OUTCOME BASED CURRICULUM

Bachelor of Science in Computer Science and Engineering
Faculty of Science and Engineering

Department of Computer Science and Engineering (CSE)

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Chapter 1

1.1 Title of the Academic Program:
Bachelor of Science in Computer Science and Engineering.

1.2 Name of the University:
Teesta University

1.3 Vision of the University
Teesta University has been established with a vision to transfer technical and entrepreneurial knowledge, innovation of new knowledge and development of skilled man power for regional development and global societal needs and industry.

1.4 Mission of the University
The mission of Teesta University is
1. to address regional higher education deficits.
2. to impart world-class teaching effectively to imbue the human mind with knowledge, tolerance, and vision, and to stimulate a lasting attitude of inquiry in students.
3. to develop students' free intellectual practice, thoughtfulness, freedom of thought and inquisitiveness.
4. to disseminate knowledge using the highest possible information technology paring with latest global trend to acquaint the students with the modern and fast-moving world.
5. to create a better environment for students towards productive self-employment, research basic and applied research.
6. to create a better environment for students to be interested in relentless pursuit of knowledge and versatile social and cultural activities.
7. to create science-minded, secular, liberal, human wellbeing-oriented, progressive and visionary citizens suitable for leadership in all spheres of life.
8. to make teachers and students interested in learning, research, creativity and innovation.
9. to play an effective role in building citizens motivated by human values and patriotism.

1.5 Name of the Program Offering Entity
Computer Science and Engineering (Faculty of Science and Engineering).

1.6 Vision of the Program
To produce “Creators of Innovative Technology”.

1.7 Mission of the Program
1. To impart knowledge in the state of art in Computer Science and Engineering with relevant theoretical basis.
2. To participate in design and development process in industries and research establishments.
3. To promote research of international quality.

1.8 Objectives of the Program
- Graduates will have a thorough grounding in the key principles and practices of computing, and will have applied their software development skills and knowledge of foundational principles to the design and implementation of practical systems consisting of software and/or hardware components to meet customer requirements.
- Graduates will have an understanding of additional engineering principles, and the mathematical and scientific concepts that underlie them, and will have applied this understanding, as appropriate, in analyzing real-world problems and designing suitable solutions.
- Graduates will have an understanding of human and social issues, and will be in the process of becoming informed and involved members of their communities, and responsible engineering and computing professionals.
- Graduates will have appropriate interaction and organizational skills, and will be routinely using and further developing these skills in their professional careers.

- Graduates will be successfully employed in the computing profession, and will be actively engaged in learning, understanding, and applying new ideas and technologies as the field evolves; or will have successfully completed, or be actively pursuing, graduate studies in computing.

1.9 Name of the Degree
B.Sc. in Computer Science and Engineering.

1.10 Description of the Program
Duration of Course: Four (4) years/ Eight (8) semesters.
Total Credit Hours: 155.

Medium of Instruction: English is the medium of instruction for all the subjects of study and for examinations of the course.

Eligibility for Admission: A student intending to pursue the course for the B.Sc. in Computer Science and Engineering may be admitted provided she/he has passed the S.S.C and H.S.C (or A Level) examination with required grades (minimum GPA-2.5 in each) with Physics, Mathematics and Computer Science. They will also be required to have good knowledge in both Bangla and English languages.

Studying Computer Science and Engineering is becoming very important. In the present world, information technology is being applied in all aspects of life including jobs, businesses, economics and social processes. Like many other developing nations, the benefits of Information Technology in Bangladesh need to be further extended. The demand and importance of the Computer Science and Engineers are highest for the implementation of "Digital Bangladesh" as proposed by the government.

1.11 Graduate Attributes
- **Communication:** No computer engineer does everything on his or her own; they are nearly always part of a team. Being part of a team means you will need to be able to communicate well, interact with others, and stay abreast of team progress.
- **Patience:** A good deal of your time is going to be spent sitting and doing nothing but writing code. This is a task that requires a lot of patience, which is why patience is a skill you can't succeed without.
- **Ability to work under pressure:** This is about keeping calm in a crisis and not becoming too overwhelmed or stressed.
- **Presentation skills**: This is not a computer science skill, but this is one of the most important skills that computer science students are missing. You must treat presentation as equally important, or more important than your program, design, and algorithms. And you must spend as much time learning presentation
- **Management:** If you want to get ahead in the field of computer engineering, you'll need to lead a team of computer engineers. If you don't have management skills, you could end up stuck in the same position - never able to advance in your career

1.12 Program Educational Objectives (PEOs)
PEO-1: Graduates of the program will be employed in the computing profession and at the same time will be engaged in life-long learning, understanding and applying new ideas and technologies as the field evolves and society modernized. As over 50 million CSE professionals are required worldwide currently so this program intends to meet 5-10% of this market demand.
PEO-2: Graduates will act ethically and responsibly towards their profession and society to show patriotism and cultural values.
PEO-3: Graduates will apply principles and practices of computing to successfully meet customer business objectives and productively engage in advanced studies and research.

1.13 Program Learning Outcomes (PLOs)
Upon graduation, students of Computer Science and Engineering will be able to -
PLO 1: acquire ability to apply mathematical foundations, algorithmic principles and computer science theory in the modeling and design of computer-based systems.

PLO 2: apply the engineering knowledge in all domains like IT, business, health care, banking and finance and other professions.
PLO 3: function effectively as a member of a team to accomplish a common goal.
PLO 4: propose original ideas and solutions, culminating into a modern, easy to use tool, by a larger section of the society with longevity.
PLO 5: design, implement and evaluate secure hardware and software systems with assured quality and efficiency.
PLO 6: communicate effectively the engineering solution to customers/users or peers.
PLO 7: understand professional, ethical, legal, security and social issues and responsibilities.
PLO 8: understand contemporary issues and to get engaged in lifelong learning by independently and continually expanding knowledge and abilities.
PLO 9: analyze the local and global impact of computing on individuals, organizations and society.

1.14 Mapping of mission of the university with PEOs

PEOs	Mission 1	Mission 2	Mission 3	Mission 4	Mission 5	Mission 6	Mission 7	Mission 8	Mission 9
PEO1			**m**	**m**	**m**			**m**	
PEO2		**m**	**m**			**m**	**m**		**m**
PEO3	**m**	**m**			**m**		**m**	**m**	

m= matched

1.15 Mapping of PLOs with the PEOs

PLOs	PEO1	PEO2	PEO3
PLO1	**m**		**m**
PLO2			**m**
PLO3	**m**	**m**	
PLO4		**m**	**m**
PLO5		**m**	**m**
PLO6	**m**		**m**
PLO7		**m**	
PLO8	**m**		**m**
PLO9	**m**	**m**	

m= matched

1.16 Mapping of Courses and PLOs

S: Strong Correlation **M:** Medium Correlation **Blank:** No Correlation

Course Code	Course Name	Program Learning Outcomes								
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
CSE1101	Introduction to Computer System	S	S	S	S	S	S		M	
CSE1102	Structured Programming Language	S	S	S	S		S	M	M	M
CSE1103L	Structured Programming Language Lab	S	S	S	S		S		M	M
CSE1201	Object Oriented Programming Language (C++)	S	S	S	S		S		M	
CSE1202L	Object Oriented Programming Language (C++) Lab	S	S	S	S		S		M	
CSE1205L	Engineering Drawing and CAD Lab	S	S	S	S	S	S	M	M	
CSE2301	Data Structures	S	S	S	S					
CSE2302L	Data Structures Lab	S	S	S	S					
CSE2303	Digital Logic & System Design	S	S							
CSE2304L	Digital Logic & System Design Lab	S	S			M	S		S	
CSE2305	Algorithm	S	S	S	S	M	S		S	
CSE2306L	Algorithm Lab	S	S	S	S					

CSE2401	Database Management Systems	S	S	S	S	S	S		S	
CSE2402L	Database Management Systems Lab	S	S	S		S	S		M	
CSE2403	Microprocessors & Microcontrollers	S	S							
CSE2404L	Microcontrollers & Assembly Language Lab	S	S			S	S		S	
CSE2405L	Java Programming Language Lab	S					M		M	
CSE3501	Operating System	S	S	M	M	S	S		S	
CSE3502L	Operating System Lab	S	S	M	M	S	S		S	
CSE3503	Computer Graphics & Animation	S	S	S		S	S		M	
CSE3504L	Computer Graphics & Animation Lab	S	S	S	S	S	S		M	
CSE3505	Communication Engineering	S	S	S	S	S			M	
CSE3506	Technical Writing & Presentation	S	S	S	S	S	S		M	
CSE3507	Computer Peripherals and Interfacing	S	S	M						
CSE3508	Computer Ethics and Cyber Law	S	S	S	S	S	S		M	
CSE3601	Software Design and Engineering	S	S		S		S	S	S	
CSE3602L	Software Design and Engineering Lab	S	S		S		S	S	S	
CSE3603	Web Design and Development	S	S	S	S	S	S		M	M
CSE3604L	Web Design and Development Lab	S	S	S	S	S	S		M	M
CSE3605	Computer Architecture	S	S	S	S	S	S		M	
CSE3606	Simulation and Modeling	S	S	S	S	S	S		M	
CSE3607L	Mobile Application Lab	S	S	M	M	S	S		S	
CSE4701	Computer Networks	S	S	S	S	S	S		M	
CSE4702	Cyber Security		M	M	S	S		S		
CSE4703L	Computer Networks & Cyber Security Lab	S	S	S	S	S	S		M	
CSE 4704	Digital Signal and Image Processing	S	S			S	S		M	
CSE 4705L	Digital Signal and Image Processing Lab	S	S			S	S		M	
CSE4706	Software Project Management and Quality Assurance	S	S	S	S					S
CSE4707	Automata & Compiler Design	S				S			M	
CSE4708	Data ware-housing & Data Mining	S	S	S	S					M
CSE4801	Artificial Intelligence & Expert System	S	S	S	S					
CSE4802L	Artificial Intelligence & Expert System Lab	S	S	S	S	S	S		M	
CSE4803	Distributed Systems	S	M		S					
CSE4804	Introduction to IoT	M	S		S	S				
CSE4805L	Machine Learning Lab	S	S	S	S	S	S	S	S	
CSE4806	Internship/ Industrial attachment		M	S	M	M	S	S	S	M
CSE4807	Thesis/ Project Work	S	S	S	S	S	S	S	S	S

Chapter 2
Structure of the Curriculum

2.1 Duration of the program: Year: **04** Semesters: **08**
2.2 Admission Requirements: Minimum GPA 2.5 in both SSC & HSC from Science Group
2.3 Total minimum credit requirement to complete the program: 155 Credits
2.4 Total class weeks in a Year/semester: 18 Weeks per Semester
2.5 Minimum CGPA requirements for graduation: CGPA 2.00
2.6 Maximum academic years of completion: 6 Years
2.7 Category of Courses:

i) General Education Courses:

SL	Course Code	Course Title	Credit
1.	MAT1104	Math-I (Calculus)	3
2.	MAT1105	Discrete Mathematics	3
3.	PHY1106	Physics (Electricity, Magnetism & Optics)	3
4.	ENG1107	English Reading Skills & Public Speaking	2
5.	BBA1108	Introduction to Management & Marketing	2
6.	EEE1203	Electrical & Electronics Circuits	3
7.	EEE1204L	Electrical & Electronics Circuits Lab	2
8.	STA1206	Statistics & Probability	3
9.	MAT1207	Math-II (Co-ordinate Geometry & Vector Analysis)	2
10.	ENG1208	English Writing Skills and Communications	2
11.	MAT2307	Math-III (Differential Equation & Special Function)	2
12.	ECO2308	Industrial Economics	2
13.	MAT2406	Numerical Methods	2
14.	MAT2407	Math-IV (Matrix & Complex Analysis)	2
15.	BBA2408	Financial & Managerial Accounting	2

ii) Major/ Core courses:

SL	Course Code	Course Title	Credit
1.	CSE1101	Introduction to Computer System	2
2.	CSE1102	Structured Programming Language	3
3.	CSE1103L	Structured Programming Language Lab	2
4.	CSE1201	Object Oriented Programming Language (C++)	3
5.	CSE1202L	Object Oriented Programming Language (C++) Lab	2
6.	CSE1205L	Engineering Drawing and CAD Lab	2
7.	CSE1209	Viva Voce	1
8.	CSE2301	Data Structures	3
9.	CSE2302L	Data Structures Lab	2
10.	CSE2303	Digital Logic & System Design	3
11.	CSE2304L	Digital Logic & System Design Lab	2
12.	CSE2305	Algorithm	3
13.	CSE2306L	Algorithm Lab	2
14.	CSE2401	Database Management Systems	3

15.	CSE2402L	Database Management Systems Lab	2
16.	CSE2403	Microprocessors & Microcontrollers	3
17.	CSE2404L	Microcontrollers & Assembly Language Lab	2
18.	CSE2405L	Java Programming Language Lab	2
19.	CSE2409	Viva Voce	1
20.	CSE3501	Operating System	3
21.	CSE3502L	Operating System Lab	2
22.	CSE3503	Computer Graphics & Animation	3
23.	CSE3504L	Computer Graphics & Animation Lab	2
24.	CSE3505	Communication Engineering	3
25.	CSE3506	Technical Writing & Presentation	2
26.	CSE3507	Computer Peripherals and Interfacing	3
27.	CSE3508	Computer Ethics and Cyber Law	2
28.	CSE3601	Software Design and Engineering	3
29.	CSE3602L	Software Design and Engineering Lab	2
30.	CSE3603	Web Design and Development	3
31.	CSE3604L	Web Design and Development Lab	2
32.	CSE3605	Computer Architecture	3
33.	CSE3606	Simulation and Modeling	2
34.	CSE3607L	Mobile Application Lab	2
35.	CSE3608	Viva Voce	1
36.	CSE4701	Computer Networks	3
37.	CSE4702	Cyber Security	2
38.	CSE4703L	Computer Networks & Cyber Security Lab	2
39.	CSE 4704	Digital Signal and Image Processing	3
40.	CSE 4705L	Digital Signal and Image Processing Lab	2
41.	CSE4706	Software Project Management and Quality Assurance	3
42.	CSE4707	Automata & Compiler Design	3
43.	CSE4708	Data ware-housing & Data Mining	3
44.	CSE4801	Artificial Intelligence & Expert System	3
45.	CSE4802L	Artificial Intelligence & Expert System Lab	2
46.	CSE4803	Distributed Systems	2
47.	CSE4804	Introduction to IoT	2
48.	CSE4805L	Machine Learning Lab	2
49.	CSE4808	Viva-Voce	1

iii) Elective Courses:Not Applicable

iv) Capstone course/Internship/Thesis/Projects/Portfolio:

SL	Course Code	Course Title	Credit
1.	CSE4806	Internship/ Industrial attachment	3
2.	CSE4807	Thesis/ Project Work	3

2.8 Year/ Semester wise Distribution of Courses

Undergraduate students of Computer Science and Engineering (CSE) Department have to undertake a specific course schedule. The year/ semester wise course schedule of Dept. of CSE is given below:

YEAR – 1, SEMESTER – 1

Course Code	Course Name	Contact Hours Theory / Lab	Credits	Marks
CSE1101	Introduction to Computer System	36	2	50
CSE1102	Structured Programming Language	54	3	100
CSE1103L	Structured Programming Language Lab	72	2	50
MAT1104	Math-I (Calculus)	54	3	100
MAT1105	Discrete Mathematics	54	3	100
PHY1106	Physics (Electricity, Magnetism & Optics)	54	3	100
ENG1107	English Reading Skills & Public Speaking	36	2	50
BBA1108	Introduction to Management & Marketing	36	2	50
Total		**396**	**20**	**600**

YEAR – 1, SEMESTER – 2

Course Code	Course Name	Contact Hours Theory / Lab	Credits	Marks
CSE1201	Object Oriented Programming Language (C++)	54	3	100
CSE1202L	Object Oriented Programming Language (C++) Lab	72	2	50
EEE1203	Electrical & Electronics Circuits	54	3	100
EEE1204L	Electrical & Electronics Circuits Lab	72	2	50
CSE1205L	Engineering Drawing and CAD Lab	72	2	50
STA1206	Statistics & Probability	54	3	100
MAT1207	Math-II (Co-ordinate Geometry & Vector Analysis)	36	2	50
ENG1208	English Writing Skills and Communications	36	2	50
CSE1209	Viva Voce	-	1	25
Total		**450**	**20**	**575**

YEAR – 2, SEMESTER – 3

Course Code	Course Name	Contact Hours Theory / Lab	Credits	Marks
CSE2301	Data Structures	54	3	100
CSE2302L	Data Structures Lab	72	2	50
CSE2303	Digital Logic & System Design	54	3	100
CSE2304L	Digital Logic & System Design Lab	72	2	50
CSE2305	Algorithm	54	3	100
CSE2306L	Algorithm Lab	72	2	50
MAT2307	Math-III (Differential Equation & Special Function)	36	2	50
ECO2308	Industrial Economics	36	2	50
Total		**450**	**19**	**550**

YEAR – 2, SEMESTER – 4

Course Code	Course Name	Contact Hours Theory / Lab	Credits	Marks
CSE2401	Database Management Systems	54	3	100
CSE2402L	Database Management Systems Lab	72	2	50
CSE2403	Microprocessors & Microcontrollers	54	3	100
CSE2404L	Microcontrollers & Assembly Language Lab	72	2	50
CSE2405L	Java Programming Language Lab	72	2	50
MAT2406	Numerical Methods	36	2	50
MAT2407	Math-IV (Matrix & Complex Analysis)	36	2	50
BBA2408	Financial & Managerial Accounting	36	2	50
CSE2409	Viva Voce	-	1	25
Total		**432**	**19**	**525**

YEAR – 3, SEMESTER – 5

Course Code	Course Name	Contact Hours Theory / Lab	Credits	Marks
CSE3501	Operating System	54	3	100
CSE3502L	Operating System Lab	72	2	50
CSE3503	Computer Graphics & Animation	54	3	100
CSE3504L	Computer Graphics & Animation Lab	72	2	50
CSE3505	Communication Engineering	54	3	100
CSE3506	Technical Writing & Presentation	36	2	50
CSE3507	Computer Peripherals and Interfacing	54	3	100
CSE3508	Computer Ethics and Cyber Law	36	2	50
Total		**432**	**20**	**600**

YEAR – 3, SEMESTER – 6

Course Code	Course Name	Contact Hours Theory / Lab	Credits	Marks
CSE3601	Software Design and Engineering	54	3	100
CSE3602L	Software Design and Engineering Lab	72	2	50
CSE3603	Web Design and Development	54	3	100
CSE3604L	Web Design and Development Lab	72	2	50
CSE3605	Computer Architecture	54	3	100
CSE3606	Simulation and Modeling	36	2	50
CSE3607L	Mobile Application Lab	72	2	50
CSE3608	Viva Voce	-	1	25
Total		**414**	**18**	**525**

YEAR – 4, SEMESTER – 7

Course Code	Course Name	Contact Hours Theory / Lab	Credits	Marks
CSE4701	Computer Networks	54	3	100
CSE4702	Cyber Security	36	2	50
CSE4703L	Computer Networks & Cyber Security	72	2	50

	Lab			
CSE 4704	Digital Signal and Image Processing	54	3	100
CSE 4705L	Digital Signal and Image Processing Lab	72	2	50
CSE4706	Software Project Management and Quality Assurance	54	3	100
CSE4707	Automata & Compiler Design	54	3	100
CSE4708	Data ware-housing & Data Mining	54	3	100
Total		**450**	**21**	**650**

YEAR – 4, SEMESTER – 8

Course Code	Course Name	Contact Hours Theory / Lab	Credits	Marks
CSE4801	Artificial Intelligence & Expert System	54	3	100
CSE4802L	Artificial Intelligence & Expert System Lab	72	2	50
CSE4803	Distributed Systems	36	2	50
CSE4804	Introduction to IoT	36	2	50
CSE4805L	Machine Learning Lab	72	2	50
CSE4806	Internship/ Industrial Attachment	108	3	100
CSE4807	Thesis/ Project Work	108	3	100
CSE4808	Viva Voce	-	1	25
Total		**486**	**18**	**525**

Chapter 3
Description of all courses of the program

YEAR – 1, SEMESTER – 1

Course Code: CSE 1101 **Course Title:** Introduction to Computer System **Credits:** 2.00

Rationale of the Course:
Having a common starting point for computer fundamentals ensures to study, learn and understand fundamental concept of computer elements.

Course Content:
Introduction, Types, and Generation of Computers, Basic Organization and Functional Units, Hardware and Software, System Unit, Mother Board, Bus, Interface Cards. Number Systems, BCD and ASCII Code, Binary Arithmetic, Logic Functions. Keyboard, Mouse, OCR, OMR, MICR, CD-ROM, Printers, CRT's, Computer Microfilm, Hard Disk, Floppy Disk, Magnetic Tape and other input and output devices. Examples of Software's - DOS, Windows, UNIX and System Utilities, Package Programs (Word Processing, Spreadsheet, Database Package, Statistical Package, Graphic Package, etc.), High-level Language, Mid-level Language, Interpreter, Compiler and Assembler.

Course Learning Outcomes (CLOs):
- **CLO1:** To design and identify the basic elements required in a computer system.
- **CLO2:** To evaluate electronic documents using various software applications.
- **CLO3:** To explain the role of the computer for personal and professional uses.

Mapping with Course Learning Outcomes (CLOs) with the Program Learning Outcomes (PLOs):

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√	√	√						
CLO2	√	√		√	√	√	√		
CLO3	√		√	√		√		√	√

Mapping with Course Learning Outcomes (CLOs) with Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Books	Tutorial, Assignment, Quiz
CLO2	Lecture with Multimedia, Handouts	Tutorial, Case Analysis
CLO3	Lecture, Handouts, Panel Discussion	Presentation, Case Writing

Course Code: CSE 1102 **Course Title:** Structured Programming Language **Credits:** 3.00

Rationale of the Course:
The desired course is planned as a building block for students who have an aim to introduce their occupation as a programmer, system analyst and software developer.

Course Content:
Basic Programming concepts and notations; Program development stages; Compilers, interpreters and IDE; Syntax and semantics; Flow charts; Variables, Identifiers; Constants, Data types;

Operators; Input and output statements; Decision Making; Control Structures; Functions and Subroutines; Parameter passing conventions, scope rules and storage classes; Working with structured data: Arrays, Multidimensional Array; Records, Pointers and it's uses, Link lists; Utility functions; Graph, Strings, Sound using programming language C; User Defined Data Types: Structures, Unions, Enumerations, File I/O, Header files, User defined header files; Preprocessor. Bitwise Operations & Dynamic memory allocation; Error Handling; Exception Handling.

Course Learning Outcomes (CLOs):

CLO1: To improve the basic knowledge used in computer programming.
CLO2: To evaluate different basic algorithms and solve problems using computer.
CLO3: To explain the fundamental characteristics of a structured programming language.
CLO4: To develop basic programming skills according to program design and development.

Mapping Course Learning Outcomes(CLOs) with the PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√				√				
CLO2	√	√		√	√				√
CLO3	√		√			√		√	
CLO4		√	√						√

Mapping Course Learning Outcome(CLOs) with the Teaching-Learning Strategy & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Handouts	Tutorial examination & Assignment
CLO2	Handouts, Lecture, Case Study	Case study & Assignment
CLO3	Group Discussion, Lecture, Handouts,	Group discussion & Assignment
CLO4	Lecture, Books	Presentation & Case analysis

Course Code: CSE 1103L **Course Title:** Structured Programming Language Lab **Credits:** 2.00

Rationale of the Course:

The desired course is planned as a building block for students who have an aim to introduce their occupation as a programmer, system analyst and software developer.

Course Content:

Basic Programming concepts and notations; Program development stages; Compilers, interpreters and IDE; Syntax and semantics; Flow charts; Variables, Identifiers; Constants, Data types; Operators; Input and output statements; Decision Making; Control Structures; Functions and Subroutines; Parameter passing conventions, scope rules and storage classes; Working with structured data: Arrays, Multidimensional Array; Records, Pointers and it's uses, Link lists; Utility functions; Graph, Strings, Sound using programming language C; User Defined Data Types: Structures, Unions, Enumerations, File I/O, Header files, User defined header files; Preprocessor. Bitwise Operations & Dynamic memory allocation; Error Handling; Exception Handling.

Course Learning Outcomes (CLOs):

CLO1: To improve the basic knowledge used in computer programming.
CLO2: To evaluate different basic algorithms and solve problems using computer.

CLO3: To explain the fundamental characteristics of a structured programming language.
CLO4: To develop basic programming skills according to program design and development.

Mapping Course Learning Outcomes(CLOs) with the PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√				√				
CLO2	√	√		√	√				√
CLO3	√		√			√		√	
CLO4		√	√						√

Mapping Course Learning Outcome (CLOs) with the Teaching-Learning Strategy & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Explain Case Analysis	Tutorial examination & Assignment
CLO2	Handouts, Panel Discussion	Group Discussion & Quiz
CLO3	Presentation with multimedia, Handouts	Midterm Examination & Case Analysis
CLO4	Lecture with case study	Tutorial examination & Case Study

Course Code: MAT 1104 **Course Title:** Math-I (Calculus) **Credits:** 3.00

Rationale of the Course:
The intended course is designed as a building block for students who have a desire to establish their career in mathematics and engineering.The goals of this course are to provide students with the basic knowledge of differential calculus and to introduce them to integral calculus in preparation for differential equation and also advanced calculus.

Course Content:
Differential Calculus: Limits, Continuity and Differentiability, L' Hospital's rule. Successive Differentiation: Leibnitz's theorem, Expansion of functions: Rolle's Theorem, Mean value theorem, Taylor's and Maclaurin's theorems in finite and infinite forms.
Partial differentiation: Euler's theorem, Tangent and normal, Maxima and Minima, Curvature, Asymptotes.
Integral Calculus: Definition, Integration by the method of substitution, Integration by parts, Standard Integrals, Integration by successive reduction. Definite Integrals, its properties and use in summing series. Walli's formulae, Improper integrals.
Beta and Gamma function. Determinations of lengths, areas and volumes.

Course Learning Outcomes (CLOs):
CLO1: To explain the rate of change of function.
CLO2: To asses, analyze and calculate the extreme values of functions and differentiate functions partially.
CLO3: To develop the differentiation of the techniques of evaluating indefinite and definite integrals.
CLO4: To evaluate the volumes of solid objects, the length of arcs and the surface area.

Mapping Course Learning Outcome(CLOs) with the PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√				√				
CLO2	√	√	√		√				
CLO3			√			√			

CLO4				√		√			√

Mapping Course Learning Outcome(CLOs) with the Teaching-Learning Strategy & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Handouts, Books	Tutorial examination & Assignment
CLO2	Lecture, Examples	Tutorial examination & Quiz
CLO3	Lecture, Handouts	Tutorial examination & Assignment
CLO4	Lecture with Multimedia, Handouts	Tutorial examination & Case Analysis

Course Code: MAT 1105 **Course Title:** Discrete Mathematics **Credits:** 3.00

Rationale of the Course:
The intended course is designed as a building block for students who have a desire to establish their career in mathematics and engineering aspects. The goal of this course is to provide students with the basic knowledge and application of discrete mathematics.

Course Content:
Introduction to Discrete Mathematical Structure: Set theory, Mathematical reasoning and proof techniques, Prepositional calculus and predicate calculus. **Elementary Number Theory:** Relations, Function, Algebraic structures, Graph theory, Paths and trees, Generating Function, Permutation groups. **Discrete Probability:** Induction, Contradiction and recursion, counting, Principles of inclusion & execution, recurrence relations, rings and groups.

Course Learning Outcomes (CLOs):
CLO1: To develop an understanding the basic knowledge mathematical notations and techniques.
CLO2: To develop an understanding of computational problems and use mathematical objects.
CLO3: To develop an understanding of the principle of mathematical logic.
CLO4: To develop an understanding of the efficiency of an algorithm.

Mapping Course Learning Outcome (CLOs) with PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√					√	√		
CLO2	√			√	√				
CLO3	√	√	√					√	
CLO4		√	√			√	√	√	√

Mapping Course Learning Outcome (CLOs) with Teaching-Learning Strategy & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Handouts	Quiz, Assignment & Mid-exam
CLO2	Slide Presentation, Handouts	Mid-exam & Assignment
CLO3	Handouts, Lecture	Presentation, Group Discussion
CLO4	Lecture, Handouts	Mid-exam, Quiz & Assignment

Course Code: PHY 1106 **Course Title:** Physics (Electricity, Magnetism & Optics)
Credits: 3.00

Rationale of the Course:
The Course will foster skills in scientific thinking, set in context and developed through application-led learning. Learners will acquire knowledge of concepts in physics relevant to this level of Course, and be able to apply their understanding to practical situations. They will develop skills in making informed decisions, and be prepared to make reasoned evaluations on environmental and scientific issues. They will develop investigative and experimental skills in a physics context.

Course Content:
Static electricity: Charge, Electric field, and Electric dipole in an electric field, Calculation of electric field from electric dipole. Gauss's theorem and its application. **Current**: Current and current density, Drift speed, EMF, RC circuit. **Electromagnetism**: Ampere's law, Faraday's law, Biot-Savart law, Inductance, Calculation of inductance (LR circuit). **Magnetism**: Intensity of magnetism, Permeability, Susceptibility, Paramagnetic, Diamagnetic and Ferromagnetic substances. **State of Matter**: Solid, Liquid and Gas, different types of bonds, Inter-atomic force, Conductor, Insulator and semiconductor, Energy band description of semiconductor, effect of temperature on semiconductor, P-type and N-type semiconductor, P-N junction. **Waves and Oscillations:** Oscillations: Simple harmonic motion (SHM), Damped harmonic motion, Forced oscillation, Combination and composition of simple harmonic motions, Lissajous figures. Transverse and Longitudinal nature of waves, Traveling and standing waves, Phase velocity and group velocity. Sound waves: Velocity of longitudinal wave in a gaseous medium, Doppler effect. **Physical Optics:** Theories of light: Different theories of light, Huygen's principles and constructions. Interference of light: Coherent source, Relation between path difference and phase difference, Definition of interference, Young's double slit experiment, Interference in thin film, Newton's ring. Diffraction of light: Fresnel and Fraunhoffer diffraction, Diffraction by single slit, Diffraction by double slit Polarizationof light: Brewster's law, Malus law.

Course Learning Outcomes (CLOs):

CLO1: To Learn the basic of electricity and related theorem, electromagnetic theorem and its application.
CLO2: To develop the understanding of the basic of electric circuit.
CLO3: To develop the understanding of the basic of magnetic materials and the basic of band theory and electronics.
CLO4: To learn different types of motion and waves and be introduced to the concepts of some theories of light and with some basic properties of light such as-interference, diffraction and polarization.

Mapping Course Learning Outcome(CLOs) with the PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√		√	√					
CLO2			√	√				√	
CLO3		√		√			√		
CLO4		√		√					√

Mapping Course Learning Outcome(CLOs) with the Teaching-Learning Strategy & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Explain Case Study	Case Analysis & Presentation
CLO2	Lecture, Books	Tutorial examination & Assignment
CLO3	Lecture, Panel Discussion	Mid exam & Group Discussion
CLO4	Multimedia Lecture, Handouts	Quiz, Case Analysis & Assignment

Course Code: ENG 1107 **Course Title:** English Reading Skills & Public Speaking
Credits: 2.00

Rationale of the Course:
The intended course is designed as a building block for students who have a desire to learn basic skills of English Language.

Course Content:
Communicative Grammar: Article, Verbs and Tenses, Subject-Verb Agreement, Preposition, Sentence Types.
Reading skill: Reading news articles, technical papers, and small passages for specific answers. Reading passages related to the majors taken by the students. Reading short stories and English Poems for overall idea.
Writing skill: Summarization, Paragraph, and Job Application.
Listening Skill: Listening to Social English, Listening to small dialogues. From *New Headway* by Liz & John Soars, Oxford University Press.
Speaking skill: Dialogue Writing, fundamental principles and practices of rhetoric, learn the art of public speaking which involves persuasion, creative analysis and synthesis of topics, organization, language, delivery, audience awareness and adaptation and the use of supporting materials. Types of speeches will include informative, persuasive, impromptu, inspirational, and special occasion speeches.

Course Learning Outcomes (CLOs):
CLO1: To develop the awareness of correct usage of English grammar in writing and speaking.
CLO2: To improve the speaking ability in English both in terms of fluency and comprehensibility.
CLO3: To be able to give oral presentations and receive feedback on their performance.
CLO4: To increase the reading speed and comprehension of academic articles.

Mapping with Course Learning Outcomes (CLOs) with the (PLOs):

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√		√			√			
CLO2		√	√			√			√
CLO3				√			√	√	√
CLO4		√					√	√	√

Mapping with Course Learning Outcomes (CLOs) with Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Handouts	Tutorial, Assignment, Quiz

CLO2	Conversation, Panel Discussion	Presentation, Assignment
CLO3	Lecture with Multimedia	Presentation, Assignment
CLO4	Books, Newspaper	Tutorial, Presentation

Course Code: BBA 1108 **Course Title:** Introduction to Management & Marketing
Credits: 2.00

Rationale of the Course:
The intended course is designed to build managerial and marketing efficiency among the students who have a desire to establish their career as managerial position in various fields and marketing various products and services.

Course Content:
Modern management- A digital focus: Importance of management, role of management, definition of management, management process and goal attainment.
Principles of planning and making decisions: Definition of planning, purposes of planning, Advantage & potential disadvantages of planning, primacy of planning, steps in the planning process, organizational objectives, areas of organizational objectives, guidelines for establishing quality objectives, Elements of decision situation, Decision making process, Decision making conditions.
Fundamentals of Organizing: Definition of organizing, organizing process, classical organizing theory
Fundamentals of Influencing and Communication through leading and motivating: Define influencing, influencing subsystem, communication, communication barriers, definition of leadership, leader vs. manager, trait approach to leadership, situational approach to leadership, definition of motivation, different theories of motivation.
Principles of Controlling: Control & controlling, standard, controlling process, types of control
Introduction to Marketing: Definition of marketing, marketing process, marketing management orientation, marketing mix and marketing plan.
Product Marketing: (Hardware marketing) -Definition, levels of product, types of products, product decision.
Service Marketing: (Software marketing)-Definition, nature and characteristics of service, types of service marketing, 7p's of service marketing.

Course Learning Outcomes (CLOs):
CLO1: To evaluate the global context for taking managerial actions of planning, organizing and controlling.
CLO2: To assess global situation, including opportunities and threats that will impact management of an organization.
CLO3: To specify how the managerial tasks of planning, organizing, and controlling can be executed in a variety of circumstances.
CLO4: To explain the process of inquiry, and respond to feedback, accounting for ethical, social and cultural (ESC) issues
CLO5: To evaluate global situation, including opportunities and threats that will impact management of an organization.

Mapping with Course Learning Outcomes (CLOs) with the Program Learning Outcomes (PLOs):

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√	√		√					
CLO2	√		√		√	√			√

CLO3	√		√	√		√	√		
CLO4		√	√		√	√			√
CLO5	√		√			√	√		√

Mapping with Course Learning Outcomes (CLOs) with Teaching-Learning Strategy & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Handouts, Presentation	Tutorial, Assignment, Quiz
CLO2	Slide Presentation, Handouts	Case Analysis, Assignment
CLO3	Presentation, Handouts	Mid Exam, Project Assignment
CLO4	Lecture, Handouts	Case Study, Assignment
CLO5	Slide Presentation & Lecture	Tutorial, Presentation

YEAR – 1, SEMESTER – 2

Course Code: CSE 1201 **Course Title:** Object Oriented Programming Language (C++)
Credits: 3.00

Rationale of the Course:
The desired course is planned as a building block for students who have an aim to introduce their occupation as a programmer, system analyst and software developer.

Course Content:
Object-oriented Programming using C ++: An overview of C, concepts of objects and OOP, C++ console I/O, C++ comments, the introduction of class, difference between C and C++, C++ keywords. Assigning objects, structure, and unions, passing objects to functions, returning objects from functions, friend functions, in-line function and automatic in the lining, function overloading, operator overloading. Arrays, pointers, and references. Introduction to inheritance, base class access control, using protected members constructor, destructor and inheritance, multiple inheritances. Virtual functions. Virtual functions applying polymorphism. Generic functions and classes, static class members, virtual base classes. C++/I/O and file I/O basics, array-based I/O, linkage specify, and the asm keyword. Creating and conversation function.

Course Learning Outcomes (CLOs):

CLO1: To explain Acquire knowledge of underlying concepts of object-oriented paradigm.
CLO2: To develop an understanding of object-oriented design artifacts and their mapping to object-oriented programming.
CLO3: To integrate realistic solutions for small systems involving single/multiple objects.

Mapping with Course Learning Outcomes (CLOs) with the Program Learning Outcomes (PLOs):

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√	√	√						
CLO2	√		√	√	√		√		√
CLO3	√			√	√	√		√	√

Mapping with Course Learning Outcomes (CLOs) with Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Handouts	Tutorial, Assignment, Quiz
CLO2	Books, Handouts	Group Discussion, Case Analysis
CLO3	Slide Presentation, Handouts	Presentation, Project Work

Course Code: CSE 1202L **Course Title:** Object Oriented Programming Language (C++) Lab
Credits:2.00

Rationale of the Course:
The desired course is planned as a building block for students who have an aim to introduce their occupation as a programmer, system analyst and software developer.

Course Content:
Object-oriented Programming using C ++: An overview of C, concepts of objects and OOP, C++ console I/O, C++ comments, the introduction of class, difference between C and C++, C++ keywords. Assigning objects, structure, and unions, passing objects to functions, returning objects from functions, friend functions, in-line function and automatic in the lining, function overloading, operator overloading. Arrays, pointers, and references. Introduction to inheritance, base class access control, using protected members constructor, destructor and inheritance, multiple inheritances. Virtual functions. Virtual functions applying polymorphism. Generic functions and classes, static class members, virtual base classes. C++/I/O and file I/O basics, array-based I/O, linkage specify, and the ASM keyword. Creating and conversation function.

Course Learning Outcomes (CLOs):

CLO1: To help acquire knowledge of underlying concepts of object-oriented paradigm.
CLO2: To develop an understanding of object-oriented design artifacts and their mapping to object-oriented programming.
CLO3: To improve and Design and implement object-oriented solutions for small systems involving single/multiple objects.

Mapping with Course Learning Outcomes (CLOs) with the Program Learning Outcomes (PLOs):

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√	√	√		√				
CLO2	√		√	√	√			√	√
CLO3	√			√	√	√	√		√

Mapping with Course Learning Outcomes (CLOs) with Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Books	Tutorial, Assignment, Quiz
CLO2	Lecture, Example Code	Mid Exam, Assignment
CLO3	Multimedia Lecture, Handouts	Presentation, Project Work

Course Code: EEE 1203 **Course Title:** Electrical & Electronics Circuits **Credits:** 3.00

Rationale of the Course:
The course discusses basic concepts in electronics and electrical circuits by which students can understand the working principle of electronic devices.

Course Content:
Instrumentation: Avometer, signal generator, oscilloscope, pH-meter, spectrophotometers, thermostats.
Networks Analysis: Kirchhoff's laws, Wheatstone bridge, Superposition theorem, Millman's theorem, Reciprocity theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Mesh and Node circuit analysis, Reduction of complicated networks, T and p-section network.
Filters: Properties of symmetrical networks, Characteristics impedance, Filter fundamentals, Different types of filters, high pass, low pass, band pass and band elimination filter, Active Filters.
Semiconductor Diodes: Semiconductor, n-and p-type semiconductors, p-n junction as a diode and their V-I characteristics, Zener diode, half-and full wave rectifiers, voltage regulation using Zener diodes.
Transistor: Transistor action, transistor biasing, DC characteristics of CE, CB and CC configurations.
Transistor Amplifiers and Oscillators: CE, CB and CC amplifiers, current, voltage and power gains, frequency responses, principles of feedback, positive and negative feedback, oscillators and masturbators, a stable and monostable multivibrator.
Amplifiers: Voltage and current amplifiers. Operational amplifiers. Off-set null adjustments. Differential input and output impedance, frequency response and noise.
Oscillators: Hartley, Colpitts & Wine-Bridge oscillators. Introduction to JFET, MOSFET, PMOS, NMOS, AND CMOS. Biasing and application in switching circuits.
Optoelectronic Devices: PN photodiode, Phototransistor, Solar cell, Photoconductive cell, Photovoltaic, Sensors, LED, LCD, Alphanumeric display, Photo couplers, Photodiode, LDR.

Course Learning Outcomes (CLOs):

CLO1: To develop and employ circuit models for elementary electronic components, e.g., resistors, sources, inductors, capacitors, diodes and transistors.
CLO2: To explain how operational amplifiers are modeled and analyzed, and to design Op-Amp circuits to perform operations such as integration, differentiation and filtering on electronic signals.
CLO3: To introduce the concepts of both positive and negative feedback in electronic circuits.
CLO4: To evaluate how negative feedback is used to stabilize the gain of an Op-Amp-based amplifier and how positive feedback can be used to design an oscillator.

Mapping Course Learning Outcome (CLOs) with the PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√		√			√			
CLO2				√					√
CLO3	√	√			√				
CLO4						√	√		

Mapping Course Learning Outcome (CLOs) with the Teaching-Learning Strategy & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Practical Experiment, Slide Presentations, Books	Tutorial Exam & Assignment
CLO2	Slide Presentations, Project Compilation	Midterm Examination & Project
CLO3	Lecture, Project Experiment	Case Analysis & Assignment
CLO4	Handouts and Slide Presentation	Group Project & Presentation

Course Code: EEE 1204L **Course Title:** Electrical & Electronics Circuits Lab **Credits:** 2.00

Rationale of the Course:
The course discusses basic concepts in electronics and electrical circuits by which students can understand the working principle of electronic devices.

Course Content:
Instrumentation: Avometer, signal generator, oscilloscope, pH-meter, spectrophotometers, thermostats.
Networks Analysis: Kirchhoff's laws, Wheatstone bridge, Superposition theorem, Millman's theorem, Reciprocity theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Mesh and Node circuit analysis, Reduction of complicated networks, T and p-section network.
Filters: Properties of symmetrical networks, Characteristics impedance, Filter fundamentals, Different types of filters, high pass, low pass, band pass and band elimination filter, Active Filters.
Semiconductor Diodes: Semiconductor, n-and p-type semiconductors, p-n junction as a diode and their V-I characteristics, Zener diode, half-and full wave rectifiers, voltage regulation using Zener diodes.
Transistor: Transistor action, transistor biasing, DC characteristics of CE, CB and CC configurations.
Transistor Amplifiers and Oscillators: CE, CB and CC amplifiers, current, voltage and power gains, frequency responses, principles of feedback, positive and negative feedback, oscillators and masturbators, a stable and monostable multivibrator.
Amplifiers: Voltage and current amplifiers. Operational amplifiers. Off-set null adjustments. Differential input and output impedance, frequency response and noise.
Oscillators: Hartley, Colpitts & Wine-Bridge oscillators. Introduction to JFET, MOSFET, PMOS, NMOS, AND CMOS. Biasing and application in switching circuits.
Optoelectronic Devices: PN photodiode, Phototransistor, Solar cell, Photoconductive cell, Photovoltaic, Sensors, LED, LCD, Alphanumeric display, Photo couplers, Photodiode, LDR.

Course Learning Outcomes (CLOs):

CLO1: To develop and employ circuit models for elementary electronic components, e.g., resistors, sources, inductors, capacitors, diodes and transistors.
CLO2: To explain how operational amplifiers are modeled and analyzed, and to design Op-Amp circuits to perform operations such as integration, differentiation and filtering on electronic signals.
CLO3: To introduce the concepts of both positive and negative feedback in electronic circuits.
CLO4: To evaluate how negative feedback is used to stabilize the gain of an Op-Amp-based amplifier and how positive feedback can be used to design an oscillator.

Mapping Course Learning Outcome (CLOs) with the PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√		√			√			
CLO2				√					√
CLO3	√	√			√				
CLO4						√	√		

Mapping Course Learning Outcome (CLOs) with the Teaching-Learning Strategy & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Practical experiments, Slide presentation	Tutorial exam, Group Discussion, Lab report
CLO2	Slide presentation and Lecture	Tutorial Exam, Case Study, Lab Report
CLO3	Presentation and Practical Experiments	Tutorial Examination, Group Discussion, Presentation & Lab report
CLO4	Handouts and Slide Presentation	Group Discussion & Lab report

Course Code: CSE 1205L **Course Title:** Engineering Drawing and CAD Lab **Credits:** 2.00

Rationale of the Course:
The intended course is designed to provide the idea of basic engineering drawing techniques and modeling with computer system.

Course Content:
Introduction of Engineering Drawings, Instrument and their use, drawing of geometrical figures, Scale drawing, Orthographic drawing, Isometric and oblique projections, Drawing of block diagram and circuit diagram, Project on Engineering Drawing and CAD using Auto CAD Software and Concept of 3D printing.

Course Learning Outcomes (CLOs):

CLO1: To develop an understanding of the basic concepts of engineering drawing to communicate engineering ideas.

CLO2: To improve the ability to communicate all needed information to the stakeholders throw modeling.

CLO3: To design and model complex structures of a system.

Mapping Course Learning Outcome (CLOs) with PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√	√				√			
CLO2			√			√	√		√
CLO3		√	√	√	√			√	

Mapping Course Learning Outcome (CLOs) with the Teaching-Learning Strategy and Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Slide Presentations, Handouts	Paper Drawing & Assignment
CLO2	Presentations, Handouts, Practical Experiment with AutoCAD	AutoCAD Drawing Assignment & Oral Presentation

CLO3	Slide Presentations, Handouts, Practical Experiment with AutoCAD	Project & Assignment

Course Code: STA 1206 **Course Title:** Statistics & Probability **Credits:** 3.00

Rationale of the Course:
To introduce some statistical concepts associated with producing, presenting and interpreting data, to develop skills in critical analysis and synthesis of statistical information, to provide the opportunity to demonstrate your statistical literacy skills.

Course Content:
Introduction: Definition, Types, Types of Variables, Importance, and Limitation.
Graphical and Diagrammatical Presentation: Graphs and Diagrams.
Measures of Central Tendency: Arithmetic Mean, Geometric Mean, Harmonic Mean, Median.
Measures of Dispersion: Range, Mean Deviation, Standard Deviation, Coefficient of Variation.
Shape Characteristics of Distribution: Moments, Skewness, Kurtosis.
Probability: Concepts of Probability, Random Variable, Moments of Random Variable, Permutation, Combination.
Probability Distribution: Binomial Distribution, Poisson Distribution, Uniform, Normal Distribution.

Course Learning Outcomes (CLOs):
CLO1: To recognize and differentiate between key termssampling and Data and apply various types of sampling methods to data collection. Create and interpret frequency tables.
CLO2: To understand of basic probability axioms and rules and the moments of discrete and continuous random variables as well as be familiar with common named discrete and continuous random variables.
CLO3: To identify, describe, and calculate the measures of location of data: quartiles and percentiles, mean, median, and mode, variance, standard deviation, and range.
CLO4: To understand and use the terminology of probability. Determine whether two events are mutually exclusive and whether two events are independent. Calculate probabilities using the Addition Rules and Multiplication Rules.

Mapping with Course Learning Outcomes (CLOs) with the Program Learning Outcomes (PLOs):

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√	√		√					
CLO2	√	√	√		√			√	
CLO3	√		√		√	√			√
CLO4	√		√		√		√		√

Mapping with Course Learning Outcomes (CLOs) with Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Handouts, Presentation	Tutorial, Assignment
CLO2	Presentation, Handouts	Case Study, Quiz
CLO3	Slide Presentation and Lecture	Mid exam, Assignment
CLO4	Lecture, Handouts	Group Discussion, Assignment

Course Code: MAT 1207 **Course Title:** Mathematics-II (Co-ordinate Geometry & Vector Analysis) **Credits:** 2.00

Rationale of the Course:
The following course is designed as a building block for students who have a desire to establish their career in mathematics and engineering.The goals of this course are to provide students with the basic knowledge for higher studies.

Course Content:
Co-ordinate Geometry: Change of axes, Pair of straight lines, Circles, System of Circles, Parabola, ellipse and hyperbola. **Solid Geometry:** Direction cosines and ratios, Planes and Straight lines **Vector Analysis**: Scalars and vectors, Vector addition and subtraction, scalar and vector products, Vectors differentiation and integration, Gradient, divergence and curl of a vector.

Course Learning Outcomes (CLOs):
CLO1: To gather the ability to simplify equation in different coordinate system.
CLO2: To identify a point, diameter, radius and chord from a diagram.
CLO3: To apply definitions and concepts to complete five interactive exercises.
CLO4: To distinguish between different kinds of fields in mathematical physics: scalar field, vector field and tensor field, able to apply vector algebra.

Mapping Course Learning Outcome(CLOs) with the PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√		√	√					
CLO2			√	√				√	
CLO3			√			√	√		
CLO4		√		√			√		√

Mapping Course Learning Outcome(CLOs) with the Teaching-Learning Strategy & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Books, Lecture, Handouts	Quiz test, Assignment
CLO2	Lecture, Handouts, Books	Homework, Tutorial examination
CLO3	Handouts, Lecture,	Tutorial Examination, Assignment
CLO4	Presentations, Handouts	Tutorial & Assignment

Course Code: ENG 1208 **Course Title:** English Writing Skills and Communications
Credits: 2.00

Rationale of the Course:
English writing, reading, speaking and listening are the irrevocable needs for the students of almost any discipline including C.S.E. in the modern globalized context to deal with the various aspects of the respective discipline. The course will also help the students in their further scholarly and professional world.

Course Content:
Communicative grammar: Voice, Degree of comparison**,** Wh-question**,** Linking device, Relative clauses**,** Conditional sentences**Reading skill:** Reading scientific English, short stories, English poems**,** Understanding meanings of words and sentences**,** Understanding text-organization**,** Understanding figure of speech**,** Comprehending the meaning of the whole text**,**

Comprehending the gist or summary of the text **Writing skill**: Paragraph, Letter, Report, Précis **Speaking and Listening skill**: Functions of body in English language learning, Functions of mind in English language learning, Helpful methods/ techniques (i.e. TPR) Listening to interesting audio lessons, Presentation, conversation, role play, read out, regular response (speaking), Taking interview, Debating.

Course Learning Outcomes (CLOs):

CLO1: To explain grammatical structures in short conversations and discussions.
CLO2: To self-correct when using targeted grammatical structures.
CLO3: To demonstrate research skills, integrate your own ideas with those of others.
CLO4: To use Standard Written English and revise and edit their own writing for appropriateness.

Mapping Course Learning Outcome(CLOs) with the PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√	√		√				√	
CLO2			√	√		√		√	
CLO3			√				√		√
CLO4		√		√			√		√

Mapping Course Learning Outcome(CLOs) with the Teaching-Learning Strategy & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Books	Tutorial examination & Assignment
CLO2	Handouts, Lecture	Tutorial examination & Assignment
CLO3	Multimedia Lecture, Case Study	Presentation & Case Analysis
CLO4	Lecture, Handouts	Tutorial examination & Assignment

Year – 2, Semester – 3

Course Code: CSE 2301 **Course Title:** Data Structures **Credits:** 3.00

Rationale of the Course:

Data structure provides the right way to organize information in the digital space which is a key component of Computer Science and is largely used in the areas of Artificial Intelligence, operating systems, graphics, etc.

Course Content:

Data Structures types and Operations, Algorithms: Complexity, Time space trade-off.
Data Structures: Arrays, Lists, Pointers, Structures, Iterations, Stacks, Queue, Recursion-Recursive Functions, Example: Factorial, Fibonacci.
Searching: Sequential Searches, Linear Search, Binary Search, Trees
Linked List: Traversing, Inserting, Deleting, Searching, Memory Allocation; Garbage Collection, Header Linked List, Two-way List
Tree: Binary Tree, Binary Search Tree, Complete Binary Tree, Heap, Huffman's algorithm, General Tree. Queues: Priority Queues, Heaps
Sorting: Bubble, Heap, Insertion, Selection, Quick, Radix, Merge
Searching Revisited: Red-Black trees, AVL trees, General trees, Hash Tables
Graphs: Minimum Spanning Tree, Dijkstra's Algorithm, Depth first and breadth first search, Huffman Encoding.

Course Learning Outcomes (CLOs):

CLO1: To develop an understanding of program data structures and use them in implementations of fundamental abstract data types.
CLO2: To design and implement novel solutions to small scale programming challenges.
CLO3: To estimate the algorithmic complexity of simple, non-recursive programs.
CLO4: To help make able to sensibly select appropriate data structures and algorithms for problems and to justify that choice.

Mapping Course Learning Outcome(CLOs) with the PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√		√	√					
CLO2			√	√				√	
CLO3			√			√	√		√
CLO4		√		√			√		√

Mapping Course Learning Outcome(CLOs) with the Teaching-Learning Strategy & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	PowerPoint Presentation, Lecture, Handouts	Quiz, Tutorial, Group Discussion & Assignment
CLO2	Lecture, Handouts	Tutorial Examination, Case Study, Quiz, & Assignment
CLO3	Handouts, Lecture, PowerPoint Presentation	Midterm Examination, Case Analysis & Assignment
CLO4	Lecture, Handouts	Group Discussion, Case Study & Assignment

Course Code: CSE 2302L **Course Title:** Data Structures Lab **Credits:** 2.00

Rationale of the Course:

Data structures Lab is important for students who will be able to explain implementation and operations of basic data structures: Linked list, stack, queue, tree and graph.

Course Content:

Analyzing the sorting algorithm: Bubble Sort, Insertion sort, Radix sort. Divide and conquer algorithm; Merge sort, Heap sort.Implementing stack and queue. Implementation of Searching algorithm: Linear search, Binary search. Quicksort: implementation of quicksort, Performance of quicksort. Linked List: Insertion, Deletion and searching in a linked list. Tree: Making binary tree and binary search tree.

Course Learning Outcomes (CLOs):

CLO1: To develop an understanding of program data structures and use them in implementations of fundamental abstract data types.
CLO2: To design and implement novel solutions to small scale programming challenges.
CLO3: To estimate the algorithmic complexity of simple, non-recursive programs.
CLO4: To help make able to sensibly select appropriate data structures and algorithms for problems and to justify that choice.

Mapping Course Learning Outcome(CLOs) with the PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√		√	√					
CLO2			√	√				√	
CLO3			√			√	√		√
CLO4		√		√			√		√

Mapping Course Learning Outcome(CLOs) with the Teaching-Learning Strategy & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Slide Presentation and Practical experiments	Tutorial Examination, Group Discussion & Lab report
CLO2	Lecture and Practical experiments	Midterm Exam, Case Study & Lab report
CLO3	Practical Experiments and Handouts	Lab report &Tutorial Examination
CLO4	Presentation and Practical Experiments	Tutorial exam, Case Analysis & Lab Report

Course Code: CSE 2303 **Course Title:** Digital Logic & System Design **Credits:** 3.00

Rationale of the Course:
The desired course is planned as a building block for students who have an aim to introduce their occupation as a Digital logic and system designer.

Course Content:
Boolean algebra: Basic theorems and properties, Boolean functions and their simplification. Digital logic gates.
Combinational logic: Adder, Sub-tractor, Multiplexer and De-multiplexer, Encoder and Decoder, Comparator.
Synchronous Sequential Logic: Flip-flops, Analysis and design of sequential circuits.
Processor logic Design: Processor organization; Arithmetic Logic Unit; Design of Logic Circuit; Design of ALU;
Control Logic Design: Control organization; Control of Processor unit; PLA control;
Memory devices: Memory Basics; RAM characteristics; Bipolar RAM; MOS static & MOS Dynamic RAM; ROM; EPROM; EEPROM; Flash memory.
Computer Design: System configuration; Computer instructions; Timing and control; Execution of instruction; design of computer registers; design of control; Computer console.
Microcomputer System Design: Microcomputer & microprocessor organization; Instruction & addressing mode; Stack, Subroutines & interrupts; memory organization; Direct memory address; microprocessor-based design.

Course Learning Outcomes (CLOs):
CLO1: To identify and explain fundamental concepts of digital logic design including basic and universal gates, number systems, binary coded systems, basic components of combinational and sequential circuits.
CLO2: To demonstrate the acquired knowledge to apply techniques related to the design and analysis of digital electronic circuits including Boolean algebra and multi-variable Karnaugh map methods.
CLO3: To analyze small-scale combinational and sequential digital circuits.
CLO4: To design and develop a small-scale combinational and synchronous sequential digital circuit using Boolean algebra and K-maps.

Mapping with Course Learning Outcomes (CLOs) with the Program Learning Outcomes (PLOs):

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√	√		√					
CLO2	√		√		√	√	√	√	√
CLO3	√		√	√		√	√		√
CLO4		√	√		√	√			√

Mapping with Course Learning Outcomes (CLOs) with Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Handouts, Presentation	Tutorial, Assignment, Mid Exam, Quiz
CLO2	Books, Slide Presentation	Group Discussion, Tutorial, Assignment
CLO3	Handouts, Lecture	Mid Exam, Tutorial, Assignment
CLO4	Lecture, Handouts, Presentation	Group Discussion, Tutorial, Assignment

Course Code: CSE 2304L **Course Title:** Digital Logic & System Design Lab **Credits:** 2.00

Rationale of the Course:
The desired course is planned as a building block for students who have an aim to introduce their occupation as a Digital logic and system designer.

Course Content:
Study of Logic Gates, Adders and Sub-tractors, Code Converters, Parity generator and checker, Decoders and Encoders, Multiplexers and De-Multiplexers, Study of Flip-Flops, Shift Registers, Counters, Implementation of Combinational Logic functions using standard ICs**,** Implementation of Registers and Counters using standard ICs

Course Learning Outcomes (CLOs):

CLO1: To acquire knowledge related to the concepts, tools and techniques for the design of digital electronic circuits.

CLO2: To demonstrate the skills to design and analyze both combinational and sequential circuits using a variety of techniques

CLO3: To apply the acquired knowledge to simulate and implement small-scale digital circuits

CLO4: To understand the relationship between abstract logic characterizations and practical electrical implementations.

CLO5: To work towards problem solving through logical reasoning both in individual capacity and collectively.

Mapping with Course Learning Outcomes (CLOs) with the Program Learning Outcomes (PLOs):

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1		√		√				√	
CLO2	√		√		√	√	√		√
CLO3			√	√				√	√
CLO4	√		√	√		√			
CLO5		√	√		√	√			√

Mapping with Course Learning Outcomes (CLOs) with Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Handouts	Lab Report, Assignment
CLO2	Presentation, Practical Experiment	Practical Exam, Lab Report
CLO3	Practical Class, Presentation	Project Presentation, Practical Exam
CLO4	Handouts and Practical Class	Case Study, Practical Exam
CLO5	Experiment, Presentation	Lab Project, Case Analysis

Course Code: CSE 2305 **Course Title:** Algorithm **Credits:** 3.00

Rationale of the Course:
The desired course is planned as a building block for students who have an aim to introduce their occupation as a programmer, system analyst and software developer.

Course Content:
The role of algorithm in computing: what is algorithm? Algorithm as a technology, Analyzing algorithm; Designing algorithm: Growth of functions, Asymptotic notation, Standard notation and common function; Divide and conquer approach, What is divide and conquer approach?Analyzing the divide and conquer algorithm; Heap sort, Heaps, Maintaining the heap property, Building a heap, the heap sort algorithm; Quicksort: Description of quicksort, Performance of quicksort, Analysis of quicksort; Dynamic Programming: What is dynamic programming? How it works? Elements of dynamic programming, Example Analysis (Rod cutting problem, Matrix chain multiplication, Longest Common Subsequence); Greedy Algorithm: How greedy algorithm differs from dynamic programming? Elements of the greedy strategy, Huffman code, Elementary Graph Algorithm: Representation of graphs, BFS algorithm, DFS algorithm, Prim's & Kruskal's algorithm

Course Learning Outcomes (CLOs):
CLO1: To apply design principles andconcepts to algorithm design.
CLO2: To gather the mathematical foundation in analysis of algorithms.
CLO3: To develop the understanding of different algorithmic design strategies.
CLO4: To analyze the efficiency of algorithms using time and space complexity theory.

Mapping Course Learning Outcome(CLOs) with the PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√		√	√					
CLO2			√	√				√	√
CLO3			√			√	√		
CLO4		√		√			√		

Mapping Course Learning Outcome(CLOs) with the Teaching-Learning Strategy & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Handouts, Presentation	Tutorial examination & Quiz
CLO2	Presentation, Lecture, Handouts	Case Analysis & Assignment
CLO3	Presentation, Handouts	Mid-term, Presentation & Assignment
CLO4	Lecture, Presentation	Tutorial examination & Assignment

Course Code: CSE 2306L **Course Title:** Algorithm Lab **Credits:** 2.00

Rationale of the Course:
The desired course is planned as a building block for students who have an aim to introduce their occupation as a programmer, system analyst and software developer.

Course Content:
Analyzing the divide and conquer algorithm; Heap sort, Heaps, Maintaining the heap property, Building a heap, The heap sort algorithm; Quicksort: Description of quicksort, Performance of quicksort, Analysis of quicksort; Dynamic Programming: How it works Example Analysis (Rod cutting problem, Matrix chain multiplication, Longest Common Subsequence); Greedy Algorithm: Huffman code, BFS algorithm, DFS algorithm, Prim's & Kruskal's algorithm

Course Learning Outcomes (CLOs):
CLO1: To apply design principles andconcepts of algorithm design.
CLO2: To gather the mathematical foundation in analysis of algorithms.
CLO3: To develop the understanding of different algorithmic design strategies.
CLO4: To analyze the efficiency of algorithms using time and space complexity theory.

Mapping Course Learning Outcome(CLOs) with the PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√		√	√					
CLO2			√	√				√	
CLO3			√			√	√		√
CLO4		√		√			√		

Mapping Course Learning Outcome(CLOs) with the Teaching-Learning Strategy & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Slide Presentation and Practical experiments	Quiz & Assignment
CLO2	Lecture and Practical experiments	Tutorial examination & Presentation
CLO3	Slide presentation and Handouts	Tutorial examination & Quiz
CLO4	Practical Experiments and Slide Presentation	Case Analysis & Assignment

Course Code: MAT 2307 **Course Title:** Math-III (Differential Equation & Special Function)
Credits: 2.00

Rationale of the Course:
The intended course is designed as a building block for students who have a desire to establish their career in Engineering.

Course Contents:
Differential Equations: Degree and order of ordinary differential equations. Formulation of differential equations. Solution of first order differential equations by various methods. Solution of general linear differential equations of second and higher orders with constant coefficients. Solution of homogeneous linear equations. Solution of differential equations by operator methods. Concept of partial differential equations.

Laplace Transform: Definition. Laplace transforms of some elementary functions. Inverse Laplace transformations. The unit step function. Periodic function. Evaluation of improper integrals.
Fourier Analysis: Fourier series, Fourier integral, Fourier transforms.
Special Function: Gamma and Beta functions, Bessel functions, Orthogonal functions, Legendre.

Course Learning Outcomes (CLOs):

CLO1: To develop an understanding of degree and order of ordinary differential equations
CLO2: To gather knowledge about General linear differential and homogeneous linear equations
CLO3: To analyze Differential equations by operator methods and Partial differential equations
CLO4: To evaluate Special Functions

Mapping Course Learning Outcome (CLOs) with PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√	√		√					
CLO2	√		√	√	√		√		√
CLO3	√		√	√			√		√
CLO4	√		√	√			√	√	

Mapping Course Learning Outcome (CLOs) with the Teaching-Learning Strategy and Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Handouts, Presentation	Class test & Quiz
CLO2	Handouts, Lecture	Tutorial Examination & Assignment
CLO3	Slide Presentation, Handouts	Case Study & Assignment
CLO4	Presentation, Lecture, Handouts,	Tutorial & Assignment

Course Code: ECO 2308 **Course Title:** Industrial Economics **Credits:** 2.00

Rationale of the Course:
To introduce some economical concepts associated with producing, presenting and interpreting of graph and mathematical term, to develop skills of economical information.

Course Contents:
The Fundamental of economics: Definition of economics, Basics of economics, Government in a modern economy.
Microeconomics: Basic elements of supply and demand, Choice and utility, indifference curve technique, market, farm.
Production and Business Organization: Analysis of cost, Short run long run theory of production, factors of production.
Macroeconomics: Key concept of macroeconomics, Saving, consumption, investment, National income analysis, Inflation, Unemployment, Money.
Development: Theories of developments, Banking system of Bangladesh, National Budget.
The Fundamental of economics: Definition of economics, Basics of economics, Government in a modern economy.

Course Learning Outcomes (CLOs):

CLO1: To develop an understanding of the fundamentals of economics.
CLO2: To analyze microeconomics and macro-economics.
CLO3: To improve understanding of business, production and development.

Mapping Course Learning Outcome (CLOs) with PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1		√	√					√	
CLO2		√	√		√				√
CLO3				√	√	√		√	

Mapping Course Learning Outcome (CLOs) with the Teaching-Learning Strategy and Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Handouts, Presentation	Tutorial Examination & Assignment
CLO2	Presentation, Handouts	Case Study & Assignment
CLO3	Lecture, Handouts	Presentation, Case Analysis & Assignment

Year – 2, Semester – 4

Course Code: CSE 2401 **Course Title:** Database Management Systems **Credits** 3.00

Rationale of the Course:

The desired course is planned as a building block for students who have an aim to introduce their occupation as a database system analyst or database administrative.

Course Content:

Basic concepts of data and database systems. Data models. Query languages: Relational algebra and calculus, SQL; Query processing, interpretation, cost estimation, optimization; Functional dependency and normalization; File organization; Data Dictionary and directory systems; Database management: Database administration, security and integrity; Introduction to distributed database.

Course Learning Outcomes (CLOs):

CLO1: To gather knowledge about basic database management system and compare with previous systems of database.
CLO2: To develop an understanding of data models, distributed database system.
CLO3: To develop an understanding of Query languages, SQL and Relational algebra.
CLO4: To analyze Database administration, security and integrity.

Mapping Course Learning Outcome (CLOs) with PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√				√		√		
CLO2	√		√	√		√		√	
CLO3			√	√		√			
CLO4		√			√			√	√

Mapping Course Learning Outcome (CLOs) with the Teaching-Learning Strategy and Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Group Discussion	Assignment
CLO2	Slide Presentation	Tutorial examination & Quiz
CLO3	Group Discussion with Practical Experiment	Mid-Term examination
CLO4	Lecture, Practical Experiment	Project Assignment

Course Code: CSE 2402L **Course Title:** Database Management Systems Lab **Credits** 2.00

Rationale of the Course:
The desired course is planned as a building block for students who have an aim to introduce their occupation as a database system analyst or database administrative.

Course Content:
Basic concepts of data and database systems. Data models. Query languages: Relational algebra and calculus, SQL; Query processing, interpretation, cost estimation, optimization; Functional dependency and normalization; File organization; Data Dictionary and directory systems; Database management: Database administration, security and integrity; Introduction to distributed database.

Course Learning Outcomes (CLOs):
CLO1: To gather knowledge about basic database management system and compare with previous systems of database.
CLO2: To develop an understanding of data models, distributed database system.
CLO3: To develop an understanding of Query languages, SQL and Relational algebra.
CLO4: To analyze Database administration, security and integrity.

Mapping Course Learning Outcome (CLOs) with PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√				√		√		
CLO2	√		√	√		√		√	
CLO3			√	√		√			
CLO4		√			√			√	√

Mapping Course Learning Outcome (CLOs) with the Teaching-Learning Strategy and Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Practical Experiment	Tutorial Examination
CLO2	Slide Presentation, Practical Experiment	Project Assignment
CLO3	Practical Experiment	Mid-Term Examination
CLO4	Lecture, Practical Experiment	Group Discussion, Tutorial Examination

Course Code: CSE 2403 **Course Title:** Microprocessors & Microcontrollers **Credits:** 3.00

Rationale of the Course:
This course will focus on microprocessors and microcontrollers for knowing primitive microprocessor architecture, instruction set, features of some advanced microprocessors, Interrupts, microcontroller architecture, etc.

Course Content:
Introduction to Microprocessor and Microcontroller; Architectural overview of Microprocessor and its operation; Common instruction types; **Intel8086 Microprocessor:** Internal architecture, register structure, programming model, addressing modes, shift and rotate instructions, instruction set, I/O Pin diagram and Control signals; Cache Memory; Distinguishing features of Intel 80186, 80386, 80486, and Pentium; Linear to physical address translation; Interrupts and Exception in Intel 80X86 families, types of Interrupts, Interrupts in real mode and protected mode, Interrupt descriptor tables, Interrupts priorities; **Microcontrollers:** Architecture of 8051 microcontroller, pin diagram of 8051 microcontroller, register set and memory of the microcontroller.

Course Learning Outcomes (CLOs):

CLO1: To develop an understanding of the basic components and classifications of microprocessors.

CLO2: To gather knowledge about the architecture of a microprocessor, instruction set, interrupt structure of microprocessors.

CLO3: To analyze the basic features of some advanced microprocessors and memory interfacing.

CLO4: To improve an understanding of architecture, register set, and memory of 8051 microcontroller

Mapping Course Learning Outcomes (CLOs) with the PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√				√				
CLO2				√		√			
CLO3	√								
CLO4		√							√

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Presentation, Lecture, Handouts	Tutorial Examination & Assignment
CLO2	Lecture, Handouts, Presentation	Case Study & Quiz
CLO3	Lecture, Handouts	Mid examination & Case Analysis
CLO4	Presentation, Handouts	Tutorial Examination & Assignment

Course Code: CSE 2404 **Course Title:** Microcontrollers and Assembly Language Lab
Credits: 2.00

Rationale of the Course:
This course is based on several laboratory exercises utilizing the assembly language program. The desired course is planned for the students who have the desired goal to introduce their occupation as programmers and system analysts.

Course Content:
Intel8086 Microprocessor: Internal architecture, register structure, programming model, addressing modes, shift and rotate instructions, instruction set, I/O Pin diagram and Control signals; Cache Memory; Distinguishing features of Intel 80186, 80386, 80486, and Pentium; Linear to physical address translation; Interrupts and Exception in Intel 80X86 families, types of Interrupts, Interrupts in real mode and protected mode, Interrupt descriptor tables, Interrupts

priorities; **Microcontrollers:** Architecture of 8051 microcontroller, pin diagram of 8051 microcontroller, register set and memory of the microcontroller.

Course Learning Outcomes (CLOs):

CLO1: To develop an understanding of the basic components and classifications of microprocessors.

CLO2: To gather knowledge about the architecture of a microprocessor, instruction set, interrupt structure of microprocessors.

CLO3: To analyze the basic features of some advanced microprocessors and memory interfacing.

CLO4: To improve an understanding of architecture, register set, and memory of 8051 microcontroller

Mapping Course Learning Outcomes (CLOs) with the PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√				√				
CLO2				√		√			
CLO3	√								
CLO4		√							√

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Handouts & Utilizing simulation-based software	Tutorial & Assignment
CLO2	Slide Presentation & Utilizing simulation-based software	Group Discussion & Quiz
CLO3	Lecture & Utilizing simulation-based software	Mid exam & Case Analysis
CLO4	Handouts & Utilizing simulation-based software	Tutorial exam, Assignment

Course Code: CSE 2405L **Course Title:** Java Programming Language Lab **Credits:** 2.00

Rationale of the Course:

The desired course is planned as a building block for students who have an aim to introduce their occupation as a Software Developer (Java).

Course Content:

Object Oriented Programming Concepts and features, Java as OOP language, Comparison between Java and C++ as OOP, Typical Java Development Environment. Java's Primitive Data Types, Operator (arithmetic and logical) and Control Structures. Java Classes, Objects, Methods and instance variables, Program Modules in Java, static Methods, static Fields, Methods with Multiple Parameters, Java API Packages. Arrays, Enhanced for Statement, Passing Arrays to Methods, Variable-Length Argument Lists, Using Command-Line Arguments. Encapsulation and data hiding, the notions of data abstraction and abstract data types (ADTs), use of static variables and methods, Inheritance, Polymorphism, Packages. Exception and error handling. To create, read, write and update files, to retrieve information about files and directories, Java input/output stream class hierarchy, differences between text files and binary files, Sequential-access and random-access file processing. The design principles of graphical user interfaces (GUIs), Understanding and implementing Java networking applications with sockets and datagrams, to understand how to implement Java clients and servers that communicate with one another, to understand how to implement network-based collaborative applications.

Course Learning Outcomes (CLOs):

CLO1: To develop the understanding of introductory concepts of object-oriented programming and Java run-time environment.
CLO2: To gather the basic concept of network programming and use of database in Java.
CLO3: To design, model and develop Java standalone programs.
CLO4: To analyze, evaluate and deploy Java Applications.

Mapping Course Learning Outcome (CLOs) with PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√		√				√		
CLO2	√	√			√	√	√		
CLO3				√		√	√	√	√
CLO4		√	√					√	√

Mapping Course Learning Outcome (CLOs) with the Teaching-Learning Strategy and Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Slide Presentations, Lab Implementation	Lab Tutorial & Assignment
CLO2	Lab Implementation and Slide Presentations	Case Analysis & Assignment
CLO3	Presentations and Handouts	Group Discussion and Quiz
CLO4	Lecture and Slide Presentations	Group Assignment

Course Code: MAT 2406 **Course Title:** Numerical Methods **Credits:** 2.00

Rationale of the Course:

Numerical analysis is the study of algorithms that use numerical approximation for the problems of analysis. Numerical analysis continues this long tradition of practical mathematical calculations. The modern numerical analysis does not seek exact answers, because exact answers are often impossible to obtain in practice. Instead, much of numerical analysis is concerned with obtaining approximate solutions while maintaining reasonable bounds on errors.

Course Content:

Introduction: Numerical Computing, Errors in Computation, Stability and convergence. **Roots of Nonlinear Equations:** Bisection, False position and Newton-Raphson method. **Solution linear equations:**Gaussian Elimination, Gauss-Jordan Method, Jacobi's and Gauss-Seidel Method. **Regression:** Linear and exponential. **Interpolation:** Lagrange and Newton Polynomials. **Numerical Differentiation and Integration:** Trapezoidal and Simpson. **Numerical Solution of ordinary Differential Equation:** Taylor series, Picard, Runge-Kutta, Euler's method.

Course Learning Outcomes (CLOs):

CLO1: To develop an understanding of the basic concepts of numerical analysis and errors
CLO2: To derive appropriate numerical methods to solve algebraic and transcendental equations
CLO3: To solve linear equations, differentiation, and Integration with knowledge of numerical methods
CLO4: To gather conception of the interpolation and derived different types of interpolation formula

Mapping Course Learning Outcomes (CLOs) with the PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1			√						√
CLO2						√			
CLO3	√								
CLO4	√	√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Presentation, Lecture, Handouts	Tutorial Examination & Assignment
CLO2	Lecture, Handouts, Presentation	Mid examination & Case Study
CLO3	Slide Presentation, Lecture	Home Task & Assignment
CLO4	Presentation, Handouts	Tutorial Examination & Assignment

Course Code: MAT 2407 **Course Title:** Math-IV (Matrix & Complex Analysis) **Credits:** 2.00

Rationale of the Course:
The intended course is designed as a building block for students who have a desire to their career in Computer science and engineering.

Course Content:
Matrix*:* Concepts of Matrices, Different types of matrices. Transpose, Adjoin and Inverse of a matrix, Determinants, Cramer's Rule, Solution of linear equations. The characteristics roots and the characteristic equation of a matrix, Determination of Eigen values and Eigen vectors of a square matrix, Caley Hamilton theorem.
Complex Variables: Complex number system. Complex function, Analytic function, Cauchy Riemann equations, Cauchy's Integral theorem, Cauchy's Integral formula, Mapping and conformal mapping of elementary functions, Poles and singularities.

Course Learning Outcomes (CLOs):
CLO1: To develop an Understanding of the basic knowledge about different types of matrices.
CLO2: To develop an Understanding of the basic concept of complex number, plane and function, limit and continuity.
CLO3: To develop an Understanding of different types of functions, conditions and mapping.
CLO4: To develop an Understanding of complex integration, power series representation, Cauchy's theorem, Singularities.

Mapping Course Learning Outcome (CLOs) with PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√			√		√			
CLO2	√			√		√		√	
CLO3	√			√		√			√
CLO4		√	√						√

Mapping Course Learning Outcome (CLOs) with Teaching-Learning Strategy & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Handouts, Presentation	Tutorial examination & Assignment

CLO2	Handouts, Lecture	Quiz, mid exam & Assignment
CLO3	Presentation, Handouts	Presentation & Assignment
CLO4	Lecture, Presentation	Final exam & Group Discussion

Course Code: BBA 2408 **Course Title:** Financial & Managerial Accounting **Credits: 2.00**

Rationale of the Course:
A significant number of graduates contact with accounting information. Accounting is the language of business. It is the means by which an enterprise's financial situation is reported and communicated. This course, aims to provide students with the skills needed to measure and report that financial situation.

Course Content:

Accounting in Action: What is Accounting, Three Activities of Accounting.

The Building Blocks of Accounting: Ethics in Financial Reporting, Measurement Principles, Assumptions.

The Basic Accounting Equation: Assets, Liabilities, Owner's Equity.

Using the Basic Accounting Equation: Transactions Analysis, Summary of Transactions Analysis, Income Statement, Owner's Equity Statement, Balance Sheet.

The Recording Process: Debits and Credits.

Steps in The Recording Process: The Journal, The Ledger, The Trial Balance, Liquidity Ratios, Profitability Ratios, Solvency ratios, Summary of Ratios, Fixed Cost, Mixed Costs, Variable Cost.

Course Learning Outcomes (CLOs):

CLO1: To develop an understanding of the basics of accounting and the financial statement presentation.
CLO2: To gather knowledge about the basics of the recording process.
CLO3: To analyze the Financial Statement.
CLO4: To improve conception of the basics of the cost terms.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√	√							
CLO2				√					
CLO3	√								√
CLO4								√	

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture & Group Discussion	Tutorial examination & Assignment
CLO2	Slide Presentation	Mid-Term Examination
CLO3	Lecture, Case Study	Quiz-Test
CLO4	Lecture, Handouts	Group Discussion & Assignment

Year – 3, Semester – 5

Course Code: CSE 3501 **Course Title:** Operating System **Credits:** 3.00

Rationale of the Course:
Having a common starting point for operating systems ensures that when system administrators, users, and developers move from one host to another they will know what they can expect.

Course Content:
Introduction: Role of OS: Types of OS, Batch Systems; Multiprogramming; Time Sharing; Distributed & Real time OS. Computer structure and OS: System Architecture – I/O, Storage, Processors; System components- OS Services, System Calls, System Programs; System Design, Implementation and Generation.
Process Management: Concepts of process: Process status, Process description, Process model. Process Scheduling: Concepts, Scheduler organization, preemptive and non- preemptive scheduler strategies, scheduling algorithms: FCFS, SJN, Priority Scheduling, Round Robin Scheduling, Multiple Processor scheduling, Cloud Technology, Thread Concepts and Multiple threaded OS.
Process Synchronization and Deadlock: Process Co-operation, Concepts of Inter-process communication, Process Synchronization, Synchronization Issues, Critical Section problem, Mutual exclusion Primitives and Algorithms, Process Synchronization with semaphores. Concepts of Deadlock, Conditions for Deadlocks, Resource Concepts & Abstractions, Deadlock Prevention, Avoidance and Recovery, Banker Algorithms for Deadlock Avoidance
Memory Management and File system: Paging, Segmentation and Contiguous memory allocation. Virtual Memory: Demand Paging, Page replacement and Frame Allocation policies, Thrashing. File System: Concepts, Access Method, Directory Structure, and File System Management.

Course Learning Outcomes (CLOs):
CLO1: To develop an understanding of the fundamental operating system abstractions such as processes, threads, files, semaphores, IPC abstractions, shared memory regions, etc.
CLO2: To analyze important algorithms e.g., Process scheduling and memory management algorithms.
CLO3: To categorize the operating system's resource management techniques, dead lock management techniques, memory m techniques.
CLO4: To explain the ability to perform OS tasks in Linux Enterprise.

Mapping Course Learning Outcome (CLOs) with the PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√	√						√	
CLO2	√		√			√			√
CLO3	√	√							
CLO4					√	√	√		

Mapping Course Learning Outcome (CLOs) with the Teaching-Learning Strategy & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, PowerPoint Presentation, Handouts	Tutorial Examination, Group Discussion & Assignment

CLO2	Slide Presentation, Handouts	Quiz, Tutorial examination, Case Study & Assignment
CLO3	Handouts, Lecture, PowerPoint Presentation	Tutorial Examination, Case Analysis & Assignment
CLO4	Lecture, Handouts	Group Discussion, Tutorial examination & Assignment

Course Code: CSE 3502L **Course Title:** Operating System Lab **Credits:** 2.00

Rationale of the Course:
The course aims to explore the importance of the operating system, its function and different techniques used by the operating system to achieve its goals as resource manager. The course also explores how application interacts with the operating system and how the operating systems interact with the machine. Also, the course shed light on some of the existing operating systems and how the topics taught in the course are applied in these systems. Some topics in the course are implemented by witting the programs to practically know how.

Course Content:
Operating system (Ubuntu) installation process, file system portioning and dual boot setup, command line interface (shell) and various commands of UNIX, Programs to create and execute shell script, various algorithms for process scheduling, implement various algorithms for page replacement activity in memory management, inter process communication constructs.

Course Learning Outcomes (CLOs):
CLO1: To develop an understanding of Unix commands and shell programming.
CLO2: To build shell program for process and file system management with system calls.
CLO3: To implement and analyse the performance of different algorithm of Operating Systems like CPU scheduling algorithm, page replacement algorithms, deadlock avoidance, and detection algorithm and so on.
CLO4: To access, design and develop a course project.

Mapping Course Learning Outcome (CLOs) with the PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√		√	√		√			
CLO2	√							√	
CLO3	√		√						
CLO4		√		√		√	√		√

Mapping Course Learning Outcome (CLOs) with the Teaching-Learning Strategy & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Slide presentation and Practical experiments	Group Discussion & Lab report
CLO2	Lecture, Practical Experiment	Tutorial Exam, Case Study, Lab Report
CLO3	Handouts and Slide presentation	Mid examination & Lab report
CLO4	Slide presentation and Practical experiments	Tutorial Exam, Case Study, Lab Report

Course Code: CSE 3503 **Course Title:** Computer Graphics & Animation **Credit:** 3.00

Rationale of the Course:
This course gives the students to a comprehensive introduction to the fundamentals of computer graphics programming and to create different animations.

Course Content:
Computer Graphics Overview: Images, Models, Pipeline architecture, C++ Programming, Review C vs. C++, Build processes, Conventions, Modern OpenGL Programming OpenGL pipeline, Libraries, Conventions, Basic shades Linear Algebra Vectors, Matrices, Coordinate systems, Geometry Curves, Surfaces, Implicit vs. Parametric forms, Polygons, Transformations Points vs. Vectors, Homogeneous transformations, Viewing Projections, OpenGL camera control, Shading Lighting models, Surface normal, Phong shading, Texture, Mapping, Mapping methods, Texture coordinates, Buffers and Blending Translucency, Compositing images, Anti-aliasing, Clipping, Cohen-Sutherland, Bounding boxes, Hidden-surface removal, Rasterization Line drawing, Polygon fill, Line scanning, Environment Maps Reflection models, Sphere map, Cube map, Shadow Maps Projective shadows, Depth maps, Shadow test, Parametric Animation Camera motion, Splines, Quaternions, Physics-based Animation Dynamics, Particles, Rigid bodies, Fluid simulation, 3D Displays Visual cues, Stereoscopic displays, Head-coupled rendering.

Course Learning Outcomes (CLOs):

CLO1: To describe the basic graphics pipeline.
CLO2: To display 3D models of simple graphics images.
CLO3: To explain the concept and applications of texture mapping, sampling, and anti-aliasing**.**
CLO4: To implement basic physics-based animation algorithms for particle dynamics using simple Newtonian mechanics with Euler methods.

Mapping Course Learning Outcome(CLOs) with the PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√		√	√					
CLO2			√		√			√	
CLO3			√			√	√		√
CLO4	√			√			√		√

Mapping Course Learning Outcome(CLOs) with the Teaching-Learning Strategy & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Group Discussion	Tutorial Examination & Assignment
CLO2	Slide Presentation, Quiz	Tutorial & Case study
CLO3	Lecture, Handouts	Mid exam & Assignment
CLO4	Lecture	Group discussion & Presentation

Course Code: CSE 3504L **Course Title:** Computer Graphics & Animation Lab **Credits** 2.00

Rationale of the Course:
The desired course is planned as a building block for students who have an aim to introduce their occupation as a pattern designer, programmer and software developer.

Course Content:
Pipeline architecture, C++ Programming, Review C vs. C++, Build processes, Conventions, Modern OpenGL Programming OpenGL pipeline, Libraries, Conventions, Basic shades Linear Algebra Vectors, Matrices, Coordinate systems, Geometry Curves, Surfaces, Implicit vs. Parametric forms, Polygons, Transformations Points vs. Vectors, Homogeneous transformations, Viewing Projections, OpenGL camera control, Shading Lighting models, Surface normal, Phong shading, Texture, Mapping, Mapping methods, Texture coordinates, Buffers and Blending Translucency, Compositing images, Anti-aliasing, Clipping, Cohen-Sutherland, Bounding boxes, Hidden-surface removal, Rasterization Line drawing

Course Learning Outcomes (CLOs):

CLO1: To describe the basic graphics pipeline.
CLO2: To display 3D models of simple graphics images.
CLO3: To explain the concept and applications of texture mapping, sampling, and anti-aliasing**.**
CLO4: To implement basic physics-based animation algorithms for particle dynamics using simple Newtonian mechanics with Euler methods.

Mapping Course Learning Outcome(CLOs) with the PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√		√		√				
CLO2			√	√				√	
CLO3			√		√		√		√
CLO4		√		√			√		√

Mapping Course Learning Outcome(CLOs) with the Teaching-Learning Strategy & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Slide presentation and Practical experiments	Tutorial examination & Assignment
CLO2	Lecture, Practical Experiment	Mid exam & Assignment
CLO3	Handouts and Slide presentation	Tutorial examination & Assignment
CLO4	Slide presentation and Practical experiments	Group discussion & Presentation

Course Code: CSE3505 **Course Title:** Communication Engineering **Credits:** 3.00

Rationale of the Course:
The desired course is planned as a building block for students who have an aim to introduce their occupation as a communication specialist, system analyst, and network specialist.

Course Content:
Introduction: data communications**,** networks, the internet**,** protocols, and standards**; Network Models:** Layered tasks,the OSI model, layers in the OSI model**,** TCP/IP protocol suite**,** addressing**; Data and Signals:** Analog and digital**,** periodic analog signals**,** digital signals**,** transmission impairment**,** data rate limits, channel capacity**; Digital Transmission:** Digital-to-digital conversion**,** analog-to-digital conversion, transmission modes**; Analog Transmission:** Digital-to-analog conversion**,** analog-to-analog conversion**; Bandwidth Utilization:** Multiplexing and spreading**:** multiplexing**,** categories of multiplexing, spread spectrum**; Transmission Media:** Guided media**,** unguided media**; Error Detection and Correction:** Introduction, block coding**,** linear block codes, cyclic codes**,** checksum.

Course Learning Outcomes (CLOs):

CLO1: To gather knowledge about the history of communications, information systems, and the Internet.
CLO2: To develop an understanding the structures and working principles of network models.
CLO3: To improve an understanding of the analog and digital transmissions.
CLO4: To explain the role of the transmission media and error detection and correction techniques.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√				√				
CLO2		√					√		
CLO3		√							√
CLO4	√								

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Handouts	Tutorial Examination & Assignment
CLO2	Lecture, Slide presentation and Handouts	Case Analysis & Assignment
CLO3	Slide Presentation Handouts	Group Discussion & Assignment
CLO4	Lecture, Handouts	Tutorial Examination & Assignment

Course Code: CSE 3506 **Course Title:** Technical Writing and Presentation **Credits** 2.00

Rationale of the Course:

The intent of this course is to prepare the students for the type of professional communication they are likely to engage in during their first post-college jobs and beyond. This course focuses on technical communication—the presentation of specialized information in an accessible way to a variety of different audiences.

Course Content:

Introduction: Issues of technical writing and effective oral presentation in computer science & engineering; Writing styles of definitions, propositions, theorems and proofs.
Preparing of reports, research papers, thesis and books: abstract, preface, contents, bibliography and index. Writing of book reviews and referee reports.
Writing tools: LATEX; Diagram drawing software; Presentation tools.

Course Learning Outcomes (CLOs):

CLO1: To develop an understanding of different types of technical reports and reviews.
CLO2: To analyze and explain different tools for technical writing and presentations.
CLO3: To improve the ability to write good quality research paper.
CLO4: To gather the ability to prepare presentations and to develop an understanding of the art of presenting in front of audiences.

Mapping Course Learning Outcome (CLOs) with PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√	√							
CLO2				√		√	√		√

CLO3			√		√			√	√
CLO4			√		√		√	√	

Mapping Course Learning Outcome (CLOs) with the Teaching-Learning Strategy and Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Handouts	Project Assignment & Viva
CLO2	Lecture, Handouts	Presentation & Group Discussion
CLO3	Lecture, Handouts, Research Papers	Assignment, Presentation & Viva
CLO4	Lecture, Handouts, Example Videos	Case Study & Group Presentation

Course Code: CSE3507 **Course Title:** Computer Peripherals and Interfacing **Credits:** 3.00

Rationale of the Course:
The desired course is planned as a building block for students who have an aim to introduce their occupation as a computer engineer.

Course Content:
The computer system: Interaction between hardware and software, The operating system Loading software correctly, Transmission Media: Coaxial cable, twisted pair cable, RJ45, Optical fiber and UTP, Wireless Interfacing: Bluetooth, RF, IR, Wi Fi etc. Types of systems: Transport Layer Services, Multiplexing and De multiplexing, Connectionless Transport: UDP Principles of Reliable Data Transport, Connection-Oriented Transport: TCP, TCP Congestion Control Standard Components: System boards, Hard disk drives, Floppy disk drives, Memory, Monitors, Keyboards, Mouse and other pointing devices Power supply, System features: LAN architecture, MAN architecture, WAN architecture, Internetworking, Bridges, Routers, Gateway Barcode: Basic structure of barcode, Evolution of barcode, Barcode reader, Check digit, UPC-A, UPC-E, EAN8/13, DVI connection and DVI connection, Monitor.

Course Learning Outcomes (CLOs):
CLO1: To describe the basic computer system and their components.
CLO2: To understand functions of different wireless interface.
CLO3: To explain the concept and applications of various type of transmission media.
CLO4: To calculate check digit from any 11 digits.

Mapping Course Learning Outcome (CLOs) with the PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1		√		√					
CLO2	√		√	√				√	√
CLO3			√			√	√		
CLO4		√		√			√		√

Mapping Course Learning Outcome(CLOs) with the Teaching-Learning Strategy & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture & Group Discussion	Tutorial Examination & Assignment
CLO2	Slide Presentation	Quiz & Assignment
CLO3	Lecture, Case Study	Case Analysis
CLO4	Lecture, Handouts	Presentation & Group Discussion

Course Code: CSE 3508 **Course Title:** Computer Ethics & Cyber Law **Credits:** 2.00

Rationale of the Course:
This course is designed to provide students with an ethical framework from which they may ascertain the appropriate actions to take as they work in the IT field.

Course Content:
Computer Ethics: Employee monitoring, Professional responsibilities & practice and code**Privacy:** Personal data protection principles, Exemptions, General Data Protection Regulation (GDPR), Privacy considerations for clouds, mobile apps and big data.
Intellectual Property Issues: Intellectual property rights, Copyrights, Patents, Trademarks, Designs.
Contracts and Licenses: On-line contracts, Software licenses, Management responsibilities and liabilities, Electronic transactions.
Computer Crime and Frauds: Hacking and unauthorized use of computers, Control of obscene and indecent publications, Computer virus and spamming, Jurisdiction issues in cyberspace.
Introduction to Cyber Law: Digital Security Act 2018.
Cyber Ethics: The Importance of Cyber Law, Significance of cyber-Ethics, Need for Cyber regulations and Ethics. Ethics in Information society.
Introduction to Artificial Intelligence Ethics: Ethical Issues in AI and core Principles, Introduction to Block chain Ethics.

Course Learning Outcomes (CLOs):
CLO1: To explain the ethical issues and options that confront IT workers and IT users.
CLO2: To develop an understanding of ethical issues associated with the use of social media and also the AI issues.
CLO3: To analyze laws and their effects on technological freedom of expression.
CLO4: To demonstrate the ability to include ethical considerations in your decision-making.

Mapping Course Learning Outcome (CLOs) with PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√			√				√	
CLO2	√		√	√			√		√
CLO3	√	√		√			√	√	
CLO4		√	√		√	√			√

Mapping Course Learning Outcome (CLOs) with the Teaching-Learning Strategy and Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Handouts, Case Study	Tutorial, Presentation & Assignment
CLO2	Handouts, Lecture, Examples	Case Study & Assignment
CLO3	Class Lecture, Handouts	Mid-Term Tutorial & Assignment
CLO4	Group Work, Handouts	Group Presentation & Assignment

Year – 3, Semester – 6

Course Code: CSE 3601 **Course Title:** Software Design and Engineering **Credits:** 3.00

Rationale of the Course:
Students will gain a broad understanding of the discipline of software engineering and its application to the development and management of software systems.

Course Content:
Introduction to system engineering and software engineering. Software requirements analysis, modeling and specification.
Software Process: Software process models, Process iteration, Software specification, Software design and implementation, Software validation, Software evolution.
Software Requirements: Functional and non-functional requirements, User requirements, System requirements.
Software Designing: Principles, concepts (abstraction, refinement, modularity, hierarchy etc.), models and specification.
Software Change: Program evolution dynamics, Software maintenance, Architectural evolution.

Course Learning Outcomes (CLOs):

CLO1: To development understanding of different process model for software project development.
CLO2: To integrate realistic perspective of Software Requirements Specification (SRS), Design document, Project plan of a given software system.
CLO3: To help make project management and requirement analysis.
CLO4: To development understanding of test cases using different techniques e.g., white box testing, black box testing.
CLO5: To work as an individual and as part of a multidisciplinary team to develop and deliver quality software.

Mapping Course Learning Outcome (CLOs) with the PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√	√							
CLO2			√	√		√			
CLO3				√	√				
CLO4						√			
CLO5							√	√	√

Mapping Course Learning Outcome (CLOs) with the Teaching-Learning Strategy & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Slide Presentation, Handouts	Tutorial Examination & Assignment
CLO2	Handouts, PowerPoint Presentation	Mid Exam & Case Analysis
CLO3	Lecture, Handouts, PowerPoint Presentation	Group Discussion & Assignment
CLO4	Lecture, Handouts	Project Presentation & Assignment
CLO5	PowerPoint Presentation, Lecture, Handouts	Quiz, Tutorial examination, Group Discussion & Assignment

Course Code: CSE 3602L **Course Title:** Software Design and Engineering Lab **Credits:** 2.00

Rationale of the Course:
This course is designed to provide basic knowledge of software engineering principle and practices to the intermediate level students of Computer Science and Engineering. It also involves knowledge on the application of the software engineering practices.

Course Content:
Problem statement for a suggested system of relevance, Requirement analysis and develop Software Requirement Specification Sheet (SRS) for suggested system, UML Diagram, Data Flow Diagram (DFD) and Structured chart, use case diagram, Class diagram, object diagram, State-chart diagram, Activity diagram, Sequence diagram, Collaboration diagram, Component diagram for the system, Deployment diagram for the system, Prepare time line chart/Gantt Chart/PERT Chart for selected software project.

Course Learning Outcomes (CLOs):

CLO1: To development an understanding of how graphical models can be used to represent software systems.

CLO2: To development an understanding why different types of models are required and the fundamental system modeling perspectives of context, interaction, structure and behavior.

CLO3: To foster analytical and critical thinking ability to some of the diagram types in the Unified Modeling Language (UML) and how these diagrams may be used in system modeling.

Mapping Course Learning Outcome (CLOs) with the PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√	√							
CLO2			√		√		√		
CLO3	√		√	√		√			√

Mapping Course Learning Outcome (CLOs) with the Teaching-Learning Strategy & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Practical Experiment	Group Discussion & Lab report
CLO2	Handouts and Slide Presentation	Tutorial exam, Case Study & Lab report
CLO3	Slide Presentation and Problem Solution	Case Study, Group Discussion, Presentation, Tutorial Examination & Lab Report

Course Code: CSE 3603 **Course Title:** Web Design & Development **Credits:** 3.00

Rationale of the Course:
The desired course is planned as a building block for students who have an aim to introduce their occupation as a Web Developer.

Course Contents:

Web Engineering: Attributes of Web based system and Application, Web App Engineering Layers, Web Engineering Process.

Web Apps Analysis: Requirement Analysis, Analysis Model, Web Apps Estimation, And Content Model.

Web Apps design: Design issues of Web Apps, Interface Design, Typography, Layout design, Aesthetic Design, Content Design, Architecture Design, Navigation Design, Object Oriented Hypermedia Design, and Design Metrics for web Apps.

Web Apps Implementation: Client-side scripting: Java Script, AJAX, JQuery; Server-Side Scripting: ASP.NET, PHP; Framework: PHP MVC frameworks (Code Igniter, Symfony, Zend, CakePHP) ASP.NET MVC Framework, Web Service.

Web Apps Security: Encryption techniques (digital signatures, certificates, PKI), Security threats, securing client/server interactions, Vulnerabilities at the client (desktop security, phishing, etc.) and the server (cross-site scripting, SQL injections, etc.), Building Secure Web Apps.

Testing Web Apps: Content Testing, User Interface Testing, Navigation Testing, Configuration Testing, Security Testing, Performance Testing.

Maintenance of Web Applications: Web Server and Database server load balancing, web apps performance assessment, Application usage monitoring and report generation

Course Learning Outcomes (CLOs):

CLO1: To understand the basic concept of web engineering.
CLO2: To learn different techniques and languages of web programming.
CLO3: To understand web system characteristics and model them.
CLO4: To develop the understanding of practicing technology and ICT knowledge.

Mapping Course Learning Outcome (CLOs) with PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√	√						√	
CLO2					√	√			
CLO3			√	√			√	√	√
CLO4					√			√	√

Mapping Course Learning Outcome (CLOs) with the Teaching-Learning Strategy and Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, PowerPoint Presentation, Handouts	Quiz, Case Analysis
CLO2	Lecture, Handouts, PowerPoint Presentation	Presentation, Group Discussion
CLO3	Lecture, Handouts, PowerPoint Presentation	Case Study, Mid Exam & Final exam
CLO4	Lecture, Handouts	Quiz, Case Analysis, Case Seminar

Course Code: CSE 3604L **Course Title:** Web Design & Development Lab **Credits:** 2.00

Rationale of the Course:

The desired course is planned as a building block for students who have an aim to introduce their occupation as a Web Developer.

Course Contents:

Web Engineering: Attributes of Web based system and Application, Web App Engineering Layers, Web Engineering Process.

Web Apps Analysis: Requirement Analysis, Analysis Model, Web Apps Estimation, And Content Model.
Web Apps design: Design issues of Web Apps, Interface Design, Typography, Layout design, Aesthetic Design, Content Design, Architecture Design, Navigation Design, Object Oriented Hypermedia Design, and Design Metrics for web Apps.
Web Apps Implementation: Client-side scripting: Java Script, AJAX, JQuery; Server-Side Scripting: ASP.NET, PHP; Framework: PHP MVC frameworks (Code Igniter, Symfony, Zend, CakePHP) ASP.NET MVC Framework, Web Service.
Web Apps Security: Encryption techniques (digital signatures, certificates, PKI), Security threats, securing client/server interactions, Vulnerabilities at the client (desktop security, phishing, etc.) and the server (cross-site scripting, SQL injections, etc.), Building Secure Web Apps.
Testing Web Apps: Content Testing, User Interface Testing, Navigation Testing, Configuration Testing, Security Testing, Performance Testing.
Maintenance of Web Applications: Web Server and Database server load balancing, web apps performance assessment, Application usage monitoring and report generation

Course Learning Outcomes (CLOs):
CLO1: To understand the basic concept of web engineering.
CLO2: To learn different techniques and languages of web programming.
CLO3: To understand web system characteristics and model them.
CLO4: To develop the understanding of practicing technology and ICT knowledge.

Mapping Course Learning Outcome (CLOs) with PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√	√						√	
CLO2					√	√			
CLO3			√	√			√	√	√
CLO4					√			√	√

Mapping Course Learning Outcome (CLOs) with the Teaching-Learning Strategy and Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Slide presentation and Practical experiments	Quiz, Case analysis
CLO2	Lecture, Practical Experiment	Presentation, Group discussion
CLO3	Handouts and Slide presentation	Case study, mid exam & Final exam
CLO4	Slide presentation and Practical experiments	Quiz, Case analysis, Case seminar

Course Code: CSE 3605 **Course Title:** Computer Architecture **Credits:** 3.00

Rationale of the Course:
This desired course focuses on architectures of computer system. Having a common starting point for computer architecture ensures the principle of hardware and software system, how to work it, and interact it with the existing system.

Course Content:
Information representation; Measuring performance; Flynn's classification; Instructions and data access methods: operations and an operand of computer hardware, representing instruction; **Arithmetic Logic Unit (ALU) design**: arithmetic and logical operations, floating-point operations, designing ALU; **Processor design:** data paths – single cycle and multicycle implementations; **Control Unit design** – hardwired and microprogrammed; **Pipeline**: pipelined

data path and control, superscalar and dynamic pipelining; pipelininghazard; **Memory organization**: cache memory, virtual memory; I/O channels; DMA and interrupts; Buses; **Multiprocessors:** types of multiprocessors, single bus multiprocessors, multiprocessors connected by a network; Cluster.

Course Learning Outcomes (CLOs):

CLO1: To analyze different computer models, possible operations of a computer, computer buses.

CLO2: To develop an understanding of the designing of ALU, control unit design, operations performed on floating-point numbers.

CLO3: To gather knowledge about pipelining stages and types, pipelining hazards, data path.

CLO4: To improve conception of memory organization, multiprocessors types.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√					√			
CLO2	√								
CLO3	√			√					
CLO4		√	√						√

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, PowerPoint Presentation, Handouts	Quiz, Case analysis
CLO2	Handouts, PowerPoint Presentation	Presentation, Group discussion
CLO3	Lecture, Handouts, PowerPoint Presentation	Case study, mid exam & Final exam
CLO4	Lecture, Handouts	Quiz, Case analysis, Case seminar

Course Code: CSE 3606 **Course Title:** Simulation and Modeling **Credits:** 2.00

Rationale of the Course:

The desired course is planned as a building block for students who have an aim to introduce their occupation as a modeler, system analyst and software developer.

Course Content:

Introduction to simulation and modeling: advantages and disadvantages of simulation, applications of simulation.

Basic concepts of simulation: Components of simulation, simulation methods and model building.

Introduction to simulation Packages: General purpose language for simulation (Java), simulation software, GPSS/H.

Random number generation: Characteristics of random numbers, frequency test, autocorrelation test.

Random variate generation: Necessity of random variate, random variate generation techniques.

Queuing systems: Characteristics of queuing system, Steady state behavior infinite population Monrovians models (M/M/1/N, M/M/C/C, M/M/, Stages-Erlang, M/E/1, E/M/1, bulk arrival and service systems), Steady state behavior of finite population models (M/M/1/M, M/M//M, M/M/C/K/M, M/M/C/K/K). Input modeling. Validation and verification of simulation models. Output analysis for simulation models.

Course Learning Outcomes (CLOs):

CLO1: To develop an understanding of the basic concept of simulation and modeling.
CLO2: To improve the understanding and analyze different techniques and software for simulation.
CLO3: To analyze system characteristics and model them.
CLO4: To illustrate the use of random numbers and random variates.

Mapping Course Learning Outcome (CLOs) with PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√	√							
CLO2		√		√				√	√
CLO3	√	√			√	√			√
CLO4	√		√			√	√		

Mapping Course Learning Outcome (CLOs) with the Teaching-Learning Strategy and Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	PowerPoint Presentation, Handouts	Quiz, Case analysis
CLO2	Lecture, Handouts, PowerPoint Presentation	Presentation, Group discussion
CLO3	Handouts, Lecture, PowerPoint Presentation	Case study, mid exam & Final exam
CLO4	Lecture, Handouts	Quiz, Case analysis, Case seminar

Course Code: CSE 3607L **Course Title:** Mobile Application Lab **Credits:** 2.00

Rationale of the Course:

The desired course is planned as a building block for students who have an aim to introduce their occupation as a Mobile App Developer.

Course Content:

Introduction to Android and Mobile Devices, Setting up Development Environment, Application Architecture and Lifecycle, Java Language Basics and Syntax, Object Oriented Programming in Java, Vertical and Horizontal Libraries in Java, Object Oriented Principles and Practice, Building Android Applications, Android User Interface, Advanced Android User Interface, Common Controls, Android Application Components: Activity, Broadcast Listener, Service, Content Provider, Data Storage and Relational Database: SQLite, Maps, Geocoding and Location Based Services, Communication with Internet, RESTful Web Services, Working with Multimedia and Content Providers in Android, Basic Game Development Concepts, Performance Tuning, Some More about Object Oriented Programming, Debugging, Testing & Deploying Android Applications (with Digital Signature).

Course Learning Outcomes (CLOs):

CLO1: To develop an understanding of introductory concept of mobile application and learn to set up development environment.
CLO2: To design and develop the first mobile app in java and learn different interfaces and components of Android.
CLO3: To design and develop relational database for apps.
CLO4: To test and deploy Android Applications.

Mapping Course Learning Outcome (CLOs) with PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√		√				√		
CLO2		√			√	√	√		
CLO3				√		√	√	√	
CLO4		√	√					√	

Mapping Course Learning Outcome (CLOs) with the Teaching-Learning Strategy and Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Slide Presentation and Practical Experiments	Tutorial Examination & Assignment
CLO2	Lecture, Practical Experiment	Group Discussion & Assignment
CLO3	Handouts and Slide Presentation	Midterm & Assignment
CLO4	Slide presentation and Problem Solution	Tutorial, Project & Assignment

Year – 4, Semester – 7

Course Code: CSE 4701 **Course Title:** Computer Networks **Credits:**3.00

Rationale of the Course:
The desired course is planned as a building block for students who have an aim to introduce their occupation as a Computer Networks Engineer.

Course Content:
Basic concepts, server, workstation, data communication, signaling, analog & digital communication, synchronous, asynchronous, circuit and packet switching. Network topology: Bus, tree ring and star topology, transmission media, coaxial, UTP and optical fiber. LAN, MAN, WAN, LAN architecture, IEEE standard protocols for LANs and MANs, Internetworking, bridges, routers, gateway. Protocol: OSI model and TCP/IP, TCP/IP protocol suit, layers, comparisons, TCP/IP addressing, address classes, Ipv4, Ipv6, address masking, network address, DNS and DHCP. Domain: Primary and secondary domain, host, name server, resolve, reverse resolution, DHCP assigning dynamic IP. DNS and internet configuration: Root server, cache file, boot file, zone, primary and secondary zone, reverse zone, DNS records such as A, CNAME, MX, NS, PTR, SOA etc., hosts file.

Course Learning Outcomes (CLOs):
CLO1: To describe the general principles of computer networks.
CLO2: To create different types of topologies and configure to PC.
CLO3: To explain the basic concept of switch configuration.
CLO4: To implement basic Router configuration and how to create VLAN.

Mapping with Course Learning Outcomes (CLOs) with the Program Learning Outcomes (PLOs):

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√	√	√						
CLO2	√		√	√	√			√	
CLO3		√		√		√			√
CLO4	√			√	√	√	√		√

Mapping with Course Learning Outcomes (CLOs) with Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Handouts	Tutorial, Group discussion, Quiz
CLO2	Slide Presentation, Handouts	Group Discussion, Mid Exam
CLO3	Group Discussion, Lecture, Handouts	Quiz, Tutorial Examination
CLO4	Lecture, Handouts	Tutorial, Project Work

Course Code: CSE 4702 **Course Title:** Cyber Security **Credits:** 2.00

Rationale of the Course:
The desired course is planned as a building block for students who have an aim to introduce their occupation as a Cyber Security Expert.

Course Content:
Introduction to Cyber Security: Cyber security languages (e.g. Python, SQL, PHP etc.), Types of Cyber security (e.g. Cloud Security, Endpoint Security, Mobile Security etc.), Types of cyber-attacks, 4 domains of cyber security (Application security, physical security, risk assessment, and threat intelligence).
Network Security: Preliminary concepts and definitions: Security, Cyber security, information security requirements, Secret vs public key, cryptography, Threats, models of attack, classification.
Data privacy policies, Cyber Security Design and Analysis.
Symmetric key encryption: Stream ciphers, Perfect ciphers, Properties and limits of stream ciphers, RC4 (with algorithms).

Course Learning Outcomes (CLOs):
CLO1: To explain and differentiate among different domains and types of cyber security.
CLO2: To use acquired knowledge for solving daily-life threats using cyber networks.
CLO3: To design a perfect security computer system to prevent cyber crimes.

Mapping with Course Learning Outcomes (CLOs) with the Program Learning Outcomes (PLOs):

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1		√					√		
CLO2					√				
CLO3			√	√	√		√		

Mapping with Course Learning Outcomes (CLOs) with Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Handouts	Tutorial, Group discussion, Quiz
CLO2	Slide Presentation, Handouts	Group Discussion, Mid Exam
CLO3	Group Discussion, Lecture, Handouts	Quiz, Tutorial Examination

Course Code: CSE 4703L **Course Title:** Computer Networks & Cyber Security Lab
Credits: 2.00

Rationale of the Course:
The desired course is planned as a building block for students who have an aim to introduce their occupation as a Computer Networks Engineer and Cyber Security Engineer.

Course Content:
Overview of the Internet, Some History of the Internet, Overview of Networking Protocols, Network Edge, Network Core, Principles of Networking, Applications, FTP server, Email, DNS**,** Peer-to-Peer (P2P) **Transmission Media:** Coaxial cable, Twisted pair cable, RJ45, Optical fiber and UTP, Different topologies, IP Address, Subnet mask, Hub, Basic configuration of PC, Switch and Router by Cisco packet tracer.

Course Learning Outcomes (CLOs):
CLO1: To describe the general principles of computer networks.
CLO2: To create different types of topologies and configure to PC.
CLO3: To explain the basic concept of switch configuration.
CLO4: To implement basic Router configuration and how to create VLAN.

Mapping Course Learning Outcome(CLOs) with the PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√		√		√				
CLO2			√		√			√	
CLO3			√			√	√		√
CLO4		√		√			√		√

Mapping Course Learning Outcome(CLOs) with the Teaching-Learning Strategy & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Slide Presentation and Practical Experiments	Tutorial Examination & Assignment
CLO2	Lecture, Practical Experiment	Mid Exam & Case Analysis
CLO3	Handouts and Slide Presentation	Group Discussion & Assignment
CLO4	Slide presentation and Problem Solution	Project Presentation & Assignment

Course Code: CSE 4704 **Course Title:** Digital Signal and Image Processing **Credits:** 3.00

Rationale of the Course:
Digital image processing is continuously an exciting field as it gives improved pictorial information for human clarification and processing of image data for storage, transmission, and representation for machine view.

Course Content:
Introduction: Signals, signal processing, classification of signals, the concept of frequency in continuous time and discrete time signals, analog to digital and digital to analog conversion, Sampling and quantization.
Discrete time signals: Discrete time signals, analysis, correlation and convolution of discrete time signals; The z-transform;
Frequency analysis of signals: Frequency analysis of continuous time signals, Frequency analysis of discrete time signals, Properties of Fourier transform of discrete time signals, Frequency domain.

The Discrete Fourier Transform: The DFT, Properties of the DFT, Filtering method based on the DFT, Frequency analysis of signals using the DFT.
Fast Fourier Transform Algorithms: FFT algorithms, applications of FFT algorithm.
Digital Filters: Design of FIR and IIR filters. **Adaptive filters:** Adaptive system, Kalman filters, RLS adaptive filters, the steepest-descent method, the LMS filters. **Application of DSP:** Speech processing, analysis and coding, MATLAB application to DSP.
Digital Image Fundamentals: Image Sensing and Acquisition, Key Stages of Image Processing**,** Image Sampling and Quantization, Some Basic Relationships between Pixels, Linear and Nonlinear Operations, Image Processing Applications.
Image Enhancement in the Spatial Domain: Basic Gray Level Transformations. Histogram Processing, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Image Histograms.
Color Image Processing: Color Fundamentals, Color Models, Pseudo color Image Processing, Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening, Color Segmentation.
Image Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation, Segmentation by Morphological Watersheds.
Morphological Image Processing: Structuring Elements,Dilation and Erosion, Opening and Closing, Thinning and Thickening**,** Extensions to Gray-Scale Images.
Edge Detection: Different Edge**,** Edge Detection Principle**,** Edge Detecting Operators**,** Edge Detecting Algorithms,and Comparisons between different edge detectors.
Image Compression: Compression Goals**,** Image Compression and Reconstruction**,** Image Compression AlgorithmsCompression Ratio, Fidelity Criteria.

Course Learning Outcomes (CLOs):

CLO1: To be able to study the signal and image fundamentals and mathematical transforms necessary for signal and image processing.
CLO2: To evaluate the techniques for signal processing and image enhancement and image restoration.
CLO3: To study the image compression procedures and categorize various compression techniques.
CLO4: To learn different signal transformation algorithms and feature extraction techniques for image processing and recognition.
CLO5: To be able to understand the rapid advances in Machine Vision.

Mapping Course Learning Outcome(CLOs) with the PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√		√	√					
CLO2			√	√				√	
CLO3			√			√	√		√
CLO4			√	√				√	
CLO5		√		√			√		√

Mapping Course Learning Outcome(CLOs) with the Teaching-Learning Strategy & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Handouts, Lecture	Quiz, Tutorial exam, Group Discussion, Assignment
CLO2	Lecture, Handouts, Case Study	Midterm Examination, Case Study & Assignment
CLO3	Handouts, Group Discussion	Quiz, Tutorial Exam, Case Analysis & Assignment
CLO4	Lecture, Books	Tutorial Exam, Group Discussion & Assignment

CLO5	Lecture, Presentation, Handouts	Quiz, Tutorial exam, Group Discussion, Assignment

Course Code: CSE 4705L **Course Title:** Digital Signal and Image Processing Lab
Credits: 2.00

Rationale of the Course:
Digital image processing is continuously an exciting field as it gives improved pictorial information for human clarification and processing of image data for storage, transmission, and representation for machine view.

Course Content:
Introduction: Signals, signal processing, classification of signals, the concept of frequency in continuous time and discrete time signals, analog to digital and digital to analog conversion, Sampling and quantization.
Discrete time signals: Discrete time signals, analysis, correlation and convolution of discrete time signals; The z-transform;
Frequency analysis of signals: Frequency analysis of continuous time signals, Frequency analysis of discrete time signals, Properties of Fourier transform of discrete time signals, Frequency domain.
The Discrete Fourier Transform: The DFT, Properties of the DFT, Filtering method based on the DFT, Frequency analysis of signals using the DFT.
Fast Fourier Transform Algorithms: FFT algorithms, applications of FFT algorithm.
Digital Filters: Design of FIR and IIR filters. **Adaptive filters:** Adaptive system, Kalman filters, RLS adaptive filters, the steepest-descent method, the LMS filters. **Application of DSP:** Speech processing, analysis and coding, MATLAB application to DSP.
Digital Image Fundamentals: Image Sensing and Acquisition, Key Stages of Image Processing**,** Image Sampling and Quantization,Some Basic Relationships between Pixels, Linear and Nonlinear Operations, Image Processing Applications.
Image Enhancement in the Spatial Domain: Basic Gray Level Transformations.Histogram Processing, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Image Histograms.
Color Image Processing: Color Fundamentals, Color Models, Pseudo color Image Processing, Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening, Color Segmentation.
Image Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation, Segmentation by Morphological Watersheds.
Morphological Image Processing: Structuring Elements,Dilation and Erosion, Opening and Closing, Thinning and Thickening**,** Extensions to Gray-Scale Images.
Edge Detection: Different Edge**,** Edge Detection Principle**,** Edge Detecting Operators**,** Edge Detecting Algorithms,and Comparisons between different edge detectors.
Image Compression: Compression Goals**,** Image Compression and Reconstruction**,** Image Compression AlgorithmsCompression Ratio, Fidelity Criteria.

Course Learning Outcomes (CLOs):
CLO1: To be able to study the signal and image fundamentals and mathematical transforms necessary for signal and image processing.
CLO2: To evaluate the techniques for signal processing and image enhancement and image restoration.
CLO3: To study the image compression procedures and categorize various compression techniques.

CLO4: To learn different signal transformation algorithms and feature extraction techniques for image processing and recognition.

Mapping Course Learning Outcome(CLOs) with the PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO8	PLO9
CLO1			√	√				√		
CLO2			√			√	√		√	√
CLO3		√		√			√			
CLO4	√		√	√	√				√	√

Mapping Course Learning Outcome(CLOs) with the Teaching-Learning Strategy & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Slide Presentation	Tutorial Examination & Assignment
CLO2	Handouts, Case Study	Case Analysis, Tutorial & Assignment
CLO3	Slide Presentation, Group Discussion	Quiz, Presentation & Assignment
CLO4	Lecture, Problem Solution	Project Presentation, Quiz, & Tutorial Exam

Course Code: CSE 4706 **Course Title:** Software Project Management & Quality Assurance
Credits: 3.00

Rationale of the Course:
The intended course is designed to provide basic knowledge about software project management, software quality assurance and testing to the intermediate level students of computer science and engineering.

Course Content:
Triple Constraint in Project Management: Time, Scope and Cost; Process methodology, Requirement Collection, Plan, schedule a project including risk assessment with proper documentation and presentation. Cost Estimation, Optimization, and performance calculation, Change management, Quality improvement, Use of Modern tools in project planning, resource allocation and estimation.
Software Testing: Objective and principles, testability, testing design, implementation models and documentations, verification, validation and debugging. Quality factors and methodologies for different software engineering phases. Software project management issues.
Introduction to software reliability: quality control and quality assurance; Formal verification methods; static and dynamic program verification.
Software Configuration Management: Introduction, need, basic configuration, management function, baseline, configuration.

Course Learning Outcomes (CLOs):
CLO1: To develop an understanding of the principal tasks of software project managers, and basic concepts in software projects.
CLO2: To develop the plan for software projects, including risk and quality management.
CLO3: To evaluate and relate different software processes, system models and architectural designs and assess their suitability in a given context.
CLO4: To improve the understanding of different types of software testing strategies.

Mapping Course Learning Outcome (CLOs) with PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√			√					
CLO2	√		√				√	√	
CLO3	√	√			√	√			√
CLO4		√	√			√			

Mapping Course Learning Outcome (CLOs) with Teaching-Learning Strategy & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Books	Tutorial examination & Assignment
CLO2	Handouts, Case Study	Case Analysis & Assignment
CLO3	Slide Presentation, Group Discussion	Midterm & Group Task
CLO4	Lecture, Handouts	Tutorial examination & Assignment

Course Code: CSE 4707 **Course Title:** Automata & Compiler Design **Credits:** 3.00

Rationale of the Course:
Having a common starting point for Automata and compiler design ensures the principle of providing practical programming skills that is necessary for constructing a compiler.

Course Content:
Formal Language and Regular Expressions: Languages, Definition Language regular expressions, Finite Automata-DFA, NFA. Conversion of regular expression to NFA, NFA to DFA, Applications of Finite Automata to lexical analysis, lex tools.
Context Free grammars and parsing: Context free grammars, derivation, parse trees, ambiguity LL (K) grammars and LL (1) parsing.
Bottom-up parsing handle pruning LR Grammar Parsing, LALR Parsing, Parsing ambiguous grammars, YACC Programming specification.
Semantics: Syntax directed translation, S-attributed and L-attributed grammars, and Intermediate code-abstract, syntax tree, translation of simple statements and control flow statements.
Context sensitive features -Chomsky hierarchy of languages and recognizers. Type checking, type conversions, equivalence of type expressions, overloading of functions and operations.
Run time storage: Storage organization, storage allocation strategies scope access to now local names, parameters, language facilities for dynamics storage allocation.
Code optimization: Principal sources of optimization of basic blocks, peephole optimization, flow graphs, data flow analysis of flow graphs.
Code generation: Machine dependent code generation, object code forms, generic code generation algorithm, register allocation and assignment using DAG representation of Block.

Course Learning Outcomes (CLOs):
CLO1: To develop an understanding of Formal Language and Regular Expressions.
CLO2: To develop an understanding of different basic regular language and grammar.
CLO3: To develop an understanding of a compiler for a language.
CLO4: To develop an understanding of run time storage, code optimization and generation.

Mapping Course Learning Outcome (CLOs) with PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√	√		√	√				
CLO2	√			√	√				
CLO3	√		√	√	√				
CLO4		√	√	√	√			√	√

Mapping Course Learning Outcome (CLOs) with Teaching-Learning Strategy & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Books	Tutorial Exam & Assignment
CLO2	Handouts, Case Study	Presentation & Group Discussion
CLO3	Slide Presentation, Group Discussion	Midterm Examination & Presentation
CLO4	Lecture, Handouts	Final Examination & Assignment

Course Code: CSE 4708 **Course Title:** Data ware-housing & Data Mining **Credits:** 3.00

Rationale of the Course:
The desired course is planned as a building block for students who have an aim to analyze and extract information from data.

Course Content:
Introduction: Models, methodologies, and processes, The KDD process, Generic tasks, Application, Example: weather data
Warehouse and OLAP: Data Warehousing and introduction to Big data analysis, OLTP vs. OLAP, Multidimensional data model, OLAP operations,
Data preprocessing: Data cleaning, Data transformation, Data reduction, Discretization and generating concept hierarchies, Experiments with Weka - filters, discretization
Data mining knowledge representation: Task relevant data, Background knowledge, Interestingness measures, Representing input data and output knowledge, Visualization techniques, Experiments with Weka - visualization
Attribute-Value Learning Techniques: Attribute generalization, Attribute relevance, Decision trees, Decision lists, Classification and regression trees, Association rules, Correlations, Rule-based mining. The prediction task, Statistical (Bayesian) classification, Instance-based methods (nearest neighbor), Linear models, Experiments with Weka - using filters and statistics,- mining association rules, decision trees, prediction.
Evaluating what's been learned: Training and testing, Estimating classifier accuracy (holdout, cross-validation, leave-one-out), Combining multiple models (bagging, boosting, stacking), Experiments with Weka - training and testing.
Clustering: Basic issues in clustering, First conceptual clustering system: Cluster/2, Partitioning methods: k-means, expectation maximization (EM), Hierarchical methods: distance-based agglomerative and divisible clustering, Conceptual clustering: Cobweb, Experiments with Weka - k-means, EM, Cobweb.

Course Learning Outcomes (CLOs):
CLO1: To gather knowledge of data preprocessing and data quality, modeling and design of data warehouses, algorithms for data mining.
CLO2: To explain the knowledge discovery process.
CLO3: To analyze some real-life applications involving data mining techniques.
CLO4: To apply data mining techniques depending on the nature of data and intended

application.

Mapping Course Learning Outcome (CLOs) with the PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√								
CLO2	√				√		√		
CLO3	√	√		√					√
CLO4		√						√	√

Mapping Course Learning Outcome (CLOs) with the Teaching-Learning Strategy & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Slide Presentation	Tutorial Examination & Assignment
CLO2	Handouts, Case Study	Case Analysis, Tutorial & Assignment
CLO3	Slide Presentation, Group Discussion	Quiz, Presentation & Assignment
CLO4	Lecture, Problem Solution	Project Presentation, Tutorial Exam

Year – 4, Semester - 8

Course Code: CSE 4801 **Course Title:** Artificial Intelligence & Expert System
Credits: 3.00

Rationale of the Course:
The intended course is designed as a building block for students who have a desire to establish their career in Artificial Intelligence.

Course Content:
Introduction: Survey of basic Artificial Intelligence concept and controversies, different approaches, intelligent agent, task environments.
Knowledge representation: Propositional logic, First order predicate logic and rule-based representation, inconsistencies and uncertainties, structured representation, Fuzzy logic, Expert system concept.
Uninformed Search Techniques: Search and control strategies, game playing, planning, decision making, BFS, DFS.
Informed Search Techniques: Optimization problems, Heuristics, A* search, Hill climbing, Evolutionary algorithms, Simulated Annealing.
Perception and communication: Languages (PROLOG), basic problem-solving techniques, knowledge representation and computer inference.
Machine Learning and Artificial Neural Network: Basic introduction to machine learning and ANN, Relation between AI and ML, natural language understanding and processing, visual image understanding, computer vision, introduction to virtual and augmented reality, robotics.

Course Learning Outcomes (CLOs):
CLO1: To develop an understanding of the introductory concept of AI and understand the applications of AI.
CLO2: To build knowledge base for AI agents and design AI agents.
CLO3: To analyze and evaluate different searching algorithms and optimization algorithms.
CLO4: To design and develop expert systems and deploy them.

Mapping Course Learning Outcome (CLOs) with PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√	√					√		
CLO2			√	√	√	√			√
CLO3				√		√	√		
CLO4		√	√				√	√	√

Mapping Course Learning Outcome (CLOs) with the Teaching-Learning Strategy and Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Books	Tutorial Examination & Assignment
CLO2	Handouts, Lecture, Class work	Group Discussion & Assignment
CLO3	Multimedia Lecture, Handouts	Midterm, Case Analysis
CLO4	Lecture, Handouts	Tutorial Examination & Assignment

Course Code: CSE4802L **Course Title:** Artificial Intelligence & Expert System Lab
Credits: 2.00

Rationale of the Course:
The intended course is designed as a building block for students who have a desire to establish their career in Artificial Intelligence.

Course Content:
First order predicate logic and rule-based representation, introduction to expert system, introduction to logic programming, use of prolog, Searching and Optimization Algorithms (BFS, DFS, Best-First Search, A* Search, Hill Climbing, Simulated Annealing, etc.), Genetic Algorithm.

Course Learning Outcomes (CLOs):
CLO1: To develop an understanding of the introductory concept of AI and understand the applications of AI.
CLO2: To build knowledge base for AI agents and design AI agents.
CLO3: To analyze and evaluate different searching algorithms and optimization algorithms.
CLO4: To design and develop expert systems and deploy them.

Mapping Course Learning Outcome (CLOs) with PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√		√				√		
CLO2	√	√			√		√		
CLO3				√		√		√	√
CLO4		√	√					√	

Mapping Course Learning Outcome (CLOs) with the Teaching-Learning Strategy and Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Slide Presentations, Practical Experiment	Lab Examination & Assignment
CLO2	Multimedia Lecture, Practical Experiment	Case Analysis & Assignment
CLO3	Slide Presentations, Practical Experiment	Lab Examination & Group Assignment
CLO4	Problem Solution, Slide Presentations	Group Project & Assignment

Course Code: CSE 4803 **Course Title:** Distributed Systems **Credits:** 2.00

Rationale of the Course:
The intended course is designed for students to comprehend the necessary principles, techniques, and tools for understanding, analyzing, designing and engineering distributed systems with reference to partial failure, heterogeneity, scalability, concurrency and asynchrony

Course Contents:
Introduction to Distributed Systems, Classifications of distributed systems; Distributed System Models and Enabling Technologies, distributed architectures; Virtualization, cloud computing; communication and concurrency; distributed communication; clock synchronization and MapReduce; asynchronous systems; logical clocks; causality; fault tolerance and distributed transactions; Byzantine fault tolerance; coordination and agreement algorithms; availability and reliability; decentralized algorithms; Distributed Data Storage, Distributed Filesystems.

Course Learning Outcomes (CLOs):
CLO1: To understand the basic concept and requirements of distributed systems.
CLO2: To understand useful distributed algorithms for synchronization, consistency, fault-tolerance, etc and will be able to solve day-to-day problems as appeared.
CLO3: To design and implement distributed systems from scratch required in companies.

Mapping Course Learning Outcome (CLOs) with PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√								
CLO2	√								
CLO3		√		√					

Mapping Course Learning Outcome (CLOs) with the Teaching-Learning Strategy and Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, PowerPoint Presentation, Handouts	Quiz, Case Analysis
CLO2	Lecture, Handouts, PowerPoint Presentation	Presentation, Group Discussion
CLO3	Lecture, Handouts, PowerPoint Presentation	Case Study, Mid Exam & Final exam

Course Code: CSE 4804 **Course Title:** Introduction to IoT **Credits:** 2.00

Rationale of the Course:
The course is designed to familiarize students with IoT concepts, origin, impact, methodologies and tools, and how to apply it.

Course Contents:
Introduction to IoT, IoT and digitization, IoT impact, IoT architecture and design, Software Analysis and Tooling, Network, Linking & Loading, IoT data management and compute stack, Sensors, sensors interfacing, implementation of IoT, Cloud and IoT Integration, IoT based home automation.

Course Learning Outcomes (CLOs):
CLO1: To understand the basic concept of IoT
CLO2: To learn different architecture and tools related to IoT.
CLO3: To design and implement devices using IoT principle for day-to-day life.

Mapping Course Learning Outcome (CLOs) with PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√								
CLO2	√	√							
CLO3				√	√				

Mapping Course Learning Outcome (CLOs) with the Teaching-Learning Strategy and Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, PowerPoint Presentation, Handouts	Quiz, Case Analysis
CLO2	Lecture, Handouts, PowerPoint Presentation	Presentation, Group Discussion
CLO3	Lecture, Handouts, PowerPoint Presentation	Case Study, Mid Exam & Final exam

Course Code: CSE 4805L **Course Title:** Machine Learning Lab **Credits:** 2.00

Rationale of the Course:
The intended course is designed as a building block for students who have a desire to establish their career in Data Science and Engineering.

Course Content:
Logistic Regression, Linear Regression; Supervised and Unsupervised learning; Bayesian Learning; Decision Tree Learning; Rule based learning; Instance based learning; Neural Nets; Support Vector Machine; Genetic Algorithms; Project based on practical application of machine learning.

Course Learning Outcomes (CLOs):
CLO1: To develop an understanding of the different paradigms of machine learning.
CLO2: To develop the ability to engineer data.
CLO3: To design and implement appropriate method in appropriate scenario.
CLO4: To extract knowledge and visualize.

Mapping Course Learning Outcome (CLOs) with PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
CLO1	√	√		√			√		
CLO2	√		√			√			
CLO3		√	√		√	√			
CLO4				√			√	√	√

Mapping Course Learning Outcome (CLOs) with the Teaching-Learning Strategy and Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Practical Experiment, Slide Presentations, Books	Tutorial Examination & Assignment
CLO2	Slide Presentations, Project Compilation	Midterm Examination & Project
CLO3	Lecture, Practical Experiment	Case Analysis & Assignment
CLO4	Slide Presentations, Practical Experiment	Group Project & Presentation

Course Code: CSE 4806 **Course Title:** Internship/ Industrial attachment **Credits:** 3.00

Rationale of the Course:
The course is project-driven and team-oriented. This means that students will work as team participants working with their respective team members. Students will be required to apply project management practices, data and process modeling techniques and also demonstrate software development skills.

Course Content:
Based on the Departmental Academic Committee Decisions.

Mapping of Course Learning Outcomes (CLOs) with Program Learning Outcomes (PLOs):

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
1. choose their interest in a particular career.									
2. enhance their sense of responsibility, self-confidence, teamwork spirit, creativity skills, communication skills etc.									

Mapping of Course Learning Outcome(CLOs) with the Teaching-Learning& Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	field visit, slide presentation, lecture.	assignment, presentation, viva
CLO2	lecture, group work, group discussion, industrial site visit.	report writing, practical, viva

Chapter 4
Grading/ Evaluation

4.1 Grading Scale:

A student's overall performance in a given course is based on a continuous assessment scheme. A continuous assessment is done through class participation, class test, homework, assignments and midterm examination. Final assessment for evaluation of credit is done through compilation

of the marks obtained by the students in the continuous assessment and the semester final examination. The distribution of marks in terms of percentage is as follows:

Class Attendance	10%
Class test/Homework/Assignment	10%
Mid-Term Examination	10%
Semester Final Examination	70%

4.2 Grades:

4.2.1 Grading System

The total numerical marks obtained by a student in each course (Theoretical as well as Practical) covering Semester Final and Continuous Assessment marks will be covered into letter Grades and Grade Points. A four point (4.00) grading scale corresponding to 10 letter grades will be followed for the evaluation of a student.

The following Letter Grades and corresponding grade points will be used to determine a student's Grade Point Average (GPA).

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

'F' means fail.

4.2.2 Grading Description

The Grades (with numeric values) as described as follows:

A+	Exceptional Performance / Excellent
A	Outstanding Performance
A-	Brilliant Performance
B+	Very Good Performance; Most of the course objectives achieved; objectives met in a consistently thorough manner
B	Good Performance
B-	Above Average
C+	Average, At least majority of the course objectives achieved; objectives met satisfactorily
D	Minimally Acceptable Performance; Less than the majority but more than the minimum required course objectives achieved; Objectives achieved at a minimally acceptable level

F	Unacceptable Performance; minimum required course objectives not met; objectives not met for minimally acceptable level; no credit earned

(a) A Course in which a student has obtained "D" or a higher grade will be counted as Credits earned by him/her. Any course in which a student has obtained "F" grade will not be counted towards his/her earned credit.

4.3 Grade point Average (GPA) and Cumulative Grade Point Average (CGPA):

4.3.1 GPA Calculation

Grade Point Average (GPA) is the weighted average of the Grade Points obtained by the students in all the courses in the examination of the Semester. For example, if a student passes/ completes, five courses in a semester having credits C1, C2, C3, C4 and C5 and his grade points in these courses are G1, G2, G3, G4 and G5 respectively then –

$$GPA = \frac{\Sigma C_i G_i}{\Sigma C_i} \text{where, i} = 1 \text{ to } 5$$

For example, if a student takes 6 courses in one semester and obtains the following grades –

Course	Credits	Letter Grade	Grade Points
01	4	A+	4.00
02	4	C+	2.50
03	4	A-	3.50
04	2	B-	2.75
05	2	B	3.00
06	2	F	0.00

Then the GPA for the semester, calculated to two digits after decimal point will be –

$$GPA = \frac{4(4.00) + 4(2.50) + 4(3.50) + 2(2.75) + 2(3.00) + 2(0.00)}{(4 + 4 + 4 + 2 + 2 + 2)} = 2.86$$

4.3.2 CGPA Calculation

Cumulative Grade Point Average (CGPA) is the weighted average of the GPA secured over the total number of semesters for a course of studies. We can calculate the CGPA of a student using following formula:

$$CGPA = \frac{\sum_{i=1}^{8}(Grade\ point\ average\ earned\ in\ semester\ i * Total\ credit\ hours\ in\ semester\ i)}{\sum_{i=1}^{8}(\text{Total credit hours in semester i})}$$

For example –

Semester	GPA	Credit
1	4.00	20
2	3.00	30
3	3.50	25
4	3.00	20

The CGPA in this case will be –

$$CGPA = \frac{(20 \times 4) + (30 \times 3) + (25 \times 3.5) + (20 \times 3)}{20 + 30 + 25 + 20} = 3.34$$

4.4 Course Withdrawal: Not Applicable.

4.5 Incomplete (I) Courses: Not Applicable.

4.6 Retake

a) A student who receives an 'F' grade in a course will be required to retake/supplement that course. When a student repeats a course in which he or she previously received an 'F' grade, he or she is not eligible to receive a grade higher than a 'B+' in that repeated course.
b) Marks earned earlier in Midterm / Assessment Examination of such students will be retained. Such students will be required to retake Semester Final Examination only in the failed courses.

4.7 Grade Improvement:

a) If a student obtains a Grade equal to or lower than "B" in a course, he/she will be allowed to repeat the course only once during the following Supplementary Examination but he/she will not be eligible to get a Grade better than "B+" in such a course.
b) If a student fails to improve his Grade then his/her earlier Grade will be retained.
c) If a student likes to improve the Grade earned in a course of 4^{th} year (8^{th} semester), he must apply for such improvement examination before the issuance of transcript. Improvement examination shall not be allowed once the degree is awarded.

4.8 Dropout:

A student must secure at least a GPA of 2.00 in Semester Final Examination for promotion to next higher Semester subject to the condition that he/she has not failed in more than two core courses in Semester. Otherwise, he/she will be considered as detained on that semester.

A Student who (a) is debarred from appearing at the examination due to shortage in class attendance or (b) fails in a Semester Final Examination may seek readmission within two weeks after the announcement of the result of the Semester. The student will have to pay prescribed fees for the Semester and a Readmission Fee as prescribed by the University. After readmission the student has to attend the classes regularly and must obtain 70% attendance from the date of readmission.