concerned semester
17. Leaving the examination hall without submitting the Answer Script to the invigilator.	Cancellation of the concerned examination
18. Damaging /tearing off the Answer Script/objectionable papers/cell phone or any other electronic device etc. or refusing or creating any obstruction to hand over such papers/cell phone any other electronic device to the authority.	Expulsion for two semesters. These two semesters will be the concerned semester and the next one
19. Appearing in the examination illegally through impersonation.	Expulsion from the university
20. Trying to avail special advantage illegally by falsification/pretexts of any sort (fake medical certificate/false incident/fake documents or any other fraudulent activities).	Cancellation of the all examinations for the concerned semester
21. Damaging furniture/gadgets/equipment/vehicle or any other property of university/ or anyone in the examination hall/premises or trying to set fire on such valuables in the examination hall/premises.	Expulsion from the university
22. Such other acts not mentioned above on the part of the examiner as in the opinion of the authority may be regarded as an offence.	Disciplinary action in the form of cancellation of the examination and debarring from appearing at the subsequent examinations may be taken by the appropriate authority/ discipline committee of the University.

Code of Conduct

The UAP is very keen to keep its campus free from any sort of sexual abuse or harassment. To attain this goal, the UAP administration needs the cooperation and commitment of all: the students, the faculty and the staff, alike. Sexual abuse and harassment have been identified as below:

1. Behavior colored with unwelcome sex appeal (direct or by indication) like physical touch or advances.
2. Attempts or efforts to establish sexual relations by abuse or administrative/professional power.
3. Language with tinge of sexual abuse and harassment.
4. Demand or request for sexual favors.
5. Showing pornography.
6. Remark or gesture implicating sex appeal.
7. Teasing through indecent gesture, language or remark, to get near to or follow someone with the aim of fulfilling filthy intentions without one's knowing and to tease or cut jokes in language implicating sex.
8. To say or write anything on letter, telephone, cell phone, SMS, photo, notice, cartoon, bench, chair, table, notice board, office, factory, laboratory, classroom, walls of bathrooms/toilets with a motive of sexual implications.
9. Taking still or video photographs for the purpose of blackmailing and character assassination.
10. To pose threat to keep someone away from participation in sports, cultural, institutional and academic activities for fear of sexual abuse and harassment.
11. To pose a threat or exert pressure in case of refusal of love proposals.
12. To establish or try to establish sexual relations by intimidation, deception or false assurance.

Anyone, male or female, having any complaint against anybody on any of the above grounds, must contact the 'Departmental Focal Point' (there is one in each department) of the 'Complaint Committee' and act on his/her advice. The administration is determined to take appropriate actions against the violators. UAP has a Sexual Harassment Committee to handle the different complains of students.

Class Attendances

All students are expected to attend classes regularly. The University of Asia Pacific believes that regular attendance is essential for effective learning. A student is required to attend at least 70% of all the classes held in every course in order to sit for the final examination.

i. Absence during Semester

A student shall not be absent in quizzes, tests, mid semester examinations etc., during the semester. Such absence will naturally lead to reduction in points/marks, which shall count towards the final grade. Absence in the final examination held at the end of each academic semester will result in F grades.