Outcome Based Education Curriculum

for

B.Sc. in CSE

Department of Computer Science & Engineering

Pundra University of Science & Technology

Rangpur Road, Gokul, Bogura-5800, Bangladesh

Outcome-based Education Curriculum

Part A

1. Title of the Academic Program**: Bachelor of Science in Computer Science & Engineering (B.Sc. in CSE)**
2. Name of the University: **Pundra University of Science & Technology**
3. Vision of the University:

   The Pundra University of Science & Technology will have a transformative impact on National Development beyond through excellence in higher education and research; will gain national and global recognition attracting scholars from all parts of the world.

4. Mission of the University:
   Pundra University of Science & Technology is working on the following missions:

   i) To advance knowledge and educate students in science, technology, business, liberal arts and other areas scholarships that will best serve the nation and the world.
   ii) To promote learning by engaging students in advancing scholarly inquiry cultivating critical and creative thought, developing entrepreneurial zeal with an aim to develop human potential to its fullest extend so that intellectually capable and imaginatively gifted leaders can emerge to meet challenges and harness opportunities.
   iii) To promote peace through offering show case of culturally rich Pundra Civilization and accepting best cultural values from others.

5. Name of the Program Offering Entity: **Department of Computer Science & Engineering**

6. Vision of the Program Offering Entity:

   The Department believes that student learning is the top priority and we work hard to offer our students a high standard of engineering education to achieve their fullest potential. Our students will develop their technology skills, their individual talents, sharpen their critical thinking and we are working hard to make **Pundra University of Science & Technology**, especially the department of **Computer Science & Engineering** (**CSE**), as the Center of Excellence in Engineering and Technology Education & Research by working with the students in studies as well as in applied research.

7. Mission of the Program Offering Entity

   M1 To provide high quality state of the art education and knowledge in Computer Science and Engineering to produce competent engineers, capable of solving real-world problems to meet the needs of industry and society.

   M2 To contribute towards the creation of new knowledge through eminence research and innovation in CSE and allied fields to address emerging national and global issues for wellbeing of the society.

   M3 Enhance Industry Institute Interaction program to get acquainted with corporate culture.

M4 To enable students in attaining required ethics with an attitude of entrepreneurial skills, ethical values and social consciences.

M5 To embed leadership qualities amongst the students to follow successful professional career paths and to pursue advanced studies in computer engineering and a life-long learner in cutting edge developments in the field of computing and IT.

8. Objectives of the Program Offering Entity:

   To become a prominent department, Computer Science & Engineering is producing skilled and competent professionals in the field of Computer Science & Engineering with research and innovation skills, inculcating high moral values and societal concerns to meet the national and global needs through creative research and innovations. Inspired by the mission of the university, the department of Computer Science and Engineering is striving to create a breed of students who can imagine boldly, think clearly, argue precisely and implement efficiently.

9. Name of the Degree: **Bachelor of Science in Engineering (B.Sc. Engg.)**

10. Description of the Program:

    The Computer Science and Engineering program combines a rigorous education in computer science with added emphasis on the physical and architectural underpinnings of modern computer system design. With a background that spans computer science and computer engineering, our graduates are able to address computing systems across the hardware-software spectrum. The objective of the degree is to produce a well-rounded and well-balanced graduate who can use Computer Science tools to solve real world problems. In designing the course, the requirements of IEEE and standards laid down by American, Canadian, British and Indian universities and institutes have been taken into consideration. The aim of the Department of Computer Science & Engineering (CSE) is to enable innovation through research, advance educational programs in CSE and ICT fields and facilitate enrichment of CSE human resources-the students, faculty and staff, thereby establishing itself as a center of excellence at the national and international level.

11. Graduate Attributes (based on need assessment)

    Attribute 1: Deep discipline knowledge and intellectual breadth.
    Attribute 2: Creative and critical thinking, and problem solving.
    Attribute 3: Teamwork and communication skills.
    Attribute 4: Professionalism and leadership readiness.
    Attribute 5: Intercultural and ethical competency.

12. Program Educational Objectives (PEOs):

    The Computer Science and Engineering undergraduate program educational objectives are that our alumni/ae:

    PEO1. Practice as computing professionals, conducting research and/or leading, designing, developing, or maintaining projects in various technical areas.

    PEO2. Apply the ethical and social aspects of modern computing technology to the design, development, and usage of computing artifacts.

PEO3. Enhance their skills and embrace new computing technologies through self-directed professional development and post-graduate degree and technological research.

13. Program Learning Outcomes (PLOs)

The following Program Outcomes describes the skills imparted by our B.Sc. in Computer Science & Engineering program:

PLO1 **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals to the solution of complex problems of computer and information technology.

PLO2 **Problem analysis:** Identify, formulate, research and analyze complex computer engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PLO3 **Design/development of solutions**: Design solutions for complex computer engineering problems and design system components or processes that meet the specified needs with technological concerns.

PLO4 **Investigation:** Conduct investigations of complex computer science and technology problems, considering experimental design, data analysis and interpretation.

PLO5 **Modern tool usage:** Create, select and apply appropriate techniques, resources and modern computer engineering and ICT tools.

PLO6 **The engineer and society:** Apply reasoning informed by contextual knowledge to develop the computer technologies for society benefits.

PLO7 **Environment and sustainability:** Understand the impact of professional computer engineering solutions in societal and environmental contexts and demonstrate the knowledge for sustainable development.

PLO8 **Ethics:** Apply ethical principles and commit to professional ethics, responsibilities and the norms of the engineering practice.

PLO9 **Individual work and teamwork:** Function effectively as an individual and as a member or leader of diverse teams as well as in multidisciplinary settings.

PLO10 **Communication:** Communicate effectively about complex engineering activities with the engineering community and with society at large. Be able to comprehend and write effective reports, design documentation, make effective presentations and give and receive clear instructions.

PLO11 **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work as a member or a leader of a team to manage projects in multidisciplinary environments.

PLO12 **Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent, life-long learning in the broadest context of technological change.

14. Mapping mission of the university with PEOs

Mission	Program Educational Objectives		
	Mission 1	Mission 2	Mission 3
PEO1	√	√	
PEO2		√	
PEO3	√	√	√

15. Mapping PLOs with the PEOs

	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEO1	√	√	√	√	√		√			√		
PEO2		√					√	√		√	√	
PEO3						√	√		√	√	√	√

16. Mapping courses with the PLOs

Course Code	Program Outcomes											
	PO1	PO2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CSE 1101	√	√	√									
CSE 1102			√		√							
CSE 1103	√	√										
EEE 1101	√	√										
EEE 1102		√	√		√							
MTH 1101	√	√	√									
PHY 1101	√	√	√									
ENG 1101										√		
CE 1102	√		√	√	√				√			
CSE 1201	√	√	√									
CSE 1202	√	√	√									
CSE 1203	√	√	√		√							
CSE 1204			√		√				√			
EEE 1201	√	√	√									
EEE 1202					√		√		√		√	
PHY 1201	√	√	√									
PHY 1202	√	√		√	√				√			
MTH 1201	√	√			√							
BAN 1201										√		
ENG 1202									√	√		
CSE 2101	√	√		√								
CSE 2102		√	√						√			
CSE 2103	√		√									
CSE 2104					√				√			

EEE 2101	√	√	√									
EEE 2102			√	√								
MTH 2101	√	√	√									
CHM 2101	√	√	√				√					
CHM 2102	√	√	√	√					√			
SS 2101	√	√	√					√			√	
CSE 2201	√	√	√	√		√			√			
CSE 2202	√		√		√				√			
CSE 2203	√		√						√			√
CSE 2205	√	√										
CSE 2207	√	√	√									
MTH 2201	√	√										
BUS 2201		√								√	√	
HUM 2201						√		√				
CSE 3100		√	√	√	√				√			
CSE 3102	√		√		√				√			
CSE 3103	√	√										
CSE 3104		√	√		√							
CSE 3105	√	√										
CSE 3106	√		√		√				√			
CSE 3107	√	√										
CSE 3110										√		√
BUS 3101									√	√	√	
HUM 3101						√	√	√				
CSE 3200		√	√		√				√			
CSE 3201		√	√									
CSE 3202			√		√				√			
CSE 3203	√	√	√									
CSE 3204	√	√	√	√	√							
CSE 3205	√		√									
CSE 3206	√	√	√	√	√							
CSE 3207	√	√	√									
LAW 3201	√	√	√									
CSE 3250	√				√	√		√	√			√
CSE 4000(A)		√	√	√					√			
CSE 4101	√	√	√	√								
CSE 4103	√	√	√									
CSE 4104		√	√		√							
CSE 4105	√	√	√									

CSE 4111	√	√	√									
CSE 4113	√	√	√									
CSE 4115	√	√										
CSE 4117	√		√	√								
CSE 4119	√		√									
CSE 4121	√	√										
CSE 4122	√	√	√	√								
CSE 4123	√	√	√									
CSE 4124	√	√	√		√							
CSE 4125	√	√	√									
CSE 4126			√		√				√			
CSE 4127	√		√	√								
CSE 4128	√	√	√	√								
CSE 4000(B)		√		√	√				√		√	√
CSE 4201	√	√	√									
CSE 4202	√		√		√				√			
CSE 4231	√		√									
CSE 4233	√	√	√									
CSE 4235		√	√	√								
CSE 4237	√	√										
CSE 4239	√	√	√	√								
CSE 4241	√	√	√									
CSE 4242		√	√		√				√			
CSE 4243	√	√		√								
CSE 4244	√	√										
CSE 4245	√	√	√									
CSE 4246			√	√	√				√			
CSE 4247	√											
CSE 4248	√		√		√							
CSE 4251	√	√	√									
CSE 4252		√	√		√				√			
CSE 4253	√	√										
CSE 4254	√	√		√	√	√			√			
CSE 4255	√	√	√									
CSE 4256		√	√	√	√							
CSE 4257	√	√										
CSE 4258	√		√									

Part B

17. Structure of the Curriculum

a) Duration of the program: **Years: 04 Semesters: 08**

b) Admission Requirements:

Eligibility of Students for Admission in: The students must fulfill the following requirements:

For Bangladeshi Students

Applicants must have passed SSC (or equivalent) and HSC (or equivalent) examination in science group with minimum 2nd division in both the examinations or five subjects in O-level and three major subjects (Math, Physics and Chemistry) in A-level education are required. The students who have completed SSC and HSC under GPA system will have to have a minimum CGPA of 2.5. The O and A-level students must have an average grade of B. Those having Diploma in the relevant field with equivalent above academic result may be eligible.

For Foreign Students

(1) Educational qualifications like Bangladeshi students/equivalent. [Applicant must have twelve educational years in foreign institution]
(2) Must have security clearance from respective Embassy/High Commission in Bangladesh.

c) Total minimum credits requirement to complete the program: **160.00**

[The total credits have been set to **160 in eight semesters** for the program of B.Sc. Engg. in Computer Science & Engineering in order to achieve Program Educational Objectives as well as to ensure the Program Learning Outcomes. The following credit distribution has been designed from the above perspective and based on these credit distributions; different courses are offered indifferent semester as given below.]

d) Total class weeks in a semester

There are 14 Class weeks in a semester and 28 Class weeks in a year.
e) Minimum CGPA requirements for graduation: **2.50 (Out of 4.00)**

f) Maximum academic years of completion: **06 Year**

g) Category of Courses:

i. **Language Courses:**

Course Code		Course Title	Credits	Credit Hours
BNQF	PUB			
0231	ENG 1101	Technical and Communicative English	3.00	3.00
	ENG 1202	Developing English Skills Sessional	1.00	2.00
0232	BAN 1201	Functional Bengali Language	2.00	2.00
Total			**6.00**	**7.00**

ii. **General Education Courses:**

Course Code		Course Title	Credits	Credit Hours
BNQF	PUB			
0222	HUM 2201	Bangladesh Studies and History of Independence	2.00	2.00
0311	SS 2101	Engineering Economics	2.00	2.00
0223	HUM 3101	Professional Ethics and Environmental Protection	2.00	2.00
0421	LAW 2201	Cyber and Intellectual Property Law	2.00	2.00
0413	BUS 2201	Financial, Cost and Managerial Accounting	3.00	3.00
	BUS 3101	Technology Entrepreneurship for Business	3.00	3.00
Total			**14.00**	**14.00**

iii. **Basic Science Courses:**

Course Code		Course Title	Credits	Credit Hours
BNQF	PUB			
0533	PHY 1101	Physics I	3.00	3.00
	PHY 1201	Physics II	3.00	3.00
	PHY 1202	Physics Sessional	1.00	2.00
0531	CHM 2101	Chemistry	3.00	3.00
	CHM 2102	Chemistry Sessional	1.00	2.00
Total			**11.00**	**13.00**

iv. **Mathematics Courses:**

Course Code		Course Title	Credits	Credit Hours
BNQF	PUB			
0541	MTH 1101	Differential and Integral Calculus and Matrices	3.00	3.00
	MTH 1201	Differential Equations and Transform Mathematics	3.00	3.00
	MTH 2101	Linear Algebra, Vector Analysis and Co-ordinate Geometry	3.00	3.00
0542	MTH 2201	Complex Variable, Probability and Statistics	3.00	3.00
Total			**12.00**	**12.00**

v. Core Courses:

Course Code		Course Title	Credits	Credit Hours
BNQF	PUB			
0612	CSE 2103	Database Management Systems	3.00	3.00
	CSE 2104	Database Management Systems Sessional	1.00	2.00
	CSE 3205	Computer Networks	3.00	3.00
	CSE 3206	Computer Networks Sessional	1.00	2.00
	CSE 4103	Cryptography and Network Security	3.00	3.00
	CSE 4104	Cryptography and Network Security Sessional	1.00	2.00
0613	CSE 1101	Structured Programming Language	3.00	3.00
	CSE 1102	Structured Programming Language Sessional	1.00	2.00

	CSE 1103	Discrete Mathematics	3.00	3.00
	CSE 1201	Data Structures	3.00	3.00
	CSE 1202	Data Structures Sessional	1.00	2.00
	CSE 1203	Object Oriented Programming Language	3.00	3.00
	CSE 1204	Object Oriented Programming Language Sessional	1.00	2.00
	CSE 2101	Design and Analysis of Algorithms	3.00	3.00
	CSE 2102	Design and Analysis of Algorithms Sessional	1.00	2.00
	CSE 2201	Web Engineering	3.00	3.00
	CSE 2202	Web Engineering Sessional	1.00	2.00
	CSE 2203	Software Design Pattern	3.00	3.00
	CSE 2205	Computer Architecture and Organization	3.00	3.00
	CSE 2207	Numerical Methods	2.00	2.00
	CSE 3103	Operating Systems	3.00	3.00
	CSE 3104	Operating Systems Sessional	1.00	2.00
	CSE 3201	Compiler Design	3.00	3.00
	CSE 3202	Compiler Design Sessional	1.00	2.00
	CSE 3207	Mathematical Analysis for Computer Science	3.00	3.00
	CSE 3102	Mobile Application Development Sessional	1.00	2.00
	CSE 4201	Computer Graphics	3.00	3.00
	CSE 4202	Computer Graphics Sessional	1.00	2.00
0619	CSE 3203	Artificial Intelligence	3.00	3.00
	CSE 3204	Artificial Intelligence Sessional	1.00	2.00
	CSE 4101	Data Mining and Warehousing	3.00	3.00
0714	CSE 3105	Microprocessors, Microcontrollers and Embedded Systems	3.00	3.00
	CSE 3106	Microprocessors, Microcontrollers and Embedded Systems Sessional	1.00	2.00
	CSE 3107	Data Communication	3.00	3.00
	CSE 4105	Digital Signal Processing	3.00	3.00
0031	CSE 3110	Technical Writing and Presentation	1.00	2.00
Total			**76.00**	**91.00**

iii. **Others engineering Courses:**

Course Code		Course Title	Credits	Credit Hours
BNQF	**PUB**			
0713	EEE 1101	Basic Electrical Engineering	3.00	3.00
	EEE 1102	Basic Electrical Engineering Sessional	1.00	2.00
	EEE 2101	Electronic Devices and Circuits	3.00	3.00
	EEE 2102	Electronic Devices and Circuits Sessional	1.00	2.00
0714	EEE 1201	Digital Electronics	3.00	3.00
	EEE 1202	Digital Electronics Sessional	1.00	2.00
0732	CE 1102	Engineering Drawing and CAD Sessional	1.00	2.00
Total			**13.00**	**17.00**

iv. **Elective Courses**

Course Code		Course Title	Credits	Credit Hours
BNQF	PUB			
0613	CSE 4115	Software Testing and Quality Assurance	3.00	3.00
	CSE 4119	Blockchain Technology	3.00	3.00
	CSE 4123	Simulation and Modeling	3.00	3.00
	CSE 4124	Simulation and Modeling Sessional	1.00	2.00
	CSE 4125	VLSI Design	3.00	3.00
	CSE 4126	VLSI Design Sessional	1.00	2.00
	CSE 4127	Professional Programming with C#.NET	3.00	3.00
	CSE 4128	Professional Programming with C#.NET Sessional	1.00	2.00
	CSE 4241	Computer Peripherals and Interfacing	3.00	3.00
	CSE 4242	Computer Peripherals and Interfacing Sessional	1.00	2.00
0619	CSE 4111	Cloud Computing	3.00	3.00
	CSE 4117	Basic Graph Theory	3.00	3.00
	CSE 4113	Artificial Neural Networks	3.00	3.00
	CSE 4231	Machine Learning	3.00	3.00
	CSE 4233	Natural Language Processing	3.00	3.00
	CSE 4235	Pattern Recognition	3.00	3.00
	CSE 4237	Bioinformatics	3.00	3.00
	CSE 4239	Big Data Analysis	3.00	3.00
	CSE 4255	Computer Vision	3.00	3.00
	CSE 4256	Computer Vision Sessional	1.00	2.00
	CSE 4245	Digital Image Processing	3.00	3.00
	CSE 4246	Digital Image Processing Sessional	1.00	2.00
	CSE 4121	Optical Fiber Communications	3.00	3.00
	CSE 4122	Optical Fiber Communications Sessional	1.00	2.00
	CSE 4243	Mobile and Wireless Communication	3.00	3.00
	CSE 4244	Mobile and Wireless Communication Sessional	1.00	2.00
	CSE 4247	Real-time Embedded Systems	3.00	3.00
	CSE 4248	Real-time Embedded Systems Sessional	1.00	2.00
	CSE 4251	Robotics	3.00	3.00
	CSE 4252	Robotics Sessional	1.00	2.00
	CSE 4253	Internet of Things	3.00	3.00
	CSE 4254	Internet of Things Sessional	1.00	2.00
	CSE 4257	Wireless Networks	3.00	3.00
	CSE 4258	Wireless Networks Sessional	1.00	2.00
		Total	**72.00**	**84.00**

v. **Capstone course/Internship/Thesis/Projects/Portfolio (as applicable for the discipline/ academic program)**

Course Code		Course Title	Credits	Credit Hours
BNQF	PUB			

0613	CSE 3100	Software Development Project I	1.00	2.00
	CSE 3200	Software Development Project II	1.00	2.00
	CSE 3250	Industrial Training	1.00	4 weeks
	CSE 4000(A)	Thesis / Project	2.00	4.00
	CSE 4000(B)	Thesis / Project	3.00	6.00
Total			**12.00**	**22.00**

18. Year & Semester wise distribution of courses

1st Year 1st Semester courses

Course Code	Course Title	Credit	Credit Hours	Pre-requisite
CSE 1101	Structured Programming Language	3.00	3.00	N/A
CSE 1102	Structured Programming Language Sessional	1.00	2.00	N/A
CSE 1103	Discrete Mathematics	3.00	3.00	N/A
EEE 1101	Basic Electrical Engineering	3.00	3.00	N/A
EEE 1102	Basic Electrical Engineering Sessional	1.00	2.00	N/A
MTH 1101	Differential and Integral Calculus and Matrices	3.00	3.00	N/A
PHY 1101	Physics I	3.00	3.00	N/A
ENG 1101	Technical and Communicative English	3.00	3.00	N/A
CE 1102	Engineering Drawing and CAD Sessional	1.00	2.00	N/A
Total		**21.00**	**24.00**	

1st Year 2nd Semester courses

Course Code	Course Title	Credit	Credit Hours	Pre-requisite
CSE 1201	Data Structures	3.00	3.00	CSE 1103
CSE 1202	Data Structures Sessional	1.00	2.00	CSE 1103
CSE 1203	Object Oriented Programming Language	3.00	3.00	CSE 1101
CSE 1204	Object Oriented Programming Language Sessional	1.00	2.00	CSE 1102
EEE 1201	Digital Electronics	3.00	3.00	EEE 1101
EEE 1202	Digital Electronics Sessional	1.00	2.00	EEE 1102
PHY 1201	Physics II	3.00	3.00	PHY 1101
PHY 1202	Physics Sessional	1.00	2.00	PHY 1101
MTH 1201	Differential Equations and Transform Mathematics	3.00	3.00	MTH 1101
BAN 1201	Functional Bengali Language	2.00	2.00	N/A
ENG 1202	Developing English Skills Sessional	1.00	2.00	ENG 1101
Total		**22.00**	**27.00**	

2nd Year 1st Semester courses

Course Code	Course Title	Credit	Credit Hours	Pre-requisite
CSE 2101	Design and Analysis of Algorithms	3.00	3.00	CSE 1201
CSE 2102	Design and Analysis of Algorithms Sessional	1.00	2.00	CSE 1202
CSE 2103	Database Management Systems	3.00	3.00	N/A
CSE 2104	Database Management Systems Sessional	1.00	2.00	N/A
EEE 2101	Electronic Devices and Circuits	3.00	3.00	EEE 1101
EEE 2102	Electronic Devices and Circuits Sessional	1.00	2.00	EEE 1102
MTH 2101	Linear Algebra, Vector Analysis and Co-ordinate Geometry	3.00	3.00	N/A
CHM 2101	Chemistry	3.00	3.00	N/A
CHM 2102	Chemistry Sessional	1.00	2.00	N/A
SS 2101	Engineering Economics	2.00	2.00	N/A
Total		**21.00**	**25.00**	

2nd Year 2nd Semester courses

Course Code	Course Title	Credit	Credit Hours	Pre-requisite
CSE 2201	Web Engineering	3.00	3.00	N/A
CSE 2202	Web Engineering Sessional	1.00	2.00	N/A
CSE 2203	Software Design Pattern	3.00	3.00	N/A
CSE 2205	Computer Architecture and Organization	3.00	3.00	N/A
CSE 2207	Numerical Methods	2.00	2.00	MTH 1101
MTH 2201	Complex Variable, Probability and Statistics	3.00	3.00	N/A
BUS 2201	Financial, Cost and Managerial Accounting	3.00	3.00	N/A
HUM 2201	Bangladesh Studies and History of Independence	2.00	2.00	N/A
Total		**20.00**	**21.00**	

3rd Year 1st Semester courses

Course Code	Course Title	Credit	Credit Hours	Pre-requisite
CSE 3100	Software Development Project I	1.00	2.00	CSE 2203
CSE 3102	Mobile Application Development Sessional	1.00	2.00	CSE 2203
CSE 3103	Operating Systems	3.00	3.00	N/A
CSE 3104	Operating Systems Sessional	1.00	2.00	N/A
CSE 3105	Microprocessors, Microcontrollers and Embedded Systems	3.00	3.00	N/A
CSE 3106	Microprocessors, Microcontrollers and Embedded Systems Sessional	1.00	2.00	N/A
CSE 3107	Data Communication	3.00	3.00	N/A
CSE 3110	Technical Writing and Presentation	1.00	2.00	N/A
BUS 3101	Technology Entrepreneurship for Business	3.00	3.00	N/A

HUM 3101	Professional Ethics and Environmental Protection	2.00	2.00	N/A
Total		**19.00**	**24.00**	

3rd Year 2nd Semester courses

Course Code	Course Title	Credit	Credit Hours	Pre-requisite
CSE 3200	Software Development Project II	1.00	2.00	CSE 3100
CSE 3201	Compiler Design	3.00	3.00	N/A
CSE 3202	Compiler Design Sessional	1.00	2.00	N/A
CSE 3203	Artificial Intelligence	3.00	3.00	N/A
CSE 3204	Artificial Intelligence Sessional	1.00	2.00	N/A
CSE 3205	Computer Networks	3.00	3.00	CSE 3107
CSE 3206	Computer Networks Sessional	1.00	2.00	CSE 3107
CSE 3207	Mathematical Analysis for Computer Science	3.00	3.00	N/A
LAW 3201	Cyber and Intellectual Property Law	2.00	2.00	N/A
Total		**18.00**	**22.00**	

3rd Year Industrial Training

Course Code	Course Title	Duration	Credit	Pre-requisite
CSE 3250	Industrial Training	4 Weeks	1.00	N/A

4th Year 1st Semester courses

Course Code	Course Title	Credit	Credit Hours	Pre-requisite
CSE 4000(A)	Thesis / Project	2.00	4.00	N/A
CSE 4101	Data Mining and Warehousing	3.00	3.00	N/A
CSE 4103	Cryptography and Network Security	3.00	3.00	N/A
CSE 4104	Cryptography and Network Security Sessional	1.00	2.00	N/A
CSE 4105	Digital Signal Processing	3.00	3.00	N/A
CSE 411X	CSE **Option-I**	3.00	3.00	
CSE 412X	CSE **Option-II**	3.00	3.00	
CSE 413X	CSE **Option-II Sessional**	1.00	2.00	
Total		**19.00**	**23.00**	

Table-I: Option-I

Course Code	Course Title	Credit	Credit Hours	Pre-requisite
CSE 4111	Cloud Computing	3.00	3.00	N/A
CSE 4113	Artificial Neural Networks	3.00	3.00	CSE 3203

CSE 4115	Software Testing and Quality Assurance	3.00	3.00	CSE 2203
CSE 4117	Basic Graph Theory	3.00	3.00	CSE 2101
CSE 4119	Blockchain Technology	3.00	3.00	N/A

Table-II: Option-II and Option-II Sessional

Course Code	Course Title	Credit	Credit Hours	Pre-requisite
CSE 4121	Optical Fiber Communications	3.00	3.00	CSE 3107
CSE 4122	Optical Fiber Communications Sessional	1.00	2.00	CSE 3107
CSE 4123	Simulation and Modeling	3.00	3.00	N/A
CSE 4124	Simulation and Modeling Sessional	1.00	2.00	N/A
CSE 4125	VLSI Design	3.00	3.00	N/A
CSE 4126	VLSI Design Sessional	1.00	2.00	N/A
CSE 4127	Professional Programming with C#.NET	3.00	3.00	CSE 1203
CSE 4128	Professional Programming with C#.NET Sessional	1.00	2.00	CSE 1204

4th Year 2nd Semester courses

Course Code	Course Title	Credit	Credit Hours	Pre-requisite
CSE 4000(B)	Thesis and Project	4.00	8.00	N/A
CSE 4201	Computer Graphics	3.00	3.00	N/A
CSE 4202	Computer Graphics Sessional	1.00	2.00	N/A
CSE 423X	CSE **Option III**	3.00	3.00	
CSE 424X	CSE **Option-IV**	3.00	3.00	
CSE 424X	CSE **Option-IV** Sessional	1.00	2.00	
CSE 425X	CSE **Option-V**	3.00	3.00	
CSE 425X	CSE **Option-V** Sessional	1.00	2.00	
Total		**19.00**	**26.00**	

Table-III: Option-III

Course Code	Course Title	Credit	Credit Hours	Pre-requisite
CSE 4231	Machine Learning	3.00	3.00	CSE 4101
CSE 4233	Natural Language Processing	3.00	3.00	CSE 3203
CSE 4235	Pattern Recognition	3.00	3.00	CSE 4101
CSE 4237	Bioinformatics	3.00	3.00	N/A
CSE 4239	Big Data Analysis	3.00	3.00	CSE 4101

Table-IV: Option-IV and Option-IV Sessional

Course Code	Course Title	Credit	Credit Hours	Pre-requisite
CSE 4241	Computer Peripherals and Interfacing	3.00	3.00	CSE 3105
CSE 4242	Computer Peripherals and Interfacing Sessional	1.00	2.00	CSE 3106
CSE 4243	Mobile and Wireless Communication	3.00	3.00	N/A
CSE 4244	Mobile and Wireless Communication Sessional	1.00	2.00	N/A
CSE 4245	Digital Image Processing	3.00	3.00	CSE 4105
CSE 4246	Digital Image Processing Sessional	1.00	2.00	CSE 4105
CSE 4247	Real-time Embedded Systems	3.00	3.00	CSE 3105
CSE 4248	Real-time Embedded Systems Sessional	1.00	2.00	CSE 3106

Table-V: Option-V and Option-V Sessional

Course Code	Course Title	Credit	Credit Hours	Pre-requisite
CSE 4251	Robotics	3.00	3.00	CSE 3203
CSE 4252	Robotics Sessional	1.00	2.00	CSE 3204
CSE 4253	Internet of Things	3.00	3.00	N/A
CSE 4254	Internet of Things Sessional	1.00	2.00	N/A
CSE 4255	Computer Vision	3.00	3.00	N/A
CSE 4256	Computer Vision Sessional	1.00	2.00	N/A
CSE 4257	Wireless Networks	3.00	3.00	N/A
CSE 4258	Wireless Networks Sessional	1.00	2.00	N/A

Summary

Year & Semester	Credits	Credit Hours	No. of Courses
1st Year 1st Semester	21.00	24.00	9.00
1st Year 2nd Semester	22.00	27.00	11.00
2nd Year 1st Semester	21.00	25.00	10.00
2nd Year 2nd Semester	20.00	21.00	8.00
3rd Year 1st Semester	19.00	24.00	10.00
3rd Year 2nd Semester	19.00	22.00	10.00
4th Year 1st Semester	19.00	23.00	8.00
4th Year 2nd Semester	19.00	26.00	8.00
Total	**160.00**	**192.00**	**74.00**

Part C

9. Description of all courses of the program including the following information for each course:

Course Code:	Course Title:	Credits:
CSE 1101	**Structured Programming Language**	**3.00**

Rationale of the Course: This course is offered to introduce students with the algorithmic way of thinking and problem solving by programming language.
Course Learning Outcomes: At the end of the course, the student will be able to –

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Synthesize** fundamental programming concepts using high- level programming language to solve problems.
CLO2	**Analyze** the fundamental principles, typical characteristics and mechanisms of a structured programming language**.**
CLO3	**Develop** basic programming skills with respect to program design and development.

Course Content:

Structured Programming Language fundamentals: C overviews, History and Features, Basic Structure of C Program and Hello World Program, C Program Development Environment.

Variables, Constants, Data Types, and Operators & Expression: Declaring variables and assigning values, input from keyboard, add comments, Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operators, Bitwise Operators, Special Operators, Arithmetic Expressions, Evaluation of Expressions, Type Conversions in Expressions, Operator Precedence and Associativity.

Program control statements: Decision Making Statements: if-else statement, switch statement; Looping Statements: for loop, while loop, nested if, do while loop, nested loop; Jump Statements: continue, break

Functions: Function prototype, recursion, parameters, arguments, scope rules and storage classes.

Arrays and Pointer: One and Multi-dimensional arrays, Character Arrays and Strings, Basic of Pointer, pointer expression, pointer arrays.

User defined data types and Input/ Output: Structures, Unions, Enumerations, Standard input and output, formatted input and output, File access; Variable length argument list; Command line parameters; Error Handling; Graphics; Linking; Library functions.

Memory manipulation and Preprocessor: Dynamic Memory Allocation and Linked List, Macro substitution, File inclusion, Compiler Control Directives.
Mapping of Course Learning Outcomes (CLOs) with the Program Learning Outcomes (PLOs):

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√	√										
CLO2		√										
CLO3			√									

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Web Material	• Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Web Material	• Presentation • Final Exam • Participation
CLO4	• Lecture Note • Text Book • Web Material	• Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

Text Book:

1. Steven Prata : **C Primer Plus,** *Addison-Wesley Professional*

Books Recommended:

1. Herbert Schildt : **Tech Yourself,** *McGraw-Hill Osborne Media*

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Course Code:	Course Title:	Credits:
CSE 1102	**Structured Programming Language Sessional**	**1.00**

Rationale of the Course: This course is offered for the students to achieve hands on experience on basic programming.

Course Learning Outcomes: At the end of the course, the student will be able to –

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Design** computer programs in a structured way.
CLO2	**Apply** practical knowledge to develop basic programming skills with respect to program design and development.
CLO3	Practically **analyze** the fundamental principles, typical characteristics and mechanisms of a structured programming language

Course Content: Based on theory for course code: **CSE 1101 &** Course Title: **Structured Programming Language**

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1			√									
CLO2					√							
CLO3			√		√							

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Lab Manual	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Lab Manual	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Lab Manual	• Lab Test • Lab Report • Viva • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Lab Attendance & Performance	**10%**
Continuous Assessment (Experiment, Report & Viva)	**40%**
Final Exam (Lab Test, Viva & Project)	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final Exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

Books Recommended:

1 Herbert Schidlt : Teach Yourself C
2. E Balagurusamy : Programming in Ansi C
3. Herbert Schildt : The Complete Reference C
4. Dennis M. Ritche : C Programming Language
5. Md Kamruzzaman Niton : Sober Jonno Computer Programming Language C

* * * * *

Course Code:	Course Title:	Credits:
CSE 1103	**Discrete Mathematics**	**3.00**

Rationale of the Course: To introduce the basic elements of discrete mathematics which develop the basics knowledge and provide a foundation for an understanding of algorithms and data structures those used in computing.

Course Learning Outcomes: At the end of the course, the student will be able to –

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Evaluate** basic logic statements, proposition and predicate logic, rules of inference, methods of proof and mathematical induction
CLO2	**Explain** set theory, functions, binary relations, algebraic structure and Boolean algebra
CLO3	**Analyze** sequence and counting problems and problems which require computation of permutations and combinations of a set
CLO4	**Solve** various problems associated with graph & trees data structure

Course Content:

Mathematical Logics: Logic and Proofs; connectives; normal Forms; theory of inference for proposition calculus; predicate calculus; inference theory of predicate calculus; method of proof; mathematical induction.

Sets & Functions: Basic concept of set theory; operation of sets; ordered pairs and n-tuples; function definitions; composition of function, inverse function, binary and array operation.

Relation and ordering: Relations; properties of Binary relation in a set; composition of binary relation; relation matrix and graph of a relation; partial ordered set; external element of P.O. set; lattice; path in relation and di-graph.

Counting: Basic principles of counting; sequences; Fibonacci; Eullerian; Bernoulli numbers; permutations; combinations; Pascal's triangle.

Graph: Introduction to graph, graph terminology; representing graph; graph isomorphism; paths; reachability; connectivity; Euler and Hamilton path; shortest path problems; graph colouring; matrix representation of graph.

Trees: Introduction of trees; application of trees; tree traversal; labeling trees; trees and sorting; spanning trees; minimal spanning tree; undirected trees.

Algebraic structure: Algebraic system- general properties, some simple algebraic system; Boolean algebra- function on Boolean algebra, Boolean function as Boolean polynomial; ring; semi ring; module; semi-module; homomorphism of semi-groups and monoid; Grammars and languages; product and quotients of group.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3		√										
CLO4		√										

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Audio/Video	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book	• Final Exam • Presentation • Participation
CLO3	• Lecture Note • Text Book	• Assignment • Final Exam • Participation
CLO4	• Lecture Note • Text Book • Audio/Video • Web Material	• Class Test • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. Kenneth H. Rosen : Discrete Mathematics and Its Applications, McGraw-Hill.
ii. Seymour Lipschutz : Theory and Problems of Discrete Mathematics, Schaum's Outline Series, McGraw-Hill

2) Reference Books:

i. J. P. Tremblay and R. Manohar : Discrete Mathematics structures with applications to Computer Science, Mc-Graw Hill
ii. C.L. Liu : Elements of Discrete Mathematics, McGraw-Hill.
iii. 5 Bernard Kolman, Robert Busby, Sharon C. Ross : Discrete Mathematical Structures, Prentice Hall

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Course Code:	Course Title:	Credits:
EEE 1101	**Basic Electrical Engineering**	3.00

Rationale of the Course: To know basic Electrical and Magnetic laws required to understand computer hardware.

Course Learning Outcomes: At the end of the course, the student will be able to –

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Identify** different types of electrical and magnetic phenomena
CLO2	**Apply** the Gauss's, Kirchhoff's, Faraday's and Ampere's law to solve different types of electrical problems
CLO3	**Explain** different types of filters and network theorems

Course Content:
Electrostatics: Electric dipole; electric field due to a dipole; dipole on external electric field; Gauss's Law and its applications.

Capacitors: Parallel plate capacitors with dielectric; dielectrics and Gauss's Law; susceptibility, permeability, and dielectric constant; energy stored in an electric field. Electric Current: Electron theory of conductivity; conductor, semiconductors and insulators; superconductors, current and current density; Kirchhoff's Law and its applications.

Electromagnetic Induction: Faraday's experiment, Faraday's law, Ampere's law, motional e.m.f., self and mutual inductance, galvanometers - moving coil, ballistic and deadbeat types.

Networks Analysis: Kirchhoff's laws; 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.

DC and AC Circuits: D.C. circuits with LR, RC, and LCR in series; A.C. circuits with LR, RC, LC, and LCR in series.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3	√											

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book	• Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video	• Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. Tocci : Digital System, Pearson
ii. William H. Gothman : Digital Electronics, Prentice Hall

2) Reference Books:

i. M. Morris Mano : Digital Logic and Computer Design, *Prentice Hall*
ii. William H. : Digital Electronics**,** *Prentice Hall*

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Course Code:	Course Title:	Credits:
EEE 1102	**Basic Electrical Engineering Sessional**	**1.00**

Rationale of the Course: To perform several experiments to verify practically the theories and concepts learned and understand the difference between theory and application.

Course Learning Outcomes: At the end of the course, the student will be able to –

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Develop** circuit models for elementary electrical components, e.g. resistors, sources, inductors, capacitors etc.
CLO2	**Generate** sine, square and triangular waveforms with required frequency and amplitude using function generator.
CLO3	**Apply** various methods of circuit analysis both for DC and AC networks and their solution methods.

Course Content: Based on theory for course code: **EEE 1101 &** Course Title: **Basic Electrical Engineering**

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1			√									
CLO2			√									
CLO3		√			√							

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video • Lab Manual	• Lab Test • Lab Report • Viva • Final Exam

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Lab Attendance & Performance	**10%**
Continuous Assessment (Experiment, Report & Viva)	**40%**
Final Exam (Lab Test, Viva & Project)	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final Exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i.	Tocci	:	Digital System, Pearson
ii.	William H. Gothman	:	Digital Electronics, Prentice Hall

2) Reference Books:

i.	M. Morris Mano	:	Digital Logic and Computer Design, *Prentice Hall*
ii.	William H.	:	Digital Electronics**,** *Prentice Hall*

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Course Code:	Course Title:	Credits:
MTH 1101	**Differential and Integral Calculus and Matrices**	**3.00**

Rationale of the Course: Familiarize students with introductory calculus and Matrices.

Course Learning Outcomes: At the end of the course, the student will be able to –

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Utilize** the concept of a function, limits and continuity in order to solve the limiting value problem
CLO2	**Apply** different methods for solving ordinary and partial differentiation
CLO3	**Design** the integral of definite and indefinite forms and different matrices

Course Content:
Functions: Domain, Range, Inverse function and graphs of functions, Composition of function; Limits; Continuity and Indeterminate form.

Ordinary Differentiation: Differentiability, Differentiation, Successive differentiation and Leibnitz Theorem.

Expansions of functions: Rolle's Theorem; Mean value theorem; Taylor's and McLaurin's formulae.

Maximum and Minimum function of one variable.

Partial Differentiation: Euler's theorem; Tangents and normal; Asymptotes.

Indefinite Integrals: Method of substitution, Integration by parts, Special trigonometric functions and rational fractions.

Definite Integrals: Fundamental theorem; General properties; Evaluations of definite integrals and reduction formulas.

Application of the Definite Integral: Determination of lengths; Areas and Volumes; Area between Curves; Arc Length and Surface Area.

Algebra of Matrices: Some basic definition of matrix; Properties of matrix; Algebra of matrices; Multiplication of matrices; Crammer's Rule.

Elementary Transformations: Adjoint of matrix, Properties of on adjoint of two matrices, Inverse of matrices; Find inverse by adjoint and Elementary row transformations.

System of Linear Equations: Rank of matrix, Find rank of matrices by determinates method; Echelon forms and Canonical forms, Linear equations, Solution of a system of linear equations.

Characteristic Equation: Eigen values, Eigenvectors and Caley-Hamilton theorem.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√	√										
CLO2		√										
CLO3	√		√									

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Audio/Video	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Web Material	• Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video	• Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
    a. Continuous Assessment: **50%**
    b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i.	Gilbert Strang	:	**Calculus**, *Wellesley-Cambridge Press*.
ii.	B. C. Das and B.N. Mukherjee	:	**Differential Calculus**, *U. N. Dhur & Sons*
iii.	M. L. Khanna	:	**Matrices**

2) Reference Books:

i.	Howard Hinton	:	**Calculas - A New Horizon**, *John Wiley & Sons Inc.*
ii.	F. Ayres and Elliot Mendelson	:	**Calculus (Schaum's Outline Series)**, *McGraw-Hill*
iii.	Joseph Edwards	:	**Differential Calculus**, *Kessinger Publishing*
iv.	P. N. Chatterjee	:	Matrices

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Course Code:	Course Title:	Credits:
PHY 1101	**Physics I**	**3.00**

Rationale of the Course: This course is planned to extend the basic physics in the field of mechanics, vibrations and waves, optics and thermodynamics. The different laws, explanation of laws and derivation regarding the course will be introduced. Applications of different laws will be studied.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Explain** different parameters, laws and theories related to mechanics, vibrations and waves, optics and thermodynamics.
CLO2	**Analyze** different laws and theories to practical applications.
CLO3	**Solve** different problems associated with mechanics, vibrations and waves, optics and thermodynamics.

Course Content:

Kinematics: Rest and Motion, Inertia and Force, Conservative and Non-conservative Forces, Conservation of Momentum, Collision Problems.

Rotational Dynamics: Torque and Angular Momentum, Kinetic Energy of Rotation and Rotational Inertia, Parallel and Perpendicular Axes Theorems, Calculation of Moment of Inertia of Solids of Different Shapes.

Gravitation: Gravitation and Gravity, Newton's Law of gravitation, Acceleration due to Gravity and its Variation, Centre of Gravity and Centre of Mass, Gravitational Field and Potential, Kepler's Laws, Escape Velocity, Motion of Artificial Satellite, Geostatic Satellite, Black Hole.

Mechanics of Elastic Media: Elasticity, Hooke's Law, Elastic Constants and their Relationships, Poisson's ratio, Theory of Bending Beams, Torsion of Cylinder.

Ideal Gas: Concept of Temperature and Pressure, Ideal Gas and its Equation, Kinetic Theory of Gas, Pressure Exerted by a Gas on the Basis of Kinetic Theory, Brownian motion, Mean Free Path.

Thermodynamic Fundamentals: Thermodynamics system and surrounding, Thermodynamic

Equilibrium, Zeroth Law of Thermodynamics, Isothermal, Adiabatic, Reversible and Irreversible Process, Heat and Work, Internal Energy.

Laws of Thermodynamics: First Law of Thermodynamics, Specific Heats of Gas, Carnot's Cycle, Carnot's Heat Engine and its Efficiency, Second Law of Thermodynamics, Carnot's Theorem, Concept of Entropy, Third Law of Thermodynamics.

Vibration: Harmonic Motion, Basic Terms of Vibration, Types of Vibration and their equation of motion, Plasma Vibration.
Wave: Wave Motion, Types of Waves, Wave Equation and Solution, Progressive and Stationary Waves, Doppler's Effect.

Light: Nature of Light, Electromagnetic Spectrum and Energy, Huygens Principle, Fermat's Principle.

Interference: Superposition of Waves, Concept of Coherence, Mathematical Treatment of Interference, Young's Experiment, Newton's Rings.

Diffraction: Mathematical Treatment of Diffraction, Types of Diffraction, Single and Double Slits Diffraction, Diffraction Grating.

Polarization: Polarized and Unpolarized Light, Types of Polarization, Brewster's law, Malus law, Production and Detection of Polarization, Nichol Prism, Optical Activity, Polarimeter.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√	√									
CLO3		√	√									

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Assignment • Presentation
CLO2	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Assignment
CLO3	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Assignment

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. D. Halliday and R. Resnic : Physics Volume -I
ii. Dr. G. Ahmad : Physics for Engineering Volume I

2) Reference Books:

i. N. Subramanyan and Brizlal : A Text book of Sound, Heat and Optics
ii. N. Subramanyan and Brizlal : Properties of Matter

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Course Code:	Course Title:	Credits:
ENG 1101	**Technical and Communicative English**	**3.00**

Rationale of the Course: To introduce English to the Bangla speaking students studying for a Bachelor's degree. There is an equal emphasis on spoken and written English. The focus of the course is on making students able to hold effective conversations in English. The students will also learn the basic use of English in handling official documents which are usually required in any professional environment.

Course Learning Outcome (CLO): At the end of the course, the students will be able to –

CLO No.	Course Learning Outcomes (CLO) Statements
CLO1	**Apply** the structure and style of effective sentences, paragraphs, and essays.
CLO2	**Formulate** their skills as communicators
CLO3	**Demonstrate** their skills as critical readers and thinkers.

Course Content:

Grammar: Parts of Speech, Verb, Phrases, Clauses, Sentence Analysis, Voice, Narration

Reading: Passage Reading, Seen Comprehension, Inference, Short Stories

Writing: Professional Writing: Application, CV, Memo, Notice), Paragraph Writing, Letter Writing

Speaking: Initiating Conversation, Formal vs Informal Conversation, Making Effective Conversations, Fluency

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1										√		
CLO2										√		
CLO3										√		

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Assignment • Presentation
CLO3	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Assignment

Assessment and Evaluation

1) Assessment Strategy

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final Exam	**50%**

2) Marks Distribution
    a. Continuous Assessment: **50%**
    b. Final Exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. Wren and Martin : *High School Grammar*
ii. R. Murphy : *Intermediate English Grammar*

2) Reference Books:

i. A S Hornby : *Oxford Advanced Learner's Dictionary of Current English*

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Course Code:	Course Title:	Credits:
CE 1102	**Engineering Drawing and CAD Sessional**	**1.00**

Rationale of the Course: To develop basics knowledge on Engineering Drawing.

Course Learning Outcomes: At the end of the course, the student will be able to –

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Identify** the drawing instruments & how to draw an engineering drawing.
CLO2	**Design** the plan, section, elevation, views.
CLO3	**Analyze** the different way to any engineering drawing.

Course Content:

Introduction: Lettering, numbering and heading.

Plane geometry: Pentagon, hexagon, octagon, ellipse, parabola, hyperbola.

Projection (Solid Geometry): Cube, triangular prism, square prism, pentagonal prism, hexagonal prism, cone and cylinder.

Development: Cube, pyramid, cone and prism. Section and true shape: cube, pyramid, cone prism.

Isometric drawing: Cube, pyramid and cone. Oblique drawing: cube, pyramid and cone.

Interpretation of solids: Plan, elevation and section of single-storied buildings.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√				√							
CLO2				√								
CLO3			√						√			

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Audio/Video	• Lab Test • Lab Report • Viva

	• Lab Manual • Web Material	• Final Exam • Participation
CLO2	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video • Lab Manual	• Lab Test • Lab Report • Viva • Final Exam

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Lab Attendance & Performance	**10%**
Continuous Assessment (Experiment, Report & Viva)	**40%**
Final Exam (Lab Test, Viva & Project)	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final Exam: **50%**

3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. B.N. Ghose : Civil engineering drawing

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Course Code:	Course Title:	Credits:
CSE 1201	**Data Structures**	**3.00**

Rationale of the Course: To learn and familiarize the various data structures as well as to be able to design various data model in computer.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Define** basic static and dynamic data structures and relevant standard algorithms for them.
CLO2	**Apply** different types of data structures in order to solve problems effectively.
CLO3	**Analyze** suitable and effective algorithm for solving certain problem.

Course Content:

Introduction: Data types and data structures, Data structure operations, Introduction to algorithms, Performance analysis.

Arrays, Records and Pointer: Linear arrays, Relationships of arrays, Operation on arrays, Multidimensional arrays, Pointer arrays, Record structures, Representation of records, sparse matrices.

Linked List: Linked lists, Representation of linked list, Traversing and searching a linked list, doubly linked list and dynamic storage management, generalized list, Garbage collection and compaction.

Stacks, Queues and Recursion: Fundamentals, Different types of stacks and queues: Circular, Dequeues, etc., Evaluation of expressions, Recursion, Direct and indirect recursion, Depth of recursion, Implementation of recursive procedures by stacks.

Trees and Graphs: Basic terminology, binary trees, binary tree representation, tree traversal, extended binary tree, Huffman codes/algorithm, graphs, graph representation, shortest path and transitive closure, traversing a graph.

Sorting and Searching: Sorting, insertion sort, shell sort, heap sort, radix sort, general method of divide and conquer method, merge sort, quick sort, selection sort, binary search.

Symbol Tables: Static tree tables, dynamic tree tables, hash tables overflow handling, theoretical evaluation of overflow techniques.

Dynamic Programming: The general method, multistage graphs, all pairs shortest paths, single source shortest paths problems.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√	√									
CLO3	√	√										

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book	• Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video	• Presentation • Final Exam • Participation

Assessment and Evaluation

Assessment Strategy

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final Exam	**50%**

1) Marks Distribution
    a. Continuous Assessment: **50%**
    b. Final Exam: **50%**
2) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. S Lipschutz : Theory and Problems of Data Structures

2) Reference Books:

i. E. Horowitz and S. Sahni **:** Fundamentals of Data Structures
ii. E. Horowitz and S. Sahni **:** Computer Algorithm

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Course Code:	Course Title:	Credits:
CSE 1202	**Data Structures Sessional**	**1.00**

Rationale of the Course: To develop basics knowledge on Data Structures.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Select** basic data structures and algorithms for autonomous realization of simple programs or program parts.
CLO2	**Determine** and **Demonstrate** bugs in program, recognize needed basic operations with data structures.
CLO3	**Formulate** new solutions for programming problems or improve existing code using learned algorithms and data structures.

Course Content: Based on theory for course Code: **CSE 1201 &** Course Title: **Data Structures.**

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√	√										
CLO3	√	√	√									

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video • Lab Manual	• Lab Test • Lab Report • Viva • Final Exam

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Course Code:	Course Title:	Credits:
CSE 1203	**Object Oriented Programming Language**	**3.00**

Rationale of the Course: Introduce how to design a computer program by making them out of objects that interact with one another.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Identify** classes, objects, members of a class and relationships among them needed for a specific problem
CLO2	**Create** Java application programs using OOP principles and maintaining programs with proper program structure
CLO3	**Evaluate** user requirements for software functionality required to decide whether the Java programming language can meet user requirements
CLO4	**Apply** object-oriented design patterns in solving OOP problems.

Course Content:

Introduction: Object Oriented Programming concepts; OOP features; importance of OOP; concept of objects and classes; java as OOP language; typical java development environment; program structures

in java; memory concepts; Object Oriented modeling; unified modeling language (UML).

Language Fundamentals: Packages; identifiers; variables; data types; operators; keywords; arrays; strings; control structures; java API packages.

Principles of OOPS: OOPS paradigms; objects; correspondence between software objects and real-world objects; classes; concept of class hierarchies; data abstraction; data encapsulation and data hiding; inheritance; polymorphism; method overloading; method overriding; dynamic binding; message passing; constructors; this and super; abstract classes and methods; interfaces.

Exception Handling: Introduction; syntax of exception handling; exception handling mechanism; concept of throw & throws.

Multithreaded Programming-Creating threads; stopping and blocking a thread; life cycle of a thread; using thread methods; thread priority; synchronization; implementing the runnable interface.

Stream Classes: Stream classes; java I/O; files and streams; java input/output stream class hierarchy; using the file class, creation of files; random access file; other stream classes.

GUI Programming: The design principles of graphical user interfaces (GUIs); GUI events; user interactions with GUIs; mouse events and keyboard events; layout managers to arrange GUI components.

Design Patterns: Overview; common design patterns -singleton, factory and abstract factory, builder, adapter, iterator, observer, strategy patterns.

Graphics and Event Handling: AWT; swing; event-driven programming; components and containers, layout managers and menus, applet programming.

Java Networking: Network basics, socket programming, proxy servers, net address, url, datagrams.

Advanced Topics: Introduction to java Beans; java servlets; database connectivity with java.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2					√							
CLO3		√										
CLO4	√		√									

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Presentation • Final Exam

	• Audio/Video	• Participation
CLO2	• Lecture Note • Text Book • Web Material • Audio/Video	• Final Exam • Class Test • Presentation • Participation
CLO3	• Lecture Note • Text Book • Web Material • Audio/Video	• Assignment • Final Exam • Participation
CLO4	• Lecture Note • Text Book • Web Material • Audio/Video	• Class Test • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	**(100%)**
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. Herbert Schildt : Java: The Complete Reference, Oracle Press

2) Reference Books:

i. Vaskaran Sarcar : Java Design Patterns, Press

ii. Deitel and Deitel : Java How to program

iii. H. Schildt : Teach Yourself Java, McGraw-Hill.

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Course Code:	Course Title:	Credits:
CSE 1204	**Object Oriented Programming Language Sessional**	**1.00**

Rationale of the Course: To be able to write code in object-oriented manner and apply various OOP concepts and OOP based software development methodologies to solve real world problems

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Implement** the concept of OOP with a pure object-oriented programming language (Java).
CLO2	**Design** a computer program to solve real world problems in object-oriented manner
CLO3	**Develop** complete real world software solution by group or team works.

Course Content:

Based on theory for course Code: **CSE 1203 &** Course Title: **Object Oriented Programming Language.**

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1					√							
CLO2			√									
CLO3									√			

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Text Book • Lab Manual • Web Material • Audio/Video	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO2	• Text Book • Lab Manual • Web Material • Audio/Video	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO3	• Text Book • Lab Manual • Web Material • Audio/Video	• Lab Test • Lab Report • Viva • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Lab Attendance & Performance	**10%**
Continuous Assessment (Experiment, Report & Viva)	**40%**
Final Exam (Lab Test, Viva & Project)	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final Exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1)) Text Book:

i. Herbert Schildt : Java: The Complete Reference, Oracle Press

2) Reference Books:

i. Vaskaran Sarcar : Java Design Patterns, Press
ii. Deitel and Deitel : Java How to program
iii. H. Schildt : Teach Yourself Java, McGraw-Hill.

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Course Code:	Course Title:	Credits:
EEE 1201	**Digital Electronics**	**3.00**

Rationale of the Course: To learn and familiarize the basic logic gates as well as to be able to design various combinational and sequential circuits using logic gates.

Course Learning Outcomes: At the end of the course, the student will be able to –

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Identify** the structure of various number systems and its application in digital design.
CLO2	**Design** various combinational and sequential circuits.
CLO3	**Analyze** the memory elements, state table and state diagrams of the sequential circuit.

Course Content:
Number system and Codes: General way of representing numbers: Decimal, binary, octal and hexadecimal number systems and their representation; Conversion of number from one system to another; Compliment in number system.

Different Codes: BCD, Alphanumeric, Gray, Excess-3, ASCII and error detection codes.

Digital Logic: Boolean algebra; De-Morgan's Theorem; Logic gates and their truth tables; Canonical form of logic expression, Simplification of logic expression: Algebraic method, K-Map and Quine-Mc Clauskey method; Realization by using NAND/NOR gates.

Classification of logic systems: Combinational logic system: Combinational logic design using MSI & LSI. Adders, sub-tractors, Code Converters: Magnitude Comparator, Encoder, Decoder, Multiplexer, De-multiplexer; ROM, RAM, Programmable logic, Array (PLA), D/A and A/D converters with applications; Different types of digital storage media.

Sequential logic system: Flip-Flops: Clocked RS, JK, Master Slave JK, D-type, T-type Flip-Flops; Flip-Flop Design.

Sequential logic Registers: Different types of Registers and their application; Counters and their simplified design.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2			√									
CLO3		√										

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Audio/Video • Web Material	• Class Test • Mid-term Exam • Final Exam
CLO2	• Lecture Note • Text Book • Audio/Video • Web Material	• Assignment • Mid-term Exam • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video • Web Material	• Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**

Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. Tocci : Digital System, Pearson

ii. William H. Gothman : Digital Electronics, Prentice Hall

2) Reference Books:

i. M. Morris Mano : Digital Logic and Computer Design, *Prentice Hall*
ii. William H. : Digital Electronics**,** *Prentice Hall*

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Course Code:	Course Title:	Credits:
EEE1202	**Digital Electronics Sessional**	**1.00**

Rationale of the Course: To develop basics knowledge on Introduction to Digital Electronics.

Course Learning Outcomes: At the end of the course, the student will be able to –

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Apply** the knowledge of basic digital electronic circuits practically.
CLO2	**Design** different circuits with ICs and microprocessor to use for our day-to-day necessities.
CLO3	**Analyze** the necessity and utilization of different types of logic and sequential circuits for real problems.

Course Content: Based on theory for course Code: **EEE 1201 &** Course Title: **Digital Electronics.**

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1					√							
CLO2									√		√	

CLO3							√					

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Text Book • Lab Manual • Web Material	• Lab Attendance • Lab Performance • Lab Report • Final Exam
CLO2	• Lecture Note • Text Book • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Mid-term Exam • Final Exam
CLO3	• Lecture Note • Text Book • Audio/Video • Lab Manual	• Lab Test • Lab Report • Viva • Final Exam

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Lab Attendance & Performance	**10%**
Continuous Assessment (Experiment, Report & Viva)	**40%**
Final Exam (Lab Test, Viva & Project)	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. Tocci : Digital System, Pearson

ii. William H. Gothman : Digital Electronics, Prentice Hall

2) Reference Books:

i. M. Morris Mano : Digital Logic and Computer Design, *Prentice Hall*
ii. William H. : Digital Electronics**,** *Prentice Hall*

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Course Code:	Course Title:	Credits:
PHY 1201	**Physics II**	**3.00**

Rationale of the Course: This course is planned to extend the basic physics in the field of electricity and magnetism, nuclear and modern physics and quantum mechanics. The different laws, explanation of laws and derivation regarding the course will be introduced. Applications of different laws will be studied.

Course Learning Outcomes: At the end of the course, the student will be able to –

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Explain** different parameters, laws and theories related to electricity and magnetism, nuclear and modern physics and quantum mechanics.
CLO2	**Analyze** different laws and theories to practical applications.
CLO3	**Solve** different problems associated with electricity and magnetism, nuclear and modern physics and quantum mechanics.

Course Content:

Electrostatics: Electric Charge; Coulomb's Law; Electric Field; Electric Potential; Gauss's Law and its Applications; Electric Dipole and Quadrupole; Dielectric Material; Capacitor.

Electric Current: Ohm's Law; Current Density; Conductivity; Resistivity; Kirchhoff's Law and their Applications.

Electromagnetic Induction: Faraday's Law; Lentz's Law; Self and mutual induction; Solenoids.

Magnetic Effects of Current and Magnetism: Oersted's Experiment; Magnetic Field; Biot- Savart's Law; Ampere's Law and its Applications; Lorentz's Force Law; Magnetic Force on Charge and Current; Magnetism of Different Magnetic Substances.

Alternating Current: Generation of AC; Peak, Mean, RMS and Effective Value of AC.
Maxwell's Field Equations: Maxwell's Equations; Pointing Vector; Scalar and Vector Potential; Wave Equations.

Atomic Models: Thomson Atom Model; Rutherford Nuclear Atom Model; Bohr Atom Model; Sommerfeld Relativistic Atom Model.

Wave-Particle Duality: Photoelectric Effect; Einstein's Photoelectric Equation and its Experimental Verification; Compton Effect; Electron-Positron Pair Production and Annihilation. de Broglie Waves; Experimental Verification of Particle Waves, Production and properties of X-Rays.

The Nucleus: Constitute of Nuclei; Nuclear Mass and Density; Nuclear Size; Mass Defect; Binding Energy; Nucleon Separation Energy; Nuclear Force; Mirror Nuclei.

Radioactivity: Radioactive Decay Law; Half-Life and Mean-Life; Secular and Transient Equilibrium, Units of Radioactivity; Alpha, Beta and Gamma Decays; Artificial Radioactivity; Uses of Radioisotopes.

Nuclear Reaction: Different Types of Nuclear Reactions; Conservation of Physical Quantities in Nuclear

Reactions; Q-value of Reaction; Cross-Section; Nuclear Fission and Fusion, Nuclear Reactor.

Structure of Matter: Classification of solids, lattice, unit cell, basis, crystal system, packing fraction, interplanar spacing, Miller indices, Bragg's law, different types of bonds in solids, Insulator; Semiconductor; Conductor; Band Theory of Solids; Superconductor.

Quantum Mechanics: Wave function, uncertainty principle, postulates, Schrodinger's time dependent and time independent wave equation.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√	√									
CLO3		√	√									

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Assignment • Presentation
CLO2	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Assignment
CLO3	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Assignment

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. D. Halliday and R. Resnick : Physics Volume-II
ii. Baiser : Concept of Modern Physics

2) Reference Books:

i. Haque, Roy and Rofiqullah : Concepts of Electricity and Magnetism.
ii. N. Subrahmanyam and Brizlal : Atomic and Nuclear Physics.

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Course Code:	Course Title:	Credits:
PHY 1202	**Physics Sessional**	**1.00**

Rationale of the Course: This course introduces to the proper methods for conducting controlled physics experiments, including the acquisition, analysis and physical interpretation of data. The course involves experiments which illustrate the principles of mechanics, vibrations and waves, optics, thermodynamics, electricity and magnetism and modern physics.

Course Learning Outcomes: At the end of the course, the student will be able to –

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Apply** basic knowledge practically regarding mechanics, vibrations and waves, optics, thermodynamics, electricity and magnetism and modern physics.
CLO2	**Develop** a strong base for differentiating between theoretical knowledge with the practical observations.
CLO3	**Demonstrate** physics experiments including the acquisition, analysis and physical interpretation of data.

Course Content: Based on theory for course Code: **PHY 1101** & **PHY 1202** with course title: **Physics I** & **Physics II.**

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√	√										
CLO3				√	√				√			

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

CLOs	Teaching-Learning Strategy	Assessment Strategy

CLO1	• Lecture Note • Text Book • Lab Manual • Web Material	• Lab Test • Viva • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Lab Manual • Web Material • Lab Equipment's	• Lab Test • Lab Report • Final Exam
CLO3	• Lecture Note • Text Book • Lab Manual • Web Material • Lab Equipment's	• Lab Test • Viva • Lab Report • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Lab Attendance & Performance	**10%**
Continuous Assessment (Experiment, Report & Viva)	**40%**
Final Exam (Lab Test, Viva & Project)	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final Exam: **50%**

3) Make-up Procedures: Re-take Exam

Learning Materials

1) Text Book:

i. Dr. Giasuddin : Practical Physics

ii. C. L Arora : Practical Physics

2) Books Recommended:

i. K. Din : Practical Physics

ii. A. K. Basak : Byaboharik Padartha Vidya (Bangla)

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Course Code:	Course Title:	Credits:
MTH 1201	**Differential Equations and Transform Mathematics**	**3.00**

Rationale of the Course: To understand the formation, solution and applications of differential equations and Transform Mathematics.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Analyze** the different order differential equation and find the solution of the equation.
CLO2	**Gather** the Basic knowledge of Multivariable Calculus.
CLO3	**Acquire** the knowledge of Transform Mathematics.

Course Content:
Ordinary Differential Equation: Degree and order of ordinary differential equation; Formation of different equations; Solution of first order differential equations by various methods; Solution of general linear equations of second and higher orders with constant coefficients; Solution of homogeneous linear equations and its applications; Solution of Euler's homogeneous linear differential equations.

Partial Differential Equation: Introduction, Linear and non-linear first order differential equations; Linear equations of higher order; Total differential equations; Equations of the second order with variable co-efficient; higher order linear PDE with constant coefficients.

Laplace Transforms: Definition of Laplace transforms, Sufficient conditions for existence of Laplace transforms; Inverse Laplace transforms; Laplace transforms of derivatives; The unit step function; Periodic function; Some special theorems on Laplace transforms; Partial fraction; Solution of differential equations by Laplace transforms.

Fourier series: Fourier Integrals; Fourier transforms and their uses in solving boundary value problems of wave equations.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√	√										
CLO2	√											
CLO3	√				√							

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Audio/Video	• Class Test • Final Exam • Participation
CLO2	• Lecture Note	• Assignment

	• Text Book • Web Material	• Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video	• Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	**(100%)**
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. Shepley L. Ross : Introduction to Ordinary Differential Equations, Wiley

ii. B. D. Sharma : Differential Equations, Kedar Nath Ram Nath

iii. R. J. Beerends, HG Ter : Fourier and Laplace Transforms

2) **Reference Books**:

i. Frank Ayres : Differential Equations*, McGraw-Hill*
ii. Louis Albert Pipes : Applied Mathematics for Engineers and Physicist, *McGraw-Hill*

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Course Code:	Course Title:	Credits:
BAN 1201	**Functional Bengali Language**	2.00

Rationale of the Course: To develop basic knowledge of Bengali language.

Course Learning Outcomes: At the end of the course, the student will be able to –

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Gather** knowledge about Bengali grammar and literature.
CLO2	**Develop** skills on using Bengali language.
CLO3	**Justify** the grammatical errors in speaking and writing Bengali property

Course Contents:

বাংলা ভাষার উদ্ভব ও ভাষাতত্ত্ব: বাংলা ভাষার উৎপত্তি; ব্যকরণ এর পরিচয় ও উৎপত্তি; ভাষাতত্ত্ব: পরিচয় ও শ্রেণীবিভাগ।

ধ্বনিতত্ত্ব: ধ্বনি ও বর্ণ; ধ্বনি পরিবর্তন; ণ-ত্ব বিধান এবং ষ-ত্ব বিধান; সন্ধি।

শব্দতত্ত্ব: ধাতু; প্রকৃতি এবং প্রত্যয়; উপসর্গ; সমাস; কারক ও বিভক্তি; শব্দ; শব্দের শ্রেণীবিন্যাস; দ্বিরুক্ত শব্দ; পুরুষ ও স্ত্রীবাচক শব্দ; সংখ্যাবাচক শব্দ; পদাশ্রিত নির্দেশক; বানান শুদ্ধিকরণ; উচ্চারণ; সমার্থক শব্দ; বিপরীত শব্দ; পরিভাষা।

বাক্যতত্ত্ব: পদ প্রকরণ; ক্রিয়ার কাল; বিরাম চিহ্ন বা যতি চিহ্ন; বাক্য; বাচ্য; উক্তি; সম্বোধন পদ; অনুসর্গ; বাক্য শুদ্ধিকরণ; বাক্যে পদ-সংস্থাপনার ক্রম; বাগধারা এবং প্রবাদ প্রবচন।

বাংলা অভিধান ও শব্দকোষ: পরিচয়; প্রকারভেদ; অভিধানের প্রয়োজনীয়তা; অভিধান ব্যবহার রীতি।

পত্রলিখন: পত্র রচনার ভূমিকা; প্রকারভেদ; প্রয়োজনীয়তা; ব্যবহারিক পত্র ও দলিল রচনার কৌশল; সংবাদপত্রে পত্র রচনার কৌশল; স্মারকলিপি, মানপত্র ইত্যাদি রচনার কৌশল।

সাহিত্যের স্বরূপ ও শ্রেণীবিভাগ: বাংলা সাহিত্যের ইতিহাস; সাহিত্যের শ্রেণীবিভাগ; সাহিত্যের রূপ ও রস; কবিতা; ছোট গল্প; উপন্যাস; নাটক।

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1										√		
CLO2										√		
CLO3										√		

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book	• Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video	• Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. Dr. Muhammad Shahidullah : *Bangala Vashar Itibritto*, Dhaka, Bangla Academy, 1995.
ii. Dr. Muhammad Shahidullah : *Bangala Bakaron*, Dhaka, Bangla Academy, 1995
iii. Dr. Sunnite Kumar Chattyapadhay : *Vasa Prokash Bangala Bakaron,* Kolkata, Rup and Company*,1998.*

2) **Reference Books**:

i. Shibproshonno Lahidi, Ahmad Sharif and others : Bangla Vasar Proyog o Opoproyog, Dhaka, Bangla Academy, 1998.
ii. Jotivoshon Chaki, Bangla Vasar Bakaron : Bangla Vasar Bakaron, Kolkata, Ananda Publishers, 1996.
iii. Dr. Rafiqul Islam : Dhaka: Globe Library, 1998.

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Course Code:	Course Title:	Credits:
ENG 1202	**Developing English Skills Sessional**	**1.00**

Rationale of the Course: This course is aimed at Bangla speaking students studying for a Bachelor's degree in Computer Science & Engineering for developing four basic skills in English. The focus of the course is on making students able to hold effective conversations in English. They will develop their listening skill and learn how to pronounce words appropriately. The students will also learn the basic use of English in handling official documents which are usually required in any professional environment.

Course Learning Outcomes: At the end of the course, the student will be able to –

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Understand** what is spoken to them using English

CLO2	**Use** English fluently
CLO3	**Produce** personal and professional documents using appropriate English

Course Content:
Listening: Listening to course teacher, listening to recorded speech, answering question from recorded speech, summarizing recorded speech, Word meaning, Inference.

Speaking: Phonetics and Phonology, Appropriate pronunciation, Dialog, Conversation: Formal & Informal.

Reading: Passage reading, seen comprehension, Types of passage, Summarizing.

Writing: CV, Formal letter, Paragraph, Notice, Memo.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1										√		
CLO2										√		
CLO3									√	√		

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video • Lab Manual	• Lab Test • Lab Report • Viva • Final Exam

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Lab Attendance & Performance	**10%**

Continuous Assessment (Experiment, Report & Viva)	**40%**
Final Exam (Lab Test, Viva & Project)	**50%**

2) Marks Distribution:
    a. Continuous Assessment: **50%**
    b. Final Exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i.	George Yule	:	*The Study of Language*
ii.	Peter Roach	:	*English Phonetics and Phonology*
iii.	Dorothy Zemach and Lisa A. Rumisek	:	*Academic Writing: From Paragraph to Essay*

2) Books Recommended:

i.	Lewis, N.	:	*How to Read Better and Faster*
ii.	Greenwell, S. & Swan, M.	:	*Effective Reading, Reading Skills for Advanced Students,* CUP
iii.	Alderson, C. & Urquhart	:	*Reading in a Foreign Language*
iv.	Wallace, C.	:	*Reading,* OUP

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Course Code	Course Title	Credits
CSE 2101	**Design and Analysis of Algorithms**	**3.00**

Rationale of the Course: To get basic idea about algorithmic techniques and computational problems arising frequently in practical applications: sorting and searching, divide and conquer, greedy algorithms, dynamic programming.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Explain** a familiarity with major algorithms.
CLO2	**Examine** the running time of the advanced algorithms and data structures for some classic problems.
CLO3	**Evaluate** important algorithmic design paradigms and methods of analysis.

Course Content:
Basics of Algorithm: Algorithms as a technology, analyzing algorithms, Designing algorithms, Time and space analysis of algorithms, Average, best- and worst-case analysis, different notations, correctness proofs and techniques for analysis of algorithms, Master Theorem.

Divide and Conquer: Binary Search, Quicksort, Merge sort, Integer Multiplication, Matrix Multiplication

(Strassen's Algorithms), Maximal Subsequence.

Dynamic programming: Assembly-line scheduling, Matrix-chain multiplication, longest common subsequence, Optimal binary search trees.

Greedy method: An activity-selection problem, Elements of the greedy strategy, Huffman codes.

Graph algorithms: Depth-first search, Breadth-first search, Topological sort, Minimum spanning tree, Kruskal's and Prim's algorithm, Bellman-Ford algorithm, Dijkstra's algorithm, Floyd-Warshall algorithm, Johnson's algorithm for sparse graphs, Ford-Fulkerson method.

Elementary graph algorithm: Topological sort, strongly connected components.

Backtracking: 8 queens' problem, Sum of subsets, Graph coloring problem, Hamilton cycles.

Branch and bound: Lest cost search, 15-puzzle problem, Knapsack problem, Traveling salesman problem.

NP-Completeness: Polynomial time, Polynomial-time verification, NP-completeness and reducibility, NP-complete problems.

Approximation algorithms: LP based approximation algorithms

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3				√								

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book	• Presentation • Final Exam • Participation
CLO3	• Lecture Note • Text Book	• Assignment • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)

Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
    a. Continuous Assessment: **50%**
    b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Books:

i. T. H. Cormen; C. E. Leiserson; R. L. Rivest; C. Stein : Introduction to Algorithms, *MIT Press*

ii. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran : Fundamentals of Computer Algorithms, *Galgotia Publications*

2) Reference Book:

i. Michael T. Goodrich; Roberto Tamassia : Algorithm Design and Applications, *Wiley*

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Course Code	Course Title	Credits
CSE 2102	**Design and Analysis of Algorithms Sessional**	**1.00**

Rationale of the Course: The study of data structure is an essential part of computer science. Data structure is a logical & mathematical model of storing & organizing data in a particular way in a computer. In system programming application programming the methods & techniques of data structures are widely used. The study of data structure helps the students in developing logic & structured programs.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Demonstrate** advantages and disadvantages of specific algorithms and data structures
CLO2	**Apply** practical knowledge to determine and demonstrate bugs in programs.
CLO3	**Formulate** new solutions for problems or improve existing code using learned algorithms and data structures.

Course Content: Based on theory for course Code: **CSE 2101 &** Course Title: **Design and Analysis**

of Algorithms Sessional

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1			√						√			
CLO2		√										
CLO3		√	√									

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Audio/Video • Lab Manual	• Lab Test • Lab Report • Viva • Final Exam
CLO3	• Lecture Note • Text Book • Audio/Video • Lab Manual	• Lab Test • Lab Report • Viva • Final Exam

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Lab Attendance & Performance	**10%**
Continuous Assessment (Experiment, Report & Viva)	**40%**
Final Exam (Lab Test, Viva & Project)	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final Exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. Thomas H. Cormen, Clifford Stein, Ronald L. Rivest, Charles E. Leiserson : Introduction to Algorithms, The MIT Press

2) Books Recommended:

i. AnttiLaaksonen : Competitive Programmer's Handbook, Springe

ii. AnttiLaaksonen : Guide to Competitive Programming: Learning and Improving Algorithms Through Contests, Springer

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Course Code:	Course Title:	Credits:
CSE 2103	**Database Management Systems**	**3.00**

Rationale of the Course: This course is designed to introduce the basic concepts of database, learn the foundations of database systems, focusing on basics such as the relational algebra and data model, schema normalization, query optimization, and transactions.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Describe** the basic concepts and applications of database systems.
CLO2	**Apply** the knowledge of SQL in order to design queries.
CLO3	**Utilize** commercial relational database system (Oracle) by writing SQL using the system.
CLO4	**Illustrate** the relational database theory and write relational algebra expressions for queries.

Course Content:

Introduction: Database-System Applications, Purpose of Database Systems, View of Data, Database Languages, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture.

Introduction to the Relational Model: Structure of Relational Databases, Database Schema, Keys, Schema, Diagrams, Relational Query Languages, Relational Operations.

SQL: Overview of the SQL Query, Language, SQL Data Definition, Basic Structure of SQL, Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Sub-queries, Modification of the Database, Join Expressions, Views, Transactions, Integrity Constraints, SQL Data Types and Schemas, Authorization.

Formal Relational Query Languages: The Relational Algebra, The Tuple Relational Calculus, The Domain Relational Calculus.

Database Design and the E-R Model: Overview of the Design Process, Entity-Relationship Model, Constraints, Removing Redundant Attributes in Entity Sets, Entity-Relationship Diagrams, Reduction to Relational Schemas, Entity-Relationship Design Issues, Extended E-R Features, Alternative Notations for Modeling, Data, Other Aspects of Database Design.

Relational Database Design: Features of Good Relational Designs, Atomic Domains and First Normal

Form, Decomposition Using Functional Dependencies, Functional-Dependency Theory, Algorithms for Decomposition, Decomposition Using Multivalued Dependencies, More Normal Forms, Database-Design Process, Modeling Temporal Data, Multivalued Dependencies, Domain-Key Normal Form.

Concurrency control: Lock based protocols, Timestamp based protocols, Validation based protocols, Deadlock.

Recovery system: Failure classification, Storage structure, Recovery and atomicity, Log based recovery, Recovery with concurrent transactions, Advanced recovery techniques, RAID model.

Introduction to advanced database management systems: distributed database, parallel database, data mining and warehousing, multimedia, object-oriented, object-relational, real-time database.
Mapping of Course Learning Outcomes (CLOs) with the Program Learning Outcomes (PLOs):

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2			√									
CLO3	√											
CLO4	√											

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book	• Assignment • Final Exam • Participation
CLO2	• Lecture Note • Text Book	• Class Test • Final Exam • Participation
CLO3	• Lecture Note • Text Book	• Presentation • Final Exam • Participation
CLO4	• Lecture Note • Text Book	• Assignment • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**

Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**.

Learning Materials

1) Text Books:

i. Abraham Silberschatz, Henry F. Korth, S. Sudarshan : Database System Concept**,** *McGraw-Hill*

ii. Peter D. Smith and G.M. Barnes : Files and Databases- An Introduction, *Addison-Wesley*

2) Reference Books:

i. Raghu Ramakrishnan and Johannes Gehrke : Database Management Systems, *McGraw-Hill*

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Course Code:	Course Title:	Credits:
CSE 2104	**Database Management Systems Sessional**	1**.00**

Rationale of the Course: This course is designed to introduce the basic concepts of database, learn how to design database and gain first-hand experience through developing a real-world e-commerce database application in a term project.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Demonstrate** the knowledge in projects with a commercial relational database system (Oracle) and design a team-based project.
CLO2	**Utilize** the database design principles, SQL and PL/SQL with modern tools.
CLO3	**Apply** the relational database theory and be able to write relational algebra expressions for queries.

Course Content: Based on theory for course Code: **CSE 2103 &** Course Title: **Database Management Systems**

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1					√				√			
CLO2					√				√			

CLO3									√			

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Lab Manual	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Lab Manual	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Lab Manual	• Lab Test • Lab Report • Viva • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Lab Attendance & Performance	**10%**
Continuous Assessment (Experiment, Report & Viva)	**40%**
Final Exam (Lab Test, Viva & Project)	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final Exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. Abraham Silberschatz, Henry F. Korth, S. Sudarshan : Database System Concept**,** *McGraw-Hill*

ii. Herbert Schildt : The Complete Reference JAVA2, *McGraw-Hill Osborne Media*

2) Books Recommended:

i. Geetanjali Arora, B. Aiaswamy, Nitin Pandey : Microsoft C# Professional Projects, *Premier Press*
ii. Steven Holzner : The Complete Reference PHP 5.2, *McGraw-Hill Education*

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Course Code:	Course Title:	Credits:
EEE 2101	**Electronic Devices and Circuits**	**3.00**

Rationale of the Course: To develop basics knowledge on Electronics Circuit and their practical application with different small devices.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Apply** the knowledge of semiconductor diodes, BJT, MOSFET and JFET to solve real life engineering problems such as rectification, switching and amplification
CLO2	**Explain** the basic operation of diodes, BJT, MOSFET, JFET and their characteristics to solve engineering problems
CLO3	**Compare** the characteristics of different types of diodes and transistors

Course Contents:

P-N junction as a circuit element: Intrinsic and extrinsic semiconductors, operational principle of p-n junction diode, contact potential, current-voltage characteristics of a diode, simplified dc and ac diode models, dynamic resistance and capacitance.

Diode circuits: Half wave and full wave rectifiers, rectifiers with filter capacitor, characteristics of a zener diode, zener shunt regulator, clamping and clipping circuits.

Bipolar junction transistor (BJT) as a circuit element: Bipolar junction transistor current components, BJT characteristics and regions of operation, BJT as an amplifier, biasing the BJT for discrete circuits, small signal equivalent circuit models, BJT as a switch. Single stage mid-band frequency.

BJT amplifier circuits: Voltage and current gain, input and output impedance of a common base, common emitter and common collector amplifier circuits.

Metal-oxide-semiconductor field-effect-transistor (MOSFET) as circuit element: Structure and physical operation of an enhancement MOSFET, threshold voltage, Body effect, current- voltage characteristics of an enhancement MOSFET, biasing discrete and integrated MOS amplifier circuits, single-stage MOS amplifiers, MOSFET as a switch, CMOS inverter.

Junction field-effect-transistor (JFET): Structure and physical operation of JFET, transistor characteristics, and pinch-off voltage. Differential and multistage amplifiers: Description of differential amplifiers, small-signal operation, differential and common mode gains, RC coupled mid-band frequency amplifier.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√		√									
CLO2	√											
CLO3	√	√										

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Audio/Video • Web Material	• Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video	• Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**15%**
Final exam	**60%**

2) Marks Distribution:
   a. Continuous Assessment: **40%**
   b. Final exam: **60%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

Text Books and Reference Books:

i. Robert L. Boylestad **:** Electronic Device and Circuit Theory
ii. Sedra Smith **:** Microelectronic circuit
iii. Millman and Halkias **:** Electronic Devices Circuits

Course Code:	Course Title:	Credits:
EEE 2102	**Electronic Devices and Circuits Sessional**	**1.00**

Rationale of the Course: To learn and familiarize the basics of electronic circuits components as well as the analysis of electronic circuit practically.
Course Learning Outcomes: at the end of the Course, the Student will be able to –

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Match** basic experimental experiences in physical operation and circuit applications of semiconductor devices with the theoretical knowledge
CLO2	**Explain** how to design the diode circuits and single stage BJT or MOSFET amplifier circuits from a set of specifications and interrelate the hardware knowledge with the software knowledge by using simulation software like ORCAD
CLO3	**Design** electronic projects

Course Content: Based on theory for course Code: **EEE 2101 &** Course Title: **Electronic Devices and Circuits**

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1				√								
CLO2			√									
CLO3			√									

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video • Lab Manual	• Lab Test • Lab Report • Viva • Final Exam

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Lab Attendance & Performance	**10%**
Continuous Assessment (Experiment, Report & Viva)	**40%**
Final Exam (Lab Test, Viva & Project)	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final Exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. MD. H. Rashid **:** Spices for Circuits and Electronic Using Pspice, *Prentice Hall of India Private Ltd*

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Course Code:	Course Title:	Credits:
MTH 2101	**Linear Algebra, Vector Analysis and Co-ordinate Geometry**	**3.00**

Rationale of the Course: To introduce students with Linear Algebra, Vector Analysis and Co-ordinate Geometry and their uses in engineering.

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

CLO NO.	Course Learning Outcomes (CLO)
CLO 1	**Understand** Co-ordinate geometry, projection
CLO 2	**Apply** the concepts of linear algebra to solve real world phenomena
CLO 3	**Calculate** vector, divergence, gradient

Course Content:

Linear equation: system of linear equations; Solution of system of linear equations; homogeneous and non-homogenous equations; consistent and inconsistent system of linear equations; unique solution and general solution. Vector spaces and subspaces; linear combination and linear spans; Row space of matrix; sums and direct sums; Basis and dimensions; linear dependence and independence; Basis and dimensions and sub-space, co-ordinates.

Linear mapping: Linear mappings, linear operators, one-to-one and onto mapping; Kernel and image linear mapping, singular and nonsingular mapping, linear mapping and system of linear equation.

Vector Analysis: Vectors, The dot and cross product; Vector Differentiation and Integration; Gradient of

a Function, Divergence and Curl of Vector and their Applications; Physical Significance of Gradient; Vector Identities; Integral Forms of Gradient; Tensors.

Two-dimensional geometry: Co-ordinates in two-dimension, transformation of co-ordinates; reduction of second-degree equation to standard form; pairs of straight lines, circles and identification of conics.

Three-dimensional geometry: Co-ordinates in three dimensions, direction cosines and direction ratios; planes, straight line and Conicoid (basic definition and properties only)**.**

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√	√									
CLO3	√	√										

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Audio/Video	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Web Material	• Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video	• Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
    a. Continuous Assessment: **50%**
    b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) **Text Book**:

i.	M. A. Rahman, Linear Algebra. 4th ed., Dhaka	:	Nahar Book, 2003.
ii.	Murray R. Spiegel, Seymour Lipschutz	:	Vector Analysis (2nd Edition)
iii.	A.F.M.A. Rahman and P.K. Bhattacharjee	:	Analytic Geometry and Vector Analysis

2) Reference Books:

i.	L. Seymour	:	Linear algebra. 3rd ed., New Delhi: Mc-Graw Hill, 2004.
ii.	K. Mohammad	:	Analytic Geometry and Vector Analysis

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Course Code:	Course Title:	Credits
CHM 2101	**Chemistry**	**3.00**

Rationale of the Course: Engineering requires applied science, and chemistry is the center of all science. In the future, global problems and issues will require an in-depth understanding of chemistry to have a global solution. The physical and inorganic chemistry knowledge is expected to help the graduates in understanding the environmental impacts created by their designed systems and the way to resolve the harmful issues.

Course Learning Outcomes: At the end of the course, the student will be able to –

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Gather** knowledge on chemical bond and chemical equilibrium based on their application.
CLO2	**Evaluate** atomic structure and periodic table, based on their application
CLO3	**Aware** colloid, electrochemistry, chemical industries and environmental pollution based on their application.

Course Contents:

Atomic Structure: Modern concept of atomic structure quantum numbers, Aufbau principle, Pauli exclusion principle, Hund's rule of maximum multiplicity, wave nature of electron, de-Broglie relation, Heisenberg uncertainty principle, Spectra, Hydrogen spectrum.

Periodic Table: Periodic law, classification of elements, modern periodic table in the light of electronic configuration of elements, different types of elements, periodic properties covalent and ionic atomic radii, ionization energy, electro-negativity, electron affinity.

Chemical Bond: Different types of chemical bond (ionic, covalent, co-ordinate, hydrogen and metallic bond) Valence bond theory (VBT), hybridization, shapes of molecular orbital theory (MOT).

Glass chemistry: Principle of glass production, raw materials of glass, polymer chemistry, Catalyst and its classification, synthesis of some organic compounds.

Solutions: Types of solution, Henry's law, solubility, factors affecting solubility, solubility curve concentration of solutions, Rault's law, pH, buffer, acid, base, salts, theories of laboratory experiment.

Chemical equilibrium: Equilibrium and equilibrium constants, activation energy, Kc, Kp. Relationship between them, determination of equilibrium constants, criteria of chemical equilibrium, Le Chatelier principle and its application.

Electrochemistry: Conductors, Electrolytes and Electrolysis; Electrochemical cells, Electrode reaction and potentials. Reference electrodes; Reversible and concentration cells, Storage Batteries, electrode, anode, cathode, re-dox reaction, oxidation, reduction reaction, metal extraction such as s-block metals.

Chemical kinetics: Rate of chemical reactions, order and molecularity of reactions, different types of rate expression, methods of determining rate and order, effect of temperature on reaction rate and energy of activation.

Corrosion of metals: Corrosion and its application, mechanism of corrosion, alloys, Metalloids, GHGs, non-metal chemistry, environmental pollution.

Colloid and colloidal solution: Classification, preparation, purification, properties, protective action and application of colloids, sol, gel, emulsion, hydrosol, aerosol etc.

Cement industry: Principle of cement production, Portland cement and hardening of cement, classification, and composition, role of Al_2O_3, Fe_2O_3 and $CaSO_4.2H_2O$ on cement.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√	√									
CLO3	√		√				√					

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Audio/Video • Web Material	• Class Test • Assignment • Final Exam • Presentation • Participation
CLO2	• Lecture Note • Text Book • Audio/Video • Web Material	• Class Test • Lab performance test • Assignment • Final Exam • Presentation
CLO3	• Lecture Note • Text Book • Audio/Video • Web Material	• Class Test • Assignment • Final Exam • Presentation • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Lab Attendance & Performance	**10%**
Lab Experiment, Lab Report & Lab Viva	**15%**
Mid-Term Assessment (Exam &Viva)	**25%**
Final exam (Experiment, Viva & Project)	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final Exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) **Text Book**:

i. Morison & Boyd : Organic Chemistry, *Prentice Hall of India*.
ii. S.Z. Haider : Introduction to Modern Inorganic Chemistry, Friend's International.

2) Reference Books:

i. Haque & Nawab : Principles of Physical Chemistry, *Students' Publications*.
ii. Samuel H. Maron & Jerome B. Lando : Fundamentals of Physical Chemistry, *MacMillan Publishing* Co., Inc., Newyork.
iii. P. W. Atkins : Physical Chemistry, *Oxford University Press*.
iv. B.S. Bahl & G.D. Tuli; S. Chand Essentials of Physical Chemistry, and Company Ltd.
v. Ebbing; Houghton Mifflin Company : General Chemistry

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Course Code:	Course Title:	Credits:
CHM 2102	**Chemistry Sessional**	**1.00**

Rationale of the Course: To learn and disseminate the basic knowledge of chemistry, industrial application, concept of pollution and application as well. The qualitative and quantitative analysis of chemistry, the practical knowledge expected to help the graduates in understanding the environmental impacts created by their designed systems and the way to resolve the dangerous issues.

Course Learning Outcomes: At the end of the course, the student will be able to-

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Gather** knowledge of chemistry instruments and preparation of different kinds of standard solution.
CLO2	**Examine** some unknown solution through titration.
CLO3	**Estimate** different kinds of metal ions in a solution by showing environmental aspects.

Course Contents:

1. Preparation of different kinds of standard chemical solution
2. Standardization of Sodium Hydroxide (NaOH) Solution by Standard Oxalic Acid dihydrate ($C_2H_2O_4.2H_2O$) Solution.
3. Standardization of Hydrochloric Acid (HCl) Solution by Standard Sodium Carbonate (Na_2CO_3) Solution.
4. Determination of Calcium (Ca) Content in a Calcium Chloride dihydrate ($CaCl_2.2H_2O$) Solution with Standard Di-Sodium Ethylene Diammine Tetra Acetic Acid (Na_2EDTA) Solution.
5. Standardization of Sodium Thiosulphate Pentahydrate ($Na_2S_2O_3.5H_2O$) Solution with Standard Potassium Dichromate ($K_2Cr_2O_7$) Solution.
6. Estimation of Copper (Cu) Content in a Copper Sulphate Pentahydrate ($CuSO_4.5H_2O$) (Blue Vitriol) Solutions by Iodometric Method with 338 Standard Sodium Thiosulphate Pentahydrate ($Na_2S_2O_3.5H_2O$) Solution.
7. Determination of the heat of acid/ base neutralization reaction.
8. Determination of Zinc (Zn) Content in a Zinc Sulphate Heptahydrate ($ZnSO_4 .7H_2O$) Solution with Standard Di-Sodium EDTA (Na_2-EDTA) Solution by using Eriochrome black- T indicator.
9. Standardization of Potassium Permanganate ($KMnO_4$) Solution with Standard Oxalic Acid dihydrate ($C_2H_2O_4.2H_2O$) Solution
10. Determination of Ferrous (Fe) Content in a Ammonium Ferrous Sulphate(Mohr`s Salt) [$FeSO_4.(NH_4)_2SO_4.6H_2O$] Solution with Standard Potassium Permanganate ($KMnO_4$) Solution.
11. Determination of heat of solution by calorimetric method.
12. Standardization of Sodium Hydroxide (NaOH) Solution by Standard Oxalic Acid dehydrate ($C_2H_2O_4.2H_2O$) Solution.
13. Standardization of Hydrochloric Acid (HCl) Solution by Standard Sodium Hydroxide (NaOH) Solution.
14. Determination the strength of supplied NaOH solution by standard CH_3COOH solution.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√	√										
CLO2		√		√					√			
CLO3			√	√					√			

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Audio/Video • Web Material • Lab Manual	• Lab Report • Quiz test • Participation • Final Exam • Performance test
CLO2	• Lecture Note • Text Book • Audio/Video • Web Material • Equipment	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video • Web Material • Lab Manual	• Lab Test • Lab Report • Viva • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Lab Attendance & Performance	**10%**
Continuous Assessment (Experiment, Report & Viva)	**40%**
Final Exam (Lab Test, Viva & Project)	**50%**

1) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final Exam: **50%**
2) Make-up Procedures: **Re-take Exam**

Learning Materials

1) **Text Book**:

i. Morison & Boyd : Organic Chemistry, *Prentice Hall of India*.
ii. S. Z. Haider : Introduction to Modern Inorganic Chemistry, Friend's International.

2) **Reference Books:**

i. Haque & Nawab : Principles of Physical Chemistry, *Students' Publications*.
ii. Samuel H. Maron & Jerome B. Lando : Fundamentals of Physical Chemistry, *MacMillan Publishing* Co., Inc., Newyork.

iii. P. W. Atkins : Physical Chemistry, *Oxford University Press*.
iv. B.S. Bahl & G.D. Tuli; S. Chand Essentials of Physical Chemistry, and Company Ltd.
v. Ebbing; Houghton Mifflin Company : General Chemistry

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Course Code:	Course Title:	Credits:
SS 2101	**Engineering Economics**	**2.00**

Rational of the Course: This course offers knowledge about engineering economics related issues with economic concepts such as cost analysis, demand and supply, price determiners, market structure, production function, National income accounting. It will also help the learners to understand how evaluate a project through calculating Cost-Benefit Analysis, Payback Period, Net Present Value (NPV), Internal Rate of Return (IRR), calculating inflation and income tax that make economics decision. It is to teach awareness on engineering ethics and human values and instill moral and social values to appreciate the rights of others.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	Discuss the theoretical concepts in microeconomics, macroeconomics, and engineering economics in several sub-fields with engineering field.
CLO2	Analyze economic theory and the statistical tools of economics to specific problems or questions of a project for economics decision.
CLO3	Apply ethical principles and professional responsibility basics knowledge on economics required for a professional engineer.

Course Content:
Engineering Economics: Define of economics, Principle of economics, Economics and Engineering, Microeconomics and Macroeconomics, Description and Role in Decision Making, Performing an Engineering Economy, Professional Ethics and Economic Decision, Study Theory of Demand and Supply and Their Elasticities, Demand Estimation, Price Determination; Indifference Curve Technique, Theory of Production, Theory of Cost and Cost Estimation, Market Structure with its explanation, production function, factors of production and its analyzed.
Cash Flows: Estimation and Diagramming, Simple and Compound Interest, Introduction to Spreadsheet Use PE Progressive Example-The Cement Factory Case, Single-Amount Factors (F_P and P_F), Uniform Series Present Worth Factor and Capital Recovery Factor (P_A and A_P), Sinking Fund Factor and Uniform Series Compound Amount Factor (A_F and F_A), Factor Values for Untabulated i or n Values, Arithmetic Gradient Factors (P_G and A_G), Geometric Gradient Series Factors, Determining i or n for Known Cash Flow Values.
National Income Accounting: Depreciation; National Income, GDP, GNP, NNP, Disposable income, Circular Flow of Income and Expenditure; Cost-Benefit Analysis; Payback Period, Net Present Value (NPV), Internal Rate of Return (IRR).
Taxation: Understanding the impact of Inflation; Present Worth Calculations Adjusted for Inflation, Future Worth Calculations Adjusted for Inflation, Capital Recovery Calculations Adjusted for Inflation, Income Tax Terminology and Basic Relations, Calculation of Cash Flow after Taxes, Effect on Taxes of Different Depreciation Methods and Recovery Periods, Depreciation Recapture and Capital Gains (Losses), After-

Tax Evaluation, After-Tax Replacement Study, After-Tax Value-Added Analysis, After-Tax Analysis for International Projects, Value-Added Tax.
Fiscal and monetary policy: Economic feasibility of engineering undertakings, monetary policy, fiscal policy and trade policy with reference to Bangladesh.

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

Course Learning Outcomes (CLO) (3-5)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√		√									
CLO2		√									√	
CLO3								√				

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Audio/Video • Web Material	• Assignment • Mid-term Exam • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Audio/Video • Web Material	• Assignment • Mid-term Exam • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video • Web Material	• Assignment • Class test • Mid-term Exam • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**

3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Books:

1.	P. E. Leland Blank and P. E. Anthony Tarquin	:	Engineering Economy, *McGraw Hill*
2	Parkin, Michael	:	Microeconomics-, Eleventh Edition

2) Reference Books:

1.	K. K. Dewett	:	Modern Economic Theory, S. Chand Publishers
2.	H.L Ahuja,	:	Advanced Economic Theory, S. Chand Publishers
3.	A. Asimakopulos	:	An Introduction to Economic Theory: Microeconomics, Oxford University Press
4.	A. Koutsoyiannis	:	Modern Microeconomics, Palgrave Macmillan
5.	P. I. Samuelson	:	Economics
6.	Dornbusch Ficher	:	Macro Economics
7.	Richard H Leftwich	:	Price System and Resource Allocation

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Course Code:	Course Title:	Credits:
CSE 2201	**Web Engineering**	**3.00**

Rationale of the Course:
The course introduces students to the discipline of web Engineering including the methods and techniques used in web-based system development. This course draws upon student's previous programming and computing experience to develop practical web development and maintenance skills and to show the skills and processes needed to complement technical understanding of web-based software products in order to make you a more effective web developer in a web engineering team.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Describe** the basic concepts and techniques of web engineering.
CLO2	**Apply** the web engineering methodologies for Web application development.
CLO3	**Identify** the security risk of a Web application.
CLO4	**Construct** and work in large development groups, with different individual roles in order to be prepared to participate in large scale IT projects.

Course Content:

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

Web App Project: Formulation Web based Systems, Planning for Web Engineering Project, Building Web Engineering Team, Web App Project Management, Metrics for web engineering and Apps.

Web Apps Analysis: Requirement Analysis, Analysis Model, Web Apps Estimation, 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, Design Metrics for web Apps.

Web Apps Implementation: Client-side scripting: JavaScript, 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

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3		√										
CLO4			√	√		√			√			

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Web Material • Audio/video	• Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Web Material • Audio/video	• Presentation • Final Exam • Participation
CLO4	• Lecture Note • Text Book • Web Material • Audio/video	• Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**

Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Books:

1. Roger Pressman and David Lowe : Web Engineering, Tata McGraw Hill Edition, 2008

2) Reference Books:

1. Imar Spaanjaars : Beginning ASP.NET 4.5.1: in C# and VB, Wrox
2. Branko Ajzele : Mastering PHP 7, Packt Publishing
3. Holovaty, Adrian, Kaplan-Moss, Jacob : The Definitive Guide to Django: Web Development Done Right, Apress

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Course Code:	Course Title:	Credits:
CSE 2202	**Web Engineering Sessional**	**1.00**

Rational of the Course: The course will provide an overview of Internet technology and will introduce to the current Web protocols, client side and server-side programming, communication and design.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Gather** knowledge of different programming techniques, protocols available for development.
CLO2	**Design** different web pages by using modern tools.
CLO3	**Develop** web applications with incorporating different back end and front-end technology.

Course Content: Based on theory for course Code: **CSE 2201** & Course Title: **Web Engineering**

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2			√		√							
CLO3			√						√			

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Project Report • Viva • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Project Report • Viva • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Project Report • Viva • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Lab Attendance & Performance	**10%**
Continuous Assessment (Experiment, Report & Viva)	**40%**
Final Exam (Lab Test, Viva & Project)	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final Exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

1. Roger Pressman and David Lowe : Web Engineering, Tata McGraw Hill Edition, 2008

2) Reference Books:

1. Imar Spaanjaars : Beginning ASP.NET 4.5.1: in C# and VB, Wrox
2. Branko Ajzele : Mastering PHP 7, Packt Publishing
3. Holovaty, Adrian, Kaplan-Moss, Jacob : The Definitive Guide to Django: Web Development Done Right, Apress

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Course Code:	Course Title:	Credits:
CSE 2203	**Software Design Pattern**	**3.00**

Rationale of the Course: To show the skills and processes needed to complement technical understanding of software products in order to make you a more effective software developer in an engineering team.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Describe** different theories of how software can be developed.
CLO2	**Apply** appropriate methods for the design and implementation of modern software systems.
CLO3	**Construct** real world software within large development groups, with different individual roles in order to be prepared to participate in large scale IT projects.

Course Content:

Systems Analysis: Systems planning and the initial investigation, information gathering, the tools of structured analysis, feasibility study, cost benefit analysis.

Software engineering paradigms: Different phases of software;

Design concepts and principles: architectural design, user interface design, object-oriented software development and design, iterative development and the unified process, sequential waterfall life cycles;

UML diagrams: Interaction and Collaboration Diagram for designing Software, class diagram. Structured and non-Structured programming; Data-directed design techniques: Modular design; Design of automatic, redundant and defensive program; COCOMO model; Tree model; Agile modeling and prototyping; PNR curve; Statistical model;

Software testing: white box and black box testing, basis path testing, testing for specialized environment; Software testing strategies: unit testing, integration testing, validation testing, system testing; Art of debugging; Zips Concepts of software reliability and availability; Software repair, downtime, error and faults, specification and correction; New error generation hypothesis; Estimating number of bugs in a computer program; Reliability. Models; Availability models; Quality assurance; Quality measures; Different cost estimation models and their comparisons; Software maintenance;

Maintenance-cost models: Growth dynamic models; Documentation; Software project organization, Management and communication skills;

Deployment and maintenance: Key issues around deployment, Deployment itself, Continuous Integration and Deployment, Maintenance, Maintenance challenges, Software evolution and release management, Re-engineering.

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

Course Learning Outcomes	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2			√									
CLO3									√			√

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Web Material • Audio/video	• Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Web Material • Audio/video	• Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
    a. Continuous Assessment: **50%**
    b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. Elias M. Awad : Software Engineering, A practitioner's Approach, McGraw- Hill
ii. Ian Sommerville : System Analysis and Design (2nd Edition*), Galgotia Publications Pvt. Ltd. (2010).*

2) Reference Books:

i. Richard Fairley : Software Engineering Concepts, *McGraw-Hill.*
ii. Robert N. Charette : Software Engineering Environments*, McGraw-Hill.*
iii. Jeffery L. Whitten : System Analysis and Design Methods (7th Edition); *McGraw Hill* (2007).

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Course Code	Course Title	Credits
CSE 2205	**Computer Architecture and Organization**	**3.00**

Rational of the Course: To develop basics and design knowledge on Computer Architecture and Systems.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Explain** the basic knowledge of Computer Architecture and its organization
CLO2	**Identify** different components of a Computer Systems.
CLO3	**Compare** different processor, memory and storage of a Computer Systems.

Course Content:

Concepts and Terminology: Digital computer components Hardware & Software and their dual nature, recent development, Role of Operating Systems (OS).

Processor Design: Introduction: Processor organization, information representation, number formats; Fixed Point Arithmetic: Addition, subtraction, multiplication, division;

ALU Design: Basic ALU organization, floating point arithmetic.

Control Design: Hardwired control: Design methods, multiplier control unit, CPU control unit; Basic concept of Micro programmed Control, Control memory optimization.

Memory Devices and its Organization: Different types of semiconductor memory, magnetic memory, optical memory, virtual memory, memory hierarchies;

High-speed Memories: Interleaved memories, caches, associative memories. System Organization: Communications: Introduction, bus control; IO Systems: Programmed IO, DMA and interrupts, IO processors.

Application HDL for microcomputer design: Description of Adder, ALU by using HDL, implementation of a simple microcomputer system using HDL.

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

Course Learning Outcomes	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12

(CLO)												
CLO1	√											
CLO2		√										
CLO3	√											

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book	• Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video	• Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. John P. Hayes : Computer Architecture and Organization, *McGraw-Hill.*

ii. M. Morris Mano : Computer Architecture, *Prentice Hall.*

2) Reference Books:

i. Kai Hwang and Faye A.Briggs : Computer Architecture and Parallel Processing, *McGraw-Hill.*

ii. William Stallings : Computer Organization and Architecture: Designing for Performance, *Prentice Hall.*

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Course Code	Course Title	Credits
CSE 2207	**Numerical Methods**	**2.0**

Rationale of the Course: To know the story of how functions, derivatives, integrals, and differential equations are handled as strings of numbers in the computer.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Analyze** the mathematical errors.
CLO2	**Solve** the complex mathematical problems using only simple arithmetic operations.
CLO3	**Estimate** roots of polynomial, integral and differential equations using numerical methods.

Course Content:

Approximations and Errors: Accuracy and Precision, Error Definitions, Round-Off Errors, Truncation Errors.

Roots of Equations: Graphical Methods, The Bisection Method, The False-Position Method, Simple One-Point Iteration, The Newton-Raphson Method, The Secant Method.

Systems of linear algebraic equations: Gauss Elimination, Solving Small Numbers of Equations, Naive Gauss Elimination, Pitfalls of Elimination Methods, Matrix Inversion and Gauss –Seidel, The Matrix Inverse, Error Analysis and System Condition.

Curve Fitting: Linear Regression, Polynomial Regression, Multiple Linear Regression, Newton's Divided-Difference Interpolating Polynomials, Lagrange Interpolating Polynomials, Coefficients of an Interpolating Polynomials, Curve Fitting with sinusoidal Functions.

Numerical Differentiation and Integration: The Trapezoidal Rule, Simpson's Rules, Integration with Unequal Segments, Romberg Integration, Gauss Quadrature, High-Accuracy Differentiation Formulas, Richardson Extrapolation, Derivatives of Unequally Spaced Data. Pseudo random-number generators, the FFT.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1		√										
CLO2			√									
CLO3	√											

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures**: Re-take Exam**

Learning Materials

Text Book:

i. Steven C. Chapra, Raymond P. Canale : Numerical Methods for Engineers, *McGraw-Hill*

Books Recommended:

i. S. S. Kuo : Computer Applications of Numerical Methods, *Addison-Wesley*

ii. S. S. Sastry : Introductory Methods of Numerical Analysis *Prentice-Hall of India Pvt. Ltd.*

iii. Press, Teukolsky, Vetterling and Flannery : Numerical Recipes in C: The Art of Scientific Computing, *Cambridge University Press*.

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Course Code	Course Title	Credits
MTH 2201	**Complex Variable, Probability and Statistics**	**3.00**

Rationale of the Course: To introduce students with Complex Variable, Probability and Statistics and their uses in engineering.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Understand** the concept of function, limit and continuity, probability, statistics.
CLO2	A**pply** some types of complex differentiation and integration, binomial, Poisson, normal distribution, statistical problem to analyze engineering problems.
CLO3	C**alculate** evaluation of integrals by contour integration, Conditional application of statistics in queuing theory and simulation.

Course Content:

Complex Variable: Complex numbers; Function, limit and continuity; Complex differentiation and integration, Analytic function, Singularity; Cauchy's theorem, Cauchy's integral formula and related theorems; Residue, Residue theorem, evaluation of integrals by contour integration.

Statistics: Statistics and random variables (discrete and continuous); occurrence of random variables; concept of population and using statistics to make inference on characteristics of population. Measures of central tendency, Skewness, Kurtosis, Concept of expected value, variance, standard deviation.

Probability: Probability, Presence of the distributions in different fields particularly in engineering fields. Probability density function and (cumulative) distribution function. Binomial, Poisson and Normal distribution. Normal approximation to binomial; Poisson approximation to binomial. Two-dimensional variates; marginal distributions. Conditional application of statistics in queuing theory and simulation; introduction to queuing models: M/M/1, M/D/1, M/G/1.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√	√										
CLO3		√										

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Audio/Video	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book	• Assignment • Final Exam

	• Web Material	• Participation
CLO3	• Lecture Note • Text Book • Audio/Video	• Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Books:

i. James Ward Brown and Ruel V. Churchill : Complex Variable and Applications, 7th Edition, New York, *McGraw Hill, 2005*.
ii. S.P. Gupta : Practical Statistics
iii. Walpole, Mayers : Probability and Statistics for Engineering and Scientists

2) Reference Books:

i. M. L. Khanna : Functions of a Complex Variable, 14th ed.
ii. J. W. Brown and R. V. Churchill : Complex Variable and Applications, 7th ed., *Mc-Graw, Hill*.
iii. M. R. Spigel : Complex variables, 1st Edition, Singapore, *Mc-Graw Hill*
iv. Hogg Robert V and Tanis Elliot : Probability and Statistical Inference

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Course Code	Course Title	Credits
BUS 2201	**Financial, Cost and Managerial Accounting**	**3.00**

Rationale of the Course: To manage the industry effectively & to appraise financial performance & position of the business accurately.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Describe** the most well-known theories and practices of accounting.
CLO2	**Apply** Generally Accepted Accounting Principles (GAAP) to record common business transactions.
CLO3	**Evaluate** financial statements and other financial reports of industrial companies.

Course Content:
Introduction to Accounting: Concept of Accounting, Objectives of Accounting, Branches of Accounting
Basic Elements of Financial Statements: Operational Guidelines - GAAP, Basic Assumptions, Basic Principles and Constraints.
Concept of Accounting Cycle: Steps in Accounting cycle, Concept of Account, Types of Account, Rules for debit & credit, Double entry accounting system, Journal, Ledger, Trial Balance.
Adjusting the Accounts: Concepts of Adjustment-Types of Adjustment-Reasons for Adjustment and Adjusting Entries.
Plant Assets, Natural Resources, and Intangible Assets: Determining the Cost of Plant Assets-Depreciation -Revaluation of Plant Assets Expenditures during Useful Life- Plant Asset Disposals.
Introduction to Management Accounting: Definition-Nature of Management Accounting-Importance of Management Accounting- Comparison of Financial and Managerial Accounting.
Cost Concept: Meaning- Types of cost- Methods of costing- Preparation of cost sheet-Determination of profit- Cost behavior in decision making.
Job-Order Costing: Measuring Direct Materials Cost-Job Cost Sheet -Measuring Direct Labor Cost -Computing Predetermined Overhead Rates -Applying Manufacturing Overhead -Manufacturing Overhead.
Cost-Volume-Profit Relationships: The Basics of Cost-Volume-Profit (CVP) Analysis- Break-Even and Target Profit Analysis- CVP Considerations in Choosing a Cost Structure- Structuring Sales Commissions.
Financial Statement Analysis: Basics of Financial Statement Analysis- Tools of Analysis.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1										√	√	
CLO2										√	√	
CLO3		√								√	√	

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Audio/Video	• Class Test • Mid-term Exam • Final Exam
CLO2	• Lecture Note • Text Book • Audio/Video • Power point Slide	• Assignment • Mid-term Exam • Final Exam • Participation
CLO3	• Lecture Note • Text Book	• Presentation • Final Exam

	• Audio/Video • Power point Slide	• Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**

3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. Ricky W. Griffin : Management.
ii. Kieso & Kimmel : Financial Accounting.

2) Reference Books:

i. Martz Usry : Cost Accounting

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Course Code:	Course Title:	Credits:
HUM 2201	**Bangladesh Studies and History of independence**	**2.00**

Rational of the Course: This course presents knowledge about Bangladesh's rich heritage and cultural influences, and about events which have shaped national identity. Students will enhance through learning about agriculture, economics systems, industry of Bangladesh, series events of independence about Bangladesh (1905-1971), and constitution of Bangladesh and major amendments and main political parties of Bangladesh. Through their studies, students also gain an understanding of historical skills and concepts, and examine different interpretations of historical events & leadership skills.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Analyze** society, culture, social structure, social structural and process, culture and civilization, Social change, Problems of Society.
CLO2	**Explain** economic activities, agriculture & Industry of Bangladesh, its problems and climate with river system and resource of Bangladesh.

CLO3	**Apply** ethical principles and commit to professional ethics after knowing both the independence history of Bangladesh and the constitution of Bangladesh.

Course Content:

Culture and society of Bangladesh: Society and Culture, Education, Factors of social life, Social structure and process, Social institutions, Culture and civilization, City and Country, Social change, Problems of Society, Social Problems of Bangladesh, Urbanization Process and its impact on Bangladesh

Economic Activities: The economic activities of the people of Bangladesh, Different economic system, Underdeveloped, developing and developed economies, Basic economic problems of Bangladesh, Solution of economic problems of Bangladesh. Is Bangladesh an underdeveloped or developing country?

Agriculture of Bangladesh: Opportunities and Constraints of Agriculture in Bangladesh, Issues and challenges of agriculture in Bangladesh, Priorities areas for agricultural development, Importance and characteristics of agriculture in Bangladesh, Causes of the backwardness of agriculture in Bangladesh, Modern technology in agriculture, Strengthening Bangladesh's agricultural technology system to reduce rural poverty.

Industry of Bangladesh: The need for industrialization in Bangladesh, Inter-dependence of agriculture and industry, The dependence of industry upon agriculture, Characteristics of industry in Bangladesh, Causes of industrial backwardness in Bangladesh, Measures for industrial development in Bangladesh, Structure of industries in Bangladesh, Importance of small and cottage industries of Bangladesh, Problems of cottage industries, Measures for solution of cottage industries of Bangladesh, Supportive measures for cottage industries of Bangladesh, Sustainable Economic Development, Location, area, boundary, Ecological setting, river system, climate, people and resource of Bangladesh.

Independence of Bangladesh: Partition of Bengal (1905), Establishment of Muslim league (1906), reunited Bengal (1911), Growth of Indian National Congress, the creation of new province of East Bengal and Assam, Muslim League (1906), Bengal Pact (1923). Autonomous Bengal (1937 - 1947): East Pakistan as a province of Pakistan, establishment of Awami League, Language Movement of *1952,* United Front and Fall of Muslim League, the Military Rule of Ayub Khan, Economic disparity between the two regions, Cultural suppression of West Pakistan, 6-point Movement, Mass upsurge in 1969, the Rule of Yahya Khan, Election of 1970, the War of Independence and the Emergence of Bangladesh.

The Constitution of Bangladesh: Features of Constitution of Bangladesh -1972, Present Amended Constitution of Bangladesh, Fundamental principles of state administration, The President, The Prime Minister, The Legislature of Bangladesh, The Judiciary System of Bangladesh. Party System of Bangladesh and its Characteristics, The Executive, The Legislature and Judiciary Branch of the Government - Local Government and Agencies.

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

Course Learning Outcomes	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1						√						
CLO2						√						
CLO3						√		√				

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Audio/Video • Web Material	• Assignment • Mid-term Exam • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Audio/Video • Web Material	• Class test • Assignment • Mid-term Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video • Web Material	• Presentation • Class test • Mid-term Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i.	Prof. Dr. Mohar Ali	:	Bangladesh Politics: Problems and Issues
ii.	Md. Hasebur Rahman	:	Bangladesh Studies
iii.	A F Salahuddin Ahmed and Bazlul Mobin Chowdhury	:	National Culture and Heritage, *Independent University Publication 2004*
iv.	A M a Muhith	:	Bangladesh Emergence of a Nation

2) Reference Books:

i.	Haroun er Rashid	:	Geography of Bangladesh, University Press Limited, 1991
ii.	Talukdar Maniruzzaman	:	Bangladesh Revolution and its Aftermath
iii.	Haroun Er Rashid	:	Land and People

iv. Syed Anwar Husain : Historical Background of the liberation war: A short Analysis

v. Rounaq Jahan : Political Development in Bangladesh on the threshold of the Twenty-First Century

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Course Code:	Course Title:	Credits:
CSE 3100	**Software Development Project I**	**1.00**

Rationale of the Course: To design and develop a project from their knowledge they have acquired from Structured programming Language C.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Analyze** the previous works done by others in relevant field and choose the specific real-world topic.
CLO2	**Design** a real-world project based on their acquired knowledge.
CLO3	**Develop** complete real world software solution by group or team works.

Course Content: Based on the previous related courses.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1		√		√								
CLO2			√		√							
CLO3			√		√				√			

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Text Book • Web Material • Audio/Video	• Project presentation • Project Paper • Oral Presentation • Viva
CLO2	• Text Book • Web Material • Audio/Video	• Project presentation • Project Paper • Oral Presentation • Viva
CLO3	• Text Book • Web Material • Audio/Video	• Project presentation • Project Paper • Viva • Oral Presentation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Attendance & Performance	**10%**
Continuous Assessment	**40%**
Final Exam (Presentation, Report & Viva)	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final Exam: **50%**
3) Make-up Procedures: **Re-take Exam**

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Course Code:	Course Title:	Credits:
CSE 3102	**Mobile Application Development Sessional**	**1.00**

Rationale of the Course: To introduces the design and implementation of Android applications for mobile devices. Learn the basics of mobile application development using Android as the platform and Java and Kotlin as the programming language.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Configure** Android application development tools.
CLO2	**Design** user Interfaces for the Android platform.
CLO3	**Apply** Java and Kotlin programming concepts to Android application development.
CLO4	**Develop** real world project using Android platform.

Course Content:

Installation and Configuration of application development tools: Java Software Development Kit (JDK), Android Software Development Kit (SDK), Android Studio, Android Virtual Device Manager, Genymobile, Android Debug Bridge, Android Device Drivers

Design and develop User Interfaces for the Android platform: Android Applications, Activities and Widgets, Action Bar Activities, Customizing Styles and Themes, Displaying images, Playing video and audio, UI Fragments and the Fragment Manage, Creating custom Surface Views and simple animation, Responding to touch events, Supporting different devices, localizations, orientations, API levels, and resolutions, XML resources, Launching Activities and passing information between Activities

Saving state information across important operating system events: The Activity Lifecycle, Saving data to external and internal storage, Shared preferences, Connecting to databases and sending SQL queries, Storing information in encrypted format

Java/Kotlin programming concepts to Android app development: Extending classes, Overriding class methods, Adding new properties and methods to classes, Creating and implementing interfaces, Creating event listeners and responding to events, Tying Android XML resources to Java code, Creating Threads and Runnables for asynchronous event processing

Publishing & Security: Creating a Google Play Store account and preparing apps for the Play Store, Android manifests and permissions, APK contents, The Android security model

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√				√							
CLO2			√		√							
CLO3			√		√							
CLO4					√				√			

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Text Book • Lab Manual • Web Material • Audio/Video	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO2	• Text Book • Lab Manual • Web Material • Audio/Video	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO3	• Text Book • Lab Manual • Web Material • Audio/Video	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO4	• Text Book • Lab Manual • Web Material • Audio/Video	• Lab Test • Lab Report • Viva • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Lab Attendance & Performance	**10%**
Continuous Assessment (Experiment, Report & Viva)	**40%**
Final Exam (Lab Test, Viva & Project)	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final Exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. RetoMeier : "Professional Android Application Development", *Wrox*, 2010.

ii. Mark Murphy : "Beginning Android",Apress

2) Reference Books:

i. Rick Rogers : "Android – Application Development", *O'Reilly*

ii. Matt Gifford : PhoneGap Mobile Application Development Cookbook", *PACKT*

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Course Code:	Course Title:	Credits:
CSE 3103	**Operating Systems**	**3.00**

Rationale of the Course: To develop basics knowledge on Operating system design and principles.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Describe** responsibilities of contemporary operating system; the structure of operating systems,
CLO2	**Explain** operating system design and its impact on application system design and performance.
CLO3	**Evaluate** operating system features.

Course Content:

Introduction: Introduction to OS, operating system functions, evaluation of O.S., Different types of O.S.: batch, multi-tasking, multiprogramming, time-sharing, real-time, distributed, and parallel.

System Structure: Computer system operation, I/O structure, storage structure, storage hierarchy, different types of protections, operating system structure (simple, layered, virtual machine), operating system services, system calls.

Process Management: Processes Concept, process scheduling, operations on processes, co-operating processes, inter-process communication.

Threads: Overview of threads, benefits of threads, user and kernel threads.

CPU scheduling: Scheduling criteria, preemptive & non-preemptive scheduling, scheduling algorithms (FCFS, SJF, RR, Priority, multi-level queue, feedback queue), evaluations of algorithms, multi-processor scheduling, process affinity.

Process Synchronization: Race condition, critical section problem, critical region, synchronization hardware, classical problems of synchronization, semaphores.

Deadlocks: System model, deadlock characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock.

Storage Management: Memory Management: Background, logical vs. physical address space, swapping, contiguous memory allocation, paging, segmentation, segmentation with paging.

Virtual Memory: Background, demand paging, page fault handling, page replacement, page replacement algorithms, allocation of frames, thrashing.

File Systems: File concept, access methods, directory structure, file system structure, allocation methods (contiguous, linked, and indexed), and free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency & performance.

I/O Management: I/O hardware, polling, interrupts, DMA, application I/O interface (block and character devices, network devices, clocks and timers, blocking and non-blocking I/O), kernel I/O subsystem (scheduling, buffering, caching, spooling and device reservation, error handling), performance.

Protection & Security: Goals of protection, domain of protection, security problem, authentication, one time password, program threats, system threats, threat monitoring, encryption.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3		√										

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note	• Class Test

	• Text Book	• Final Exam • Participation • Assignment
CLO2	• Lecture Note • Text Book	• Class Test • Final Exam • Assignment
CLO3	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Assignment

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. A. Silberschatz, P. B. Galvin, Greg Gagne : **Operating Systems Concepts**, *Wiley Publisher*.

ii. Donovan : **Systems Programming**, *McGraw-Hill.*

2) Reference Books:

i. A. S. Tanenbaum : **Modern Operating Systems**, *Prentice-Hall*

ii. Terrence : **Unix System Programming in C++,** *Prentice Hall* Publication

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Course Code:	Course Title:	Credits:
CSE 3104	**Operating Systems Sessional**	**1.00**

Rationale of the Course: To develop basics on Operating System Design and to analyze its different features.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Compare** the performance of various CPU Scheduling Algorithms.
CLO2	**Implement** deadlock avoidance, and Detection Algorithms.
CLO3	**Analyze** the performance of the various memory allocation and page replacement algorithms.

Course Content: Based on theory for course Code: **CSE 3103 &** Course Title: **Operating Systems.**

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1		√			√							
CLO2			√		√							
CLO3		√										

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video • Lab Manual	• Lab Test • Lab Report • Viva • Final Exam

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Lab Attendance & Performance	**10%**

Continuous Assessment (Experiment, Report & Viva)	**40%**
Final Exam (Lab Test, Viva & Project)	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. A. Silberschatz, P. B. Galvin, Greg Gagne : **Operating Systems Concepts**, *Wiley Publisher*.

ii. Donovan : **Systems Programming**, *McGraw-Hill.*

2) Reference Books:

i. A. S. Tanenbaum : **Modern Operating Systems**, *Prentice-Hall*

ii. Terrence : **Unix System Programming in C++,** *Prentice Hall* Publication

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Course Code:	Course Title:	Credits:
CSE 3105	**Microprocessors, Microcontrollers and Embedded Systems**	**3.00**

Rationale of the Course: To develop hardware knowledge and programming skills on computer interfacing.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Gather** the basic knowledge required for microprocessor interfacing.
CLO2	**Utilize** knowledge for real world applications using programmable Interface device.
CLO3	**Explain** the use of microcontroller and development board for real world applications

Course Content:

Interfacing peripherals: Peripheral I/O and memory mapped I/O, Interfacing with external memory, microprocessor-controlled data transfer and peripheral controlled data transfer, Interfacing with LED, seven segment display, Push-button keys, commercial AD and DA converter, ADC 0809, Flash ADC, ADC 0820.

Programmable Interface device: Interfacing 8355/8755 Programmable I/O ports, 8255 Programmable peripheral interface, Block diagram of 8255, its different mode of operation,

Interfacing A/D converter using 8255, Application of 8259, 8257 PPI. AUD, RS 232 standard, Software versus programmable hardware approach, software controlled asynchronous serial I/O, 8251 programmable communication interface and its block diagram.

Microcontroller programming: Architecture of microcontroller of 8051 family, programming model, register, instruction set, enhanced 8051 features, Microchip ATmega328P architecture, ATmega328 architecture, ATmega1280 architecture, ATmega256 architecture. Arduino development board and its programming model. Introduction of Raspberry Pi. Internet of Things (IoT).

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3	√											

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book	• Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video	• Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:
   i. Rafiquzzaman : **Microprocessor and Microcomputer based System Design**, CRC Press
   ii. Ramesh Goanker : **Microcomputer Interfacing**, *McGraw-Hill*

2) Reference Books:
   i. D. V. Hall : **Concepts of Electricity and Magnetism**, *Students' Publications*
   ii. Y. Liu and G. A. Gibson : **Microcomputer Systems**: 8086/8088 Family, *Prentice-Hall*
   iii. Artwick : **Microcomputer Interfacing**, *Prentice Hall*
   iv. James E. Powell : **Designing User Interfaces**, *Microtrend Books San Marcos, CA, USA*

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Course Code:	Course Title:	Credits:
CSE 3106	**Microprocessors, Microcontrollers and Embedded Systems Sessional**	**1.00**

Rationale of the Course: To develop hardware knowledge and programming skills on computer interfacing and apply the knowledge to real world applications.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Gather** knowledge for real world applications using Arduino development board
CLO2	**Design** 8051 microcontroller-based system.
CLO3	**Apply** knowledge for real world applications targeting microcontroller board and IoT

Course Content: Based on theory for course Code: **CSE 3105 &** Course Title: **Microprocessors, Microcontrollers and Embedded Systems**

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2			√									
CLO3			√		√				√			

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video • Lab Manual	• Lab Test • Lab Report • Viva • Final Exam

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Lab Attendance & Performance	**10%**
Continuous Assessment (Experiment, Report & Viva)	**40%**
Final Exam (Lab Test, Viva & Project)	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. Rafiquzzaman : **Microprocessor and Microcomputer based System Design**, CRC Press
ii. Ramesh Goanker : **Microcomputer Interfacing**, *McGraw-Hill*

2) **Reference Books**:

i. D. V. Hall : **Concepts of Electricity and Magnetism**, *Students' Publications*
ii. Y. Liu and G. A. Gibson : **Microcomputer Systems**: 8086/8088 Family, *Prentice-Hall*
iii. Artwick : **Microcomputer Interfacing**, *Prentice Hall*

iv. James E. Powell : **Designing User Interfaces**, *Microtrend Books San Marcos, CA, USA*

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Course Code:	Course Title:	Credits:
CSE 3107	**Data Communication**	**3.00**

Rationale of the Course: The main course is to learn the working knowledge of data transmission concepts, line control and line sharing and also is to understand the operation of compression optimizing data transfer algorithms.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Explain** data communication system and its components.
CLO2	**Compare** the performances of digital and analogue channels.
CLO3	**Apply** the mechanism and techniques of encoding.
CLO4	**Illustrate** the general principles of circuit and packet switching.

Course Content:
Introduction: Communication models; data communication tasks; data communication network standards and organization introduction to TCP/IP models.

Data Transmission basics: Analog and digital data; spectrum and bandwidth; Transmission impairments; data rate; and channel capacity; Data Encoding; NRZI Manchester and Differential Manchester encoding; ASK; FSK; PSK; QPSK; QAM encoding; speared spectrum technique; Sampling theorem and pulse code modulation techniques and speech digitization.

Data Transmission: Asynchronous and synchronous data transmission techniques; error; detection techniques; parity cheeks and CRC error correction and hamming code interfacing and EIA 232D or RS 232c. DSL technology:- Data Link Control: Line configurations.

Multiplexing: Frequency division multiplexing; international FDM carrier standards; Synchronous time division multiplexing; international TDM carrier standards; statistical time division multiplexing; SONET and SDH.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3		√										
CLO4	√											

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Web Material	• Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video	• Presentation • Final Exam • Participation
CLO4	• Lecture Note • Text Book • Web Material	• Assignment • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. Behrouz A. Forouzan : **Data Communications and Networking,** Tata McGraw-Hill Edition

2) Reference Books:

i. William Stallings : **Data and Computer Communications,** *Prentice Hall International, Inc.*

ii. John M. Senior : **Optical Fiber Communications**, *Prentice-Hall of India Pvt Ltd*

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Course Code:	Course Title:	Credits:
CSE 3110	**Technical Writing and Presentation**	**1.00**

Rationale of the Course: To learn principles, techniques and skills to conduct scientific, technical or business writing and oral presentation

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Prepare** documents in a variety of professional genres such as memos, proposals, and analytical reports
CLO2	**Produce** documents that respond to the needs of multiple audiences, including international/global audiences
CLO3	**Create** effective multimedia presentations.

Course Content:

Introduction to Technical Writing, Resumes and Job Application Letters, memos and business letter, research proposal, project report writing, preparation of power point presentation, poster presentation

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1										√		√
CLO2										√		
CLO3										√		√

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book	• Class Test • Final Exam • Participation • Assignment
CLO2	• Lecture Note • Text Book	• Class Test • Final Exam • Assignment
CLO3	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Assignment

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Lab Attendance & Performance	**10%**
Continuous Assessment	**40%**
Final Exam (Lab Test, Viva & Project)	**50%**

2) Marks Distribution:
    a. Continuous Assessment: **50%**
    b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. Mike Markel : Technical Communication, 11th edition, *Bedford/St. Martins*

ii. Craig *Baehr* and Kelli *Cook Cargile* : The Agile Communicator: Principles and Practices in Technical Communication, *Kendall Hunt Publishing*

1) Reference Books:

i. John M. Swales & Christine B. Feak : Academic Writing for Graduate Students, 3rd Edition: Essential Skills and Tasks, *Michigan ELT*

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Course Code	Course Title	Credits
BUS 3101	**Technology Entrepreneurship for Business**	**3.00**

Rationale of the Course: To develop competence of entrepreneurs and small business owners/managers in the light of technology for smooth functioning of the multidisciplinary aspect of business as well as overcoming the business challenge.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Define** the concept of entrepreneurship development, functions and role of an entrepreneur in the business economy accurately.
CLO2	**Design** the procedures for preparing business Plan and contextualize with the practical business situation.
CLO3	**Apply** the necessary technological knowledge and skills to build up diverse career through analysing real life case studies on entrepreneurial context.

Course Content:
Entrepreneurship: A world of Opportunity: Meaning of Entrepreneurship, Definition of Entrepreneur, functions of Entrepreneur, Importance of Entrepreneurship, Entrepreneur versus Entrepreneurship, Characteristics of a successful Entrepreneur, Discussion about successful entrepreneurs of Bangladesh, Factors Influencing Entrepreneurship, Entrepreneurial environment, “An Entrepreneur is born or made,” Entrepreneur versus Management, National benefits of Entrepreneurship, problems faced by entrepreneurs in Bangladesh.

Classifications and Models of Entrepreneurship: Types of Entrepreneurship, Classification on the Basis of Ownership, Classification on the Basis of Personality Traits and their Style of Running Business, Classification, Entrepreneurial Models, The Opportunist Model, The Enabler Model, The Advocate Model, The Producer Model.

Entrepreneur v/s Intrapreneur: Entrepreneurial Process, Intrapreneurship, Intrapreneur: Definition, Characteristics of Intrapreneurs, Reasons for Promoting Intrapreneurs in Organization, Intrapreneurs as Dreamers and Change Agents, Similarities and Economic Differences between Entrepreneur and Intrapreneur, Legal issues for Entrepreneur: Intellectual property rights: Copyrights, Trademarks, Trade secrets, Patents.

Women Entrepreneurship: Introduction, Role of entrepreneurship in economic development, Concepts of women entrepreneurship Scope of Entrepreneurship among Women, Functions, Working Environment, Challenges in the Path of Women Entrepreneurs, Problems faced by women entrepreneur in Bangladesh.

Business Plan: Conducting Feasibility, Concept and Scope of Business Plan, Value and Importance of a Business Plan Merits of business plan; causes of product failure; functions of business plan; in search of new ideas and products; elements of the business plan; steps or guideline to develop a business plan.

Setting up a Small Business Enterprise: Concepts and meaning of small business, Types of small business, Steps of starting a small enterprise, Role of small business enterprise in the socio-economic development of Bangladesh.
Franchising: Meaning of franchising, Purpose of franchising, Types and arrangements of franchise.

Managing Small Business: Good employees are valuable asset, Human development in different stages of small business, Management functions & its applicability, Causes of failure as a small business manager.

Entrepreneurial competencies: Meaning of entrepreneurial competency or trait, major competencies, developing competencies.

Entrepreneurial Cases: Analyzing cases of different renowned and successful Entrepreneurial aspects.
Mapping of Course Learning Outcomes (CLOs) with the Program Learning Outcomes (PLOs):

Course Learning Outcomes	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1											√	
CLO2									√	√	√	
CLO3									√	√	√	

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Audio/Video	• Class Test • Mid-term Exam • Final Exam
CLO2	• Lecture Note • Text Book	• Assignment • Mid-term Exam

	• Audio/Video • Power point Slide	• Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video • Power point Slide	• Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: Re-take Exam

Learning Materials

1) Text Book:

i. Khan, A.R : Entrepreneurship, Small Business and Lives of Successful Entrepreneurs

ii. S.S. Khanka : Entrepreneurial Development

2) Reference Books:

i. Najrul Islam : Entrepreneurial Development

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Course Code	Course Title	Credits
HUM 3101	**Professional Ethics and Environmental Protection**	**2.00**

Rationale of the Course: The aim of this course is to provide knowledge on engineering and professional ethics and human values and morals, and social values to appreciate the rights of others. It will also help the learners to understand the relationship between technology and environment, to protect and manage environment, and the implied social costs and benefits.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Discuss** the basic knowledge of profession, professional ethics and various moral issues.
CLO2	**Explain** various social issues and evaluate the effects of the use of technology on social culture, economic, legal, health welfare of the society.
CLO3	**Evaluate** the effects of the use of technology on environment.

Course Content:

Introduction: Morals, values and ethics, integrity, work ethic, service learning, civic virtue, respect for others, living peacefully, caring, sharing, honesty, courage, valuing time, cooperation, commitment, empathy, self -confidence, character, spirituality, introduction to yoga and meditation for professional excellence and stress management.

Engineering Ethics: Senses of 'Engineering Ethics', variety of moral issues, types of inquiry, moral dilemmas, moral autonomy, Kohlberg's theory, Gilligan's theory, consensus and controversy, models of professional roles, theories about right action, self-interest, customs and religion, uses of ethical theories.

Risk Analysis: Safety and risk, assessment of safety and risk, risk benefit analysis and reducing risk, respect for authority, collective bargaining, confidentiality, conflicts of interest, occupational crime, professional rights, employee rights, intellectual property rights (IPR), discrimination.

Corporate Ethics: Multinational corporations, environmental ethics, computer ethics, weapons development, engineers as managers, consulting engineers, engineers as expert witnesses and advisors, moral leadership –code of conduct, corporate social responsibility.

Impact of technology on society: innovation and creativity, the history and the trend of technology on the social and culture on society.

Environmental protection: Environmental protection and related issues, role of the engineer in energy conservation ecological balance, and sustainable development.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1								√				
CLO2						√						
CLO3							√					

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book	• Class Test • Mid-term Exam • Final Exam

CLO2	• Lecture Note • Text Book • Power point Slide	• Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Power point Slide	• Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a) Continuous Assessment: **50%**
   b) Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. Mike W. Martin and Roland Schinzinger . Ethics in Engineering, Tata McGraw Hill, New Delhi, 2003

ii. Govindarajan M, Natarajan S, Senthl Kumar V. S . Engineering Ethics, Prentice Hall of India, New Delhi, 2004

2) Reference Books:

i. S.F. Johnson, J.P. Gostelow and W.J. King : Engineering and Society Challenges of Professional Practice, *Prentice-Hall*, 2000

ii. L.S. Hjorth, B.A. Eichler and A.S. Khan : A bridge to the 21st Century, *Prentice-Hall*, 2000

iii. Charles E. Harris, Michael S. Printchard and Michael J. Rabins : Engineering Ethics - Concepts and Cases, Cengage Learning, 2009

iv. Charlies B. Fleddermann : Engineering Ethics, *Pearson Prentice Hall*, New Jersey, 2004

v. Laura P. Hartman and Joe Desjardins: Business Ethics : Decision Making for Personal Integrity and Social Responsibility, *McGraw Hill education*, India Pvt. Ltd. New Delhi 2013

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Course Code:	Course Title:	Credits:
CSE 3200	**Software Development Project II**	**1.00**

Rationale of the Course: To design and develop a project from their knowledge they have acquired from Object Oriented programming Language C++/JAVA.
Course Learning Outcomes: at the end of the Course, the Student will be able to–

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Analyze** the previous works done by others in relevant field and choose the specific real-world topic.
CLO2	**Design** a real-world project based on their acquired knowledge.
CLO3	**Develop** complete real world software solution by group or team works.

Course Content:

Based on the previous related courses.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1		√										
CLO2			√									
CLO3			√		√				√			

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Text Book • Web Material • Audio/Video	• Project presentation • Project Paper • Oral Presentation • Viva
CLO2	• Text Book • Web Material • Audio/Video	• Project presentation • Project Paper • Oral Presentation • Viva
CLO3	• Text Book • Web Material • Audio/Video	• Project presentation • Project Paper • Oral Presentation • Viva

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Attendance & Performance	**10%**
Continuous Assessment	**40%**
Final Exam (Presentation, Report & Viva)	**50%**

2) Marks Distribution:
    a. Continuous Assessment: **50%**
    b. Final Exam: **50%**
3) Make-up Procedures: **Re-take Exam**

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Course Code:	Course Title:	Credits:
CSE 3201	**Compiler Design**	**3.00**

Rationale of the Course: This course is designed to provide details knowledge about a language compilation process and skills to develop a compiler.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Design** of a compiler including the phases of a typical compiler and its front- and back ends and role of a symbol table.
CLO2	**Create** Regular Expressions and Finite Automata for tokens design and implement the functions of lexical analyzer.
CLO3	**Apply** an algorithm for a top-down or a bottom-up parser construction and construct a parser for a small context-free grammar.

Course Content:

Introduction to Compiler: Fundamental of compilers and interpreters; assembler and linker; phases of compilation; compiling techniques; structure of a compiler.

Lexical Analysis: The role of the lexical analyzer; tokens; patterns; lexemes; lexical analyzer generator.

Grammars: Notation and concepts for languages and Grammars; sets and string; classification of grammars; context-free grammar; regular expression; finite automat; parse tree; ambiguous grammar.

Symbol Table: Perspective and motivation of symbol table; symbol table content; operation on symbol table; organization of symbol table.
[[
Parsing: Basic parsing technique; classification of parsing; top-down parsing; bottom-up parsing; predictive parsing; LL and LR parsers; FIRST and FOLLOW; shift reduce parsing; operator-procedure parsing; predictive parsing.

Syntax-Directed Translation: Syntax-directed definitions; syntax-directed translation schemes; Construction of syntax tree; attributes; inherited and synthesized attributes; dependency graphs.

Intermediate Code Generation: Intermediate Code; Translation of different language features; different

types of intermediate representations; three-address code; quadruples; triples; Boolean expression; directed acyclic graphs for expressions.

Code Generation: Issue in the design of a code generator; Types of code generator; problems in code generation; the target machine; run-time storage management; Basic blocks and flow graphs; Next-use information; a simple code generator; Register allocation and assignment; the dag representation of basic blocks.

Code Optimization: Code optimization; the principal source of optimization; optimization of basic blocks; variable elimination; reduction in strength; loop optimization; peephole optimization.

Error Handling: Compile time error handling; error detection; error recovery; error repair.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1			√									
CLO2		√	√									
CLO3			√									

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Web Material	• Class Test • Presentation • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Web Material • Audio/Video	• Class Test • Assignments • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
    a. Continuous Assessment: **50%**
    b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i.	Alfred V. Aho and Jeffrey D. Ullman	:	Principles of Compiler Design, *Addison-Wesley Publication.*
ii.	A. A. Puntambekar	:	Principles of Compiler Design, *Technical Publications Pune*

2) Reference Books:

i.	A.J. Holub	:	Compiler design in C, *Prentice-Hall of India*
ii.	Trembly and Sorensen	:	Theory and Practices of Compiler Writing, *McGraw-Hill computer science series.*
iii.	Hopcroft and Ulman	:	Introduction to Automata Theory, Languages and Computation, *University of Toronto*
iv.	Adamek	:	Automata and Algebra, *Kiuwer Academic Publishers Norwell, MA, USA.*

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Course Code:	Course Title:	Credits:
CSE 3202	**Compiler Design Sessional**	**1.00**

Rationale of the Course: To enlighten the student with knowledge base in compiler design and provide the ability to design and implement a significant portion of a compiler for a language.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Implement** the process of lexical analysis, parsing and other compiler design aspects
CLO2	**Use** the new tools and technologies used for designing a compiler.
CLO3	**Work** in the development phase of new computer language in the industry**.**

Course Content:

Based on theory for course Code: **CSE 3201** & Course Title: **Compiler Design.**

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1			√		√							

CLO2			√		√						
CLO3			√		√				√		

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lab Manual • Web Material • Audio/Video	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO2	• Lab Manual • Web Material • Audio/Video	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO3	• Lab Manual • Web Material • Audio/Video	• Lab Test • Lab Report • Viva • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Lab Attendance & Performance	**10%**
Continuous Assessment (Experiment, Report & Viva)	**40%**
Final Exam (Lab Test, Viva & Project)	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final Exam: **50%**
3) Make-up Procedures: **Re-take Exam.**

Learning Materials

1) Text Book:

i. Alfred V. Aho and Jeffrey D. Ullman : Principles of Compiler Design, *Addison- Wesley Publication.*

ii. A. A. Puntambekar Principles of Compiler Design, *Technical Publications Pune*

2) Reference Books:

i.	A.J. Holub	:	Compiler design in C, *Prentice-Hall of India*
ii.	Trembly and Sorensen	:	Theory and Practices of Compiler Writing, *McGraw-Hill computer science series.*
iii.	Hopcroft and Ulman	:	Introduction to Automata Theory, Languages and Computation, *University of Toronto*
iv.	Adamek	:	Automata and Algebra, *Kiuwer Academic Publishers Norwell, MA, USA.*

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Course Code:	Course Title:	Credits:
CSE 3203	**Artificial Intelligence**	**3.00**

Rationale of the Course: To develop basic knowledge on artificial Intelligence (AI) and its applications.
Course Learning Outcomes: At the end of the Course, the Student will be able to –

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Design** statements for semantic rules as well as inference rules for the logical expression
CLO2	**Explain** logics of monotonic & non-monotonic, searching techniques, Bayesian probabilistic theorem & algorithms and expert systems to find out the decision for the specific problem.
CLO3	**Apply** inductive learning, enforcement learning, neural networks, two layer & three layer neural net, supervised and unsupervised learning to build up expert systems

Course Content:
Introduction: History of AI, AI problems, AI Applications, Areas of AI, Intelligence, Knowledge, Types of Knowledge.

Knowledge Representation: Knowledge representation, Syntax and semantics for Propositional Logic, Predicate Logic (PL), Semantic Rules for statements, Inference Rules, Syntax and Semantics for First Order Predicate Logic (FOPL), Properties of Wffs, Clausal Conversion Procedure, Unification algorithm, Resolution in Propositional Logic, Resolution in Predicate Logic.

Reasoning under uncertainty: Truth Maintenance System (TMS), Logics of Monotonic & Non monotonic systems, Conceptual dependencies, Bayesian probabilistic theorem for decision, Fuzzy logic, Fuzzy and Crisp logic, membership functions, Fuzzy logic and fuzzy sets.

Searching Techniques & Algorithms in AI: Blind or Uninformed Search, Breadth-First Search, Depth-First search, Informed or Directed search, Hill Climbing search, Best-First Search Expert systems: Phases in building Expert System, Expert System Architecture, Knowledge Base (KB), Navigational Capability /Inference Engine, Rule Based Expert Systems.

Artificial Neural Networks: Biological Neuron, The McCulloch-Pitts model, Neuron Models, Applications of Neural Networks, Two-layer & Three-layer neural net, Supervised learning, Non-Supervised learning.

Planning and Learning: Planning with state space search, conditional planning, continuous planning, multi-Agent planning, Inductive learning, Reinforcement learning, Learning with decision trees AI programming languages: Introduction to python programming language,

Python Operators: Arithmetic, Logical, Comparison, Assignment, Bitwise & Precedence, Machine Learning algorithms with Python, Turbo PROLOG, knowledge representation, domain, predicate, clauses, database, back tracking, unification, list, string operations, windows, Graphics and file operations using prolog. Basic concept on other logic programming

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1			√									
CLO2	√											
CLO3		√	√									

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Web Material	• Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Web Material	• Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**

3) Make-up Procedures: **Re-take Exam**

Learning Materials

Text Book:

i. D. W. Patterson : **Introduction to Artificial Intelligence and Expert System** *Prentice-Hall of India.*

ii. Carl Townsend : **Introduction to Turbo Prolog,** *Sybex Inc.*

Books Recommended:

i. Elaine Rich, Kevin Knight and Shivashankar B. Nair : **Artificial Intelligence,** *Tata McGraw-Hill, India, 3rd Edition 2009*

ii. Patrick Henry Winston : **Artificial intelligence**, *Pearson Education Inc*. 3rd Edition 2011

iii. N. P. Padhy : **Artificial Intelligence and Intelligent System**, *Oxford University Press*

iv. Bratko, I : Prolog Programming for Artificial Intelligence, *Addison Wesley***.**

v. Clocksin, W.F. and Mellish, C.S. : Programming in Prolog: Using the ISO Standard, *Springer.*

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Course Code:	Course Title:	Credits:
CSE 3204	**Artificial Intelligence Sessional**	**1.00**

Rationale of the Course: To solve the basic problems on artificial Intelligence (AI) and its applications.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Apply** the rules to solve the problems, with variables rules, execution rules, input & output predicates and other built-in predicates
CLO2	**Compute** the arithmetical operations compound objects, dynamic and static databases, variables
CLO3	**Demonstrate** expert systems tasks, Back propagation neural networks & machine learning.

Course Content: Based on theory for course Code: **CSE 3203 &** Course Title: **Artificial Intelligence**

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1			√	√								
CLO2		√										
CLO3	√				√							

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Lab Manual	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Lab Manual	• Lab Test • Lab Report • Viva • Final Exam
CLO3	• Lecture Note • Text Book • Lab Manual	• Lab Test • Lab Report • Viva • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Lab Attendance & Performance	**10%**
Continuous Assessment (Experiment, Report & Viva)	**40%**
Final Exam (Lab Test, Viva & Project)	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final Exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

Text Book:

i. Carl Townsend : Introduction to Turbo Prolog**,** *Sybex Inc.*

ii. Clocksin, W.F. and Mellish, C.S. : Programming in Prolog: Using the ISO Standard, *Springer.*

iii. Richard L. Halterman : Fundamentals of Python Programming**,** *Southern Adventist University*, September 29, 2019

Books Recommended:

i. Brian Heinold : A Practical Introduction to Python Programming, Department of Mathematics and Computer Science, *Mount St. Mary's University*, ©2012 Brian Heinold

ii. D. W. Patterson : Introduction to Artificial Intelligence and Expert System *Prentice-Hall of India.*

iii. Patrick Henry Winston : Artificial intelligence, *Pearson Education Inc*. 3rd Edition 2011

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Course Code:	Course Title:	Credits:
CSE 3205	**Computer Networks**	**3.00**

Rationale of the Course: Resource sharing, high Reliability, increase in system performance, and security are the main objectives.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Define** different topologies of computer networks, factors influencing computer network development and the reasons for having variety of different types of networks.
CLO2	**Illustrate** knowledge of different techniques of error detection and correction to detect and solve error bit during data transmission.
CLO3	**Design** network routing for IP networks.
CLO4	**Explain** proper placement of different layers of ISO model

Course Content:

Introduction: Computer Networks and Applications, Network Topologies, OSI reference model, TCP/IP model and terminology, Connectionless and Connection Oriented services, Service primitives, The ARPANET.

Physical Layer: Circuit switching and Packet switching, X-25 protocol, Frame relay and ENGI relay, ATM reference model.

Medium Access Sublayer: Pure and slotted ALOHA, Persistent and Non persistent CSMA, CSMA with collision detection and collision free protocols, IEEE standard 802.3 and Ethernet.

Data Link Layer: Types of errors, framing, error detection & correction methods; Flow control, Stop & wait ARQ, Go-Back- N ARQ, Selective repeat ARQ, HDLC.

Network Layer: Internet address, classful address, subnetting, static vs. dynamic routing, shortest path algorithm, flooding, distance vector routing, link state routing, ARP, RARP, IP, ICMP.

Transport Layer: UDP, TCP, Connection management, Addressing, Establishing and Releasing Connection, Congestion control algorithm, Flow control and Buffering, Multiplexing.

Presentation Layer: Data Compression techniques, Frequency Dependent Coding, Context Dependent

Encoding.
Application Layer: Internet and intranets, Internet services and goals, DNS, SMTP, FTP, Telnet, HTTP, World Wide Web (WWW), DHCP and BOOTP.

Networking in Practice: Designing LAN, Cabling, Establishing Client- Server network, Configuring: Directory Server, Proxy server, FTP server, E-mail server, web server, DB server, Firewall, Network troubleshooting, network maintenance, network monitoring, Network programming.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3			√									
CLO4	√											

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book	• Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book	• Presentation • Final Exam • Participation
CLO4	• Lecture Note • Text Book	• Assignment • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
    a. Continuous Assessment: **50%**

b. Final exam: **50%**

3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. Andrew S. Tanenbaum : Computer Networks, *Prentice-Hall*
ii. Uyless Black : Computer Networks: Protocols, Standards, and Interfaces, *Prentice-Hall*

2) Reference Books:

i. W. R. Stevens : TCP/IP Illustrated Vol. I, *Addison-Wesley Professiona*
ii. James F. Kurose, Keith W. Ross : Complete Networking: A Top-Down Approach Featuring the Internet, *Addison-Wesley*

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Course Code:	Course Title:	Credits:
CSE 3206	**Computer Networks Sessional**	1**.00**

Rationale of the Course: Apply, discuss, analyze, simulate, and present architectures, applications of different types of computer networks to facilitate communication and resource-sharing among a wide range of users.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Demonstrate** a broad knowledge of the area of computer networking and its terminology
CLO2	**Examine** the operation of a basic computer network
CLO3	**Evaluate** the operations of a range of networking protocols and devices.
CLO4	**Design** a network for a small organization

Course Content: Based on theory for course Code: **CSE 3205 &** Course Title: **Computer Networks**

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√	√									
CLO3				√	√							
CLO4			√		√							

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Lab Manual	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Lab Manual	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Lab Manual	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO4	• Lecture Note • Text Book • Lab Manual	• Lab Test • Lab Report • Viva • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Lab Attendance & Performance	**10%**
Continuous Assessment (Experiment, Report & Viva)	**40%**
Final Exam (Lab Test, Viva & Project)	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final Exam: **50%**

3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. Andrew S. Tanenbaum : Computer Networks, *Prentice-Hall*

ii. Uyless Black : Computer Networks: Protocols, Standards, and Interfaces, *Prentice-Hall*

2) Books Recommended:

i. W. R. Stevens : TCP/IP Illustrated Vol. I, *Addison-Wesley Professional*

ii. James F. Kurose, Keith W. Ross : Complete Networking: A Top-Down Approach Featuring the Internet, *Addison-Wesley*

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Course Code:	Course Title:	Credits:
CSE 3207	**Mathematical Analysis for Computer Science**	**3.00**

Rationale of the Course: To achieve knowledge on probability, gain Knowledge on computation of probability with its practical and theoretical application in studying computer science.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Describe** the concepts of random variable, moment generating function and their properties
CLO2	**Utilize** Standard distributions in order to solve discrete and continuous problems
CLO3	**Apply** stochastic process and Queuing theory

Course Content:
Recurrence Problems: The Towers of Hanoi, Linear Recurrences, Divide-and-Conquer Recurrences.

Manipulation of sums: Multiple Sums, General Methods, Finite and Infinite Calculus, Infinite Sums.

Number Theory: Divisibility, Primes, Prime Examples, Factorial Factors, Relative Primality, 'Mod': The Congruence Relation, Independent Residues, Additional Applications, Phi and Mu.

Special Numbers: Stirling Numbers, Eulerian Numbers, Harmonic Numbers, Harmonic Summation, Bernoulli Numbers, Fibonacci Numbers.

Generating Functions: Infinite Series, Counting with Generating Functions, Partial Fractions, Solving Linear Recurrences, Formal Power Series.

Random variables: Random Variable Examples, Independence, Distribution Functions, Great Expectations, Linearity of Expectation.

Stochastic Process: Definition with Examples, Role of the Theory of Stochastic Processes, Describing the Probability Law of a Stochastic Process, the Wiener Process and the Poisson Process, Integration and Differentiation of Stochastic Processes.

Markov chains: Definition, Transforming a Process into a Markov Chain, Chapman–Kolmogorov Equations, discrete parameter, continuous parameter, birth-death process.

Queuing models: Birth-Death Model, Markovian Model, Open and Closed Queuing Network, Application of Queuing Models.

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

Course Learning Outcomes	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12

(CLO)												
CLO1	√											
CLO2			√									
CLO3		√										

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book	• Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video	• Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. Eric Lehman and Tom Leighton : Mathematics for Computer Science, *Samurai Media Limited*
ii. Graham, Knuth and Patashnik : Concrete Mathematics, *Addison-Wesley*

2) Reference Books:

i. Sheldon M. Ross : Introduction to Probability Models, *Elsevier Inc.*
ii. Dimitri P. Bertsekas and John N. Tsitsiklis : Introduction to Probability Models, *Athena Scientific*

iii. Emanuel Parzen : Stochastic Processes, *Holden-Day Inc.*

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Course Code:	Course Title:	Credits:
LAW 3201	**Cyber and Intellectual Property Law**	**2.00**

Rationale of the Course: To provide a deep understanding of cyber law concepts and while explaining intellectual property concepts, making students aware of their rights for the protection of their invention done.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Explain** the Laws of governing cyberspace and intellectual property right issues in the cyberspace.
CLO2	**Analyze** different types of cybercrimes and legal frameworks to deal with various cybercrimes problems.
CLO3	**Develop** the importance of the digital evidence in prosecution and compare laws of different countries for handling evidence.

Course Content:

Cyber Law: Definition Nature, Scope, Utility of Cyber Law, Origin and Development of Cyber Law and Internet.
Cyber Crime: Jurisdiction and Cyber Crime, Types of Cyber Crime, Criminal Justice in Bangladesh and Implications on Cyber Crime; Protection of Copyrights and Intellectual Property right. Invasion of Privacy, Constitutional basis of Privacy, Unsolicited dE-Mail, Defamation, Harassment and e-Mail Abuse, Present Legal Protection.

ICT Policy in Bangladesh: e-Readiness in Bangladesh- e-Commerce in Bangladesh, e-Governance in Bangladesh, e-Learning/Education in Bangladesh, e-Journal in Bangladesh, e-Voting in Bangladesh.

Electronic Evidence: Digital Signature, Electronic Evidence in Bangladesh, Legal Effects of Electronic Evidence. The Information and Communication Technology Act-2006, Digital Security Act-2018.

Intellectual Property Law: Basic Concepts of IP Law, Nature of IPR, Computer-related intellectual property rights; Copyright- Original and development of copyright law, subject matter of copyright protection, Rights protected by copyright, Neighboring rights, Limitations of Copyright protecting, Piracy and infringement, Remedies.

Patent: Patents and technological development, Requirements for patentability and ownership of patents, Scope of exclusive rights and duration of protection, Patents infringement, defenses and remedies.

Trademarks: Reasons for the protection of trademarks, Acquisition of trademark right, Registration procedure, Duration of protection and renewal, Termination.

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

Course Learning	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12

Outcomes (CLO)												
CLO1	√											
CLO2		√										
CLO3			√									

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book	• Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video	• Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**

3) Make-up Procedures: **Re-take Exam**

Learning Materials

Text Book:

i. Md. Borhan Uddin : Principles of Cyber Law (Bangladesh Perspective), *Shams Publications*

Books Recommended:

i. V. D. Dudej : Information Technology & Cyber Laws, *Commonwealth Publishers.*
ii. Arpad Bogsch : Universal Copyright Convention: An Analysis and Commentary, *Bowker*
iii. Alan Daubeny Russell Clarke : Copyright in Industrial Designs, *Sweet and M.*
iv. VivckSood : Cyber Law Simplified, *Tata McGraw Hill Publications.*

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Course Code:	Course Title:	Duration:	Credits:
CSE 3250	**Industrial Training**	**4 weeks**	**1.0**

Rationale of the Course: This course has been designed for the students to have real life experiences to help them prepare for their career.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Develop** greater clarity about academic and career goals
CLO2	**Integrate** classroom theory with workplace practice
CLO3	**Appreciate** the ethical basis of professional practice in relevant industry
CLO4	**Develop** lifelong learning skills and exercise the role of the professional /specialist /manager/ supervisor and maintain confidently in the relevant industry
CLO5	**Use** modern tools and work as a member of a team or individual

Course Content:
This course is mandatory. Evaluation report from industry is to be submitted at the end of the training and accordingly to be incorporated in the tabulation sheet.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2						√						
CLO3								√				
CLO4												√
CLO5					√				√			

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Trainer's Assessment	**50%**
Industrial Training report & Presentation	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: i) Training Report: **25%**
      ii) Presentation: **25%**
3) Make-up Procedures**: Re-take Exam**

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Course Code:	Course Title:	Credits:
CSE 4000(A)	**Thesis/Project**	**2.00**

Rationale of the Course: To create/develop/design a Thesis/Project from their knowledge they have acquired from their undergraduate program

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Analyze** the previous works done by others in relevant field and choose the specific real-world topic
CLO2	**Write** the proposal of the thesis/project he/she is going to perform throughout 4th year.
CLO3	**Design** and construct a real-world thesis/ project (50% of total work) based on their acquired knowledge

Course Content:

Study of problems in the field of Computer Science and Engineering.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1		√		√								
CLO2			√									
CLO3			√						√			

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Journal paper • Web Material • Audio/Video	• Proposal presentation • Project presentation • Viva • Participation
CLO2	• Journal paper • Web Material • Audio/Video	• Proposal presentation • Project presentation • Viva • Participation
CLO3	• Journal paper • Web Material • Audio/Video	• Proposal presentation • Project presentation • Viva • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Lab Attendance & Performance	**10%**
Continuous Assessment	**40%**
Final Exam (Presentation, Viva & Project)	**50%**

2) Marks Distribution:
    a. Continuous Assessment: **50%**
    b. Final exam: **50%**
3) Make-up Procedures**: Re-take Exam**

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Course Code:	Course Title:	Credits:
CSE 4101	**Data Mining and Warehousing**	**3.00**

Rationale of the Course: For better data analysis, visualization and decision-making concepts of data ware housing and data mining play's vital role.

Course Learning Outcomes: At the end of the course, the student will be able to –

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Decide** and evaluate models/ algorithms with respect to their accuracy.
CLO2	**Discover** and measure interesting patterns from different kinds of databases. Apply the techniques of clustering, classification, association finding, feature selection and visualization to real world data.
CLO3	**Learn** to identify problems that can profitably be addressed via data mining methods.

Course Content:

Introduction: Why Data Mining, What Kinds of Data Can Be Mined, What Kinds of Patterns Can Be Mined, Which Technologies Are Used, Which Kinds of Applications Are Targeted, Major Issues in Data Mining.

Data preprocessing: Data Preprocessing: An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.

Data Warehousing and Online Analytical Processing: Data Warehouse: Basic Concepts, Data Warehouse Modeling: Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Implementation, Data Generalization by Attribute-Oriented Induction.

Data Cube computation: Data Cube Computation: Preliminary Concepts, Data Cube Computation Methods, Processing Advanced Kinds of Queries by Exploring Cube Technology, Multidimensional Data Analysis in Cube Space.

Classification and prediction: Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy.

Cluster analysis: Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Evaluation of Clustering

Outlier Detection: Outliers and Outlier Analysis, Outlier Detection Methods, Statistical Approaches, Proximity-Based Approaches, Clustering-Based Approaches, Classification-Based Approaches, Outlier Detection in High-Dimensional Data.

Web Mining: Anatomy of a Search Engine, Crawling the Web, Web Graph Analysis, Extracting Structured Data from the Web, Classification and Vertical Search, Web Log Analysis.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1		√										
CLO2			√	√								
CLO3	√											

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Assignment • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Web Material	• Class Test • Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Web Material	• Class Test • Assignment • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:

a. Continuous Assessment: **50%**
b. Final exam: **50%**

3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. Jiawei Han : **Data Mining: Concepts and Techniques**

2) Reference Books:

i. Bharat Bhushan Agarwal, Sumit Prakash Tayal : **Data Mining and Data Warehousing**

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Course Code:	Course Title:	Credits:
CSE 4103	**Cryptography and Network Security**	**3.00**

Rationale of the Course: This course motivates to gather brief review of computer security, traditional encryption, security attacks and the fundamental security objectives.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Understand** the development of security, traditional encryption, security attacks and the fundamental security objectives
CLO2	**Determine** the security objectives, attacks, and models, so is able to recognize the security requirements in real-life cases.
CLO3	**Analyze** the design and implementation issues of a real-life security solution.

Course Content:
Introduction: Overview, symmetric cipher, classical encryption technique, block cipher and the data encryption standard (des), triple DES;

Encryption technique: advanced encryption standard, contemporary symmetric ciphers, confidentiality using symmetric encryption public, key encryption and hash functions, public-key cryptography;

Algorithms: RSA algorithm, key management, diffie-hellman key exchange, other public key cryptosystem, message authentication and hash function, hash algorithm, digital signatures and authentication protocols;

Network security: network security practice, authentication application, wireless network security, electrical mail security, ip security, web security, system security, intruders, malicious software and firewall, legal and ethical aspects.

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

Course	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12

Learning Outcomes (CLO)												
CLO1	√											
CLO2		√										
CLO3			√									

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Web Material	• Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video	• Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. William Stallings : Cryptography and Network Security

ii. Behrouz A. Forouzan : Cryptography and Network Security

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Course Code:	Course Title:	Credits:
CSE 4104	**Cryptography and Network Security Sessional**	**1.00**

Rationale of the Course: To know basic of cryptography and network security, different secure protocol, network security issues.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Demonstrate** basic cryptographic system
CLO2	**Implement** elementary algorithms such as Caesar cipher, Transposition cipher, DES, RSA, MD5, SHA
CLO3	**Apply** Cryptographic algorithms to solve real world problems.

Course Content: Based on theory for course Code: **CSE 4103** Course Title: **Cryptography and Network Security**

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1		√										
CLO2			√									
CLO3					√							

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video • Lab Manual	• Lab Test • Lab Report • Viva • Final Exam

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Lab Attendance & Performance	**10%**
Continuous Assessment (Experiment, Report & Viva)	**40%**
Final Exam (Lab Test, Viva & Project)	**50%**

2) Marks Distribution:
    a. Continuous Assessment: **50%**
    b. Final Exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. William Stallings : Cryptography and Network Security

ii. Behrouz A. Forouzan : Cryptography and Network Security

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Course Code:	Course Title:	Credits:
CSE 4105	**Digital Signal Processing**	3.**00**

Rationale of the Course: To learn and familiarize the basic signal and signal processing technique as well as to be able to design various filters for digital signals.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Identify** the signals and systems
CLO2	**Apply** the principles of discrete-time signal and Fourier transform analysis to describe the frequency characteristics of discrete-time signals and systems
CLO3	**Design** the principles of signal analysis to filtering

Course Content:
Discrete Fourier Transform: Frequency domain sampling, Discrete Fourier Transform (DFT), Properties of the DFT, Linear filtering and frequency analysis of signals using DFT.

Efficient Computation of DFT: First Fourier Transform (FFT) algorithms, Application of FFT algorithms, Linear filtering approach to the computation of DFT, Quantization effects in the computation of DFT.

Digital Filter: Causality, Symmetric and antisymmetric Finite Impulse Response (FIR) filters, Design of linear phase FIR filters using windows, FIR differentiator, Hilbert transformer, Design of Infinite Impulse Response (IIR) by impulse invariance.

Application of DSP: Speech processing, analysis and coding, Matlab application to DSP.
Multirate Signal Processing: Decimation by a Factor D, Interpolation by a Factor I, Sampling Rate

Conversion (SRC), Filter Design for SRC: Direct form FIR Digital Filter Structure, Polyphase FIR Structure, Multistage Implementation of SRC, SRC by Arbitrary Factor, Multirate Signal Processing Applications.

Optimum Filters and Spectrum Estimation: FIR Wiener Filter, IIR Wiener Filter, Discrete Kalman Filter, Nonparametric Methods: The Periodogram Method, Bartletts Method, Welch's Method, Blackman-Turkey Method, Parametric Methods: Autocorrelation Method, Co-variance Method, Modified Co-variance Method, Burg Method.

Signal Modeling: Modeling of a Simple Signal, Method of Signal Modeling: Direct method, Pade's Approximation, Prony's Method, Shank's Method; Stochastic Models.

Adaptive Filtering: Introduction, FIR Adaptive Filters, Adaptive Recursive Filters, Recursive Least Squares: Exponentially Weighted RLS, Sliding Window RLS (WRLS).

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√	√									
CLO3			√									

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book	• Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video	• Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:

a. Continuous Assessment: **50%**
b. Final exam: **50%**

3) Make-up Procedures: **Re-take Exam**

Learning Materials

Text Books:

1. J G Proakis & D G Manolakis : Digital Signal Processing- Principles and Application
2. M H Hayes : Statistical Digital Signal Processing

Reference Books:

3. R Rabiner and R W Schafer : Theory and Application of Digital Speech Processing

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Course Code:	Course Title:	Credits:
CSE 4111	**Cloud computing**	**3.00**

Rationale of the Course: To know basic concepts of cloud computing and its applications.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Identify** the architecture and infrastructure of cloud computing
CLO2	**Develop** new ideas and innovations
CLO3	**Analyze** various cloud computing solutions

Course Content:

Introduction to Cloud Computing: Definition and applications including benefits, challenges, and risks, Enabling Technologies and System Models for Cloud Computing.

Cloud Computing Models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS) and emerging XaaS.

Types of Cloud Computing: Public cloud, private cloud and hybrid clouds, Cloud OSs and platforms .
Cloud Architectures: Architectural design of Cloud computing, Interaction among infrastructure provider, business providers and the customers, roles of cloud broker, Tradeoffs between costs and customer satisfactions, Federated Clouds .

VM Resource Provisioning: Static and dynamic resource provisioning approaches, HARMONY architecture, Capacity provisioning approaches.

Scalability and Fault Tolerant Issues: Scalable computing, energy optimization vs. fault tolerant service platforms, Performance, QoS, Power management in Cloud Computing data centers.

Principles of Virtualization platforms: VMWare ESX Memory Management, Security and Privacy issues in the Cloud, Introduction to Mobile Cloud Computing: Architecture and applications of MCC, Code

partitioning, Code offloading and VM migration techniques.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2			√									
CLO3		√										

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Web Material	• Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video	• Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Text Books:

i. Zaigham, Mahmood, Riccard Puttini, Thomas ERI : Cloud Computing Concepts, Technology & Architecture
ii. Barrie Sisisky : Cloud Computing

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Course Code:	Course Title:	Credits:
CSE 4113	**Artificial Neural Networks**	**3.00**

Rationale of the Course: Reasoning complex situations by the artificial agents with the help of neural network provides better performance.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Develop** the skills to gain basic neural network theory.
CLO2	**Explore** the functional components of neural network classifiers or controllers.
CLO3	**Implement** a basic trainable neural network for a typical control, computing application or biomedical application.

Course Content:

Biological nervous system: the brain and neurons, Introduction to artificial neural network, Theory and application of Artificial neural networks.

Multi-layer perception: Back propagation algorithm, Self-organization map, Radial basis network, Hop field network, Recurrent network, Failing Adaptive Linear (ADALINE) and Multiple Adaptive Linear (MADALINE) networks, Generating internal representation, Cascade correlation and counter propagation networks, Higher order and bi-directional associated memory, Lyapunov energy function, attraction basin.

Probabilistic updates: simulated annealing, Boltzmann machine, Adaptive Resonance Theory (ART) network. ARTI. ART2. Fuzzy ART mapping (ARTMAF) networks. Kohonen feature. I\ Learning Vector Quantization (LVQ) networks, Genetic algorithm and evolution compacting, Applications to control; Pattern recognition; Nonlinear system modeling, Speech and image processing.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3			√									

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book	• Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book	• Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. Shigeo Abe : Neural Networks and Fuzzy Systems, *Springer*
ii. Jacek M. Zurada : Introduction to Artificial Neural Systems, *West Group*

2) Reference Books:

i. Patrick K. Simpson : Artificial neural systems: foundations, paradigms, applications, and implementations, *Pergamon Pr*

Course Code:	Course Title:	Credits:
CSE 4115	**Software Testing and Quality Assurance**	**3.00**

Rationale of the Course:
The course introduces the state-of-the-art and main research challenges of two important aspects of software engineering: testing and quality. The course also examines various approaches and methodologies used in software testing and quality assurance. Course topics are defined and illustrated by examples and papers from current peer-reviewed research literature in the area under study. The course will prepare students to independently conduct research in software testing and quality assurance, and to apply that knowledge in their future research and practice.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Describe** software engineering testing process and quality assurance process and its role in software development.
CLO2	**Apply** variety of testing techniques, methods, and tools.
CLO3	**Gather** skills in managing a software project to customer requirements.

Course Content:

Introduction: Introduction to Software Quality, Quality Assurance, Quality Engineering

Testing: Concepts, Issues and Techniques. Test Activities, Management, and Automation. Coverage and Usage Testing Based on Checklists and Partitions. Input Domain Partitioning and Boundary Testing. Coverage and Usage Testing Based on Finite-State Machines and Markov Chains. Control Flow, Data Dependency, and Interaction Testing. Control Flow, Data Dependency, and Interaction Testing. Elements of software testing, Localization testing, types of testing (black box & white box testing), automated testing tools, Effective methods of software testing, the test process

Testing Techniques: Adaptation, Specialization, and Integration. Defect Prevention and Process Improvement. Automated software assessment, product metrics, analysis of measurement, Software project tracking and oversight, Quality control metrics, Quality control measurement areas, quality control statistics, Metric derivation Software Quality planning, assurance and Standards, Risk Analysis, Quality Scheduling, tracking and control, Techniques of enhancing software quality (Fagan method, structured programming and clean room software development, Formal methods, software complexities and solutions), Software auditing (Comparing Quality Assurance Techniques and Activities.

Feedback Loop and Activities: Quantifiable Quality Improvement), Software Configuration Management.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3	√											

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Web Material • Audio/video	• Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Web Material • Audio/video	• Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
    a. Continuous Assessment: **50%**
    b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

1. William E. Lewis — Software Testing and Continuous Quality Improvement, Third Edition by– 2008

2) Reference Books:

1. Jeff Tian — Software quality engineering: testing, quality assurance, Second Edition by– 2005
2. B.S. Ainapure — Software testing and quality assurance by– 2009

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Course Code:	Course Title:	Credits:
CSE 4117	**Basic Graph Theory**	**3.00**

Rationale of the Course: Provides a framework to model a large set of problems in CS for better mathematical structures and pairwise relations between objects.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Learn** the standard uses of graphs as models and the fundamental theory about graphs with a sense of some of its modern applications.
CLO2	**Explain** mathematical proofs, including an appreciation of why this is important.
CLO3	**Formulate** algorithms to solve problems with graph theories.

Course Content:
Graphs and their applications, Basic graph terminologies, Basic operations on graphs, Graph representations, Degree sequence and graphic sequence, Paths, cycles and connectivity, Network flow, Euler tours, Hamiltonian cycles Ear decomposition, Trees and counting of trees, Distance in graphs and trees, graceful labeling, Matching and covering, Planar graphs, Digraphs, Graph coloring, Special classes of graphs.

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

Course Learning	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12

Outcomes (CLO)												
CLO1	√											
CLO2				√								
CLO3			√									

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Web Material	• Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video	• Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. Douglas B West : **Introduction to graph theory**
i i. Robin J. Wilson **Introduction to Graph Theory,** *Pearson Education Asia*

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Course Code:	Course Title:	Credits:
CSE 4119	**Blockchain Technology**	**3.00**

Rationale of the Course:
In this course, student will learn how blockchain technology represents the way forward. After completing

this course, student will be able to explain what blockchain is, how it works, and why it is revolutionary. Student will learn key concepts such as mining, hashing, proof-of-work, public key cryptography, and the double-spend problem. Student will be able to describe seven design principles for blockchain technology, and the challenges facing the people developing it. Student will also meet the players in the blockchain ecosystem, and consider their own role in stewarding the blockchain revolution.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Describe** the basic concepts of Blockchain Technology with their applications clearly and persuasively.
CLO2	**Create** an own Crypto token and an own Initial Coin Offering (ICO)
CLO3	**Use** cryptocurrency exchanges and wallets safely.

Course Content:

Introduction to Blockchain: Blockchain basics, technology, Network and mechanism, history, benefits, Blocks and transactions, Peer to Peer systems, Dynamic shared ledger, Digital signatures, Hashes as addresses, Ways of storing Bitcoin Keys, Trade and transact with Bitcoins, Global Blockchain Ecosystem Core, Layers Of A Blockchain.

Detailed study of Blockchain: Understanding bitcoin, the network of bitcoins, the various bitcoin wallets, public network and private consortium, Ethereum Virtual Machine, the Merkle Tree, DApps, Decentralized Autonomous Organizations (DAO), Mechanics of Bitcoin, Transcriptions, Scripts, Blocks, Peer-to-peer network, Security Measures.

Blockchain and Bitcoin: Identify Bitcoin and its Era Understand Where & How to Get Bitcoins, Identify Bitcoin Wallets, Identify Jaxx Wallet, Define Selling Bitcoins, Compare Bitcoin Blockchain, Transaction & Transaction Script Describe Various Transaction Forms in Bitcoin, Define Scripts in Bitcoin, List Nodes in Bitcoin Network

Bitcoin Mining: Economics of Bitcoin, Bitcoin Mining, Understand Mining: By pool of Miners, Mining and consensus, autonomous verification of mining, independent verification of mining, Checklist for verification of mining, combining transactions into blocks, combination of verified transactions, combining transactions into blocks, Portrayal of difficulty, condition of difficulty, Creation of block header, main chain, orphan block, creation of new block, independent validation of new block.

Creating private Blockchain with Multichain: Define Multichain, MultiChain Streams, Create & deploy private blockchain, connecting to a Blockchain, Multichain Interactive Mode, Native assets, Downloading and installing multichain, initializing blockchain, connecting to blockchain, connecting from second server, Permission for connection, Multichain interactive mode, creating new address, connected peers, native assets, Permission to create assets, new assets, Verifying transactions.

Blockchain Use Cases: Selected potential Use Cases in Blockchain, Proof of existence, Record keeping, Identity management, UPROOV – Mobile Trust Machine, Log operational maintenance data, Car leasing and Sales – DocuSign, Forecasting – Augur, Online music problem solution, Cloud storage, Blockchain and IoT, Autonomous Decentralized Peer to Peer Telemetry, ADEPT, IBM Watson IoT, IOTA, Freight Transportation,

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2			√									
CLO3	√											

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Web Material • Audio/video	• Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Web Material • Audio/video	• Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. Venkat Ankam : **Big Data Analytics,** *Packt Publishing,* 2016
ii. Ivan Marin, Ankit Shukla, Sarang VK : **Big Data Analysis with Python,** *Packt Publishing,* 2019
iii. Jesus Rogel-Salazar : **Advanced Data Science and Analytics with Python,**

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Course Code:	Course Title:	Credits:
CSE 4121	**Optical Fiber Communication**	**3.00**

Rationale of the Course: To develop fundamental concepts on optical fiber communication.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Define** the concept of optical fiber communication and the basic principle of light propagation in optical fiber.
CLO2	**Explain** different types of optical fiber and their characteristics.
CLO3	**Analyze** different propagating modes in optical fiber.

Course Content:

Concept of Optical Fiber Communication: Introduction, why OFC is required, Advantages, Disadvantages of OFC, General system, Types of Optical fiber, Light propagation principle in optical fiber, Optical fiber cables, Optical windows, Applications of Optical Fiber Communication.

Optical Fiber Waveguides: Introduction, Ray theory transmission, Electromagnetic mode theory for optical propagation, cylindrical fiber: Step index fibers, Graded index fibers; Single mode fibers, Multimode fibers.

Transmission Characteristics of Optical Fibers: Introduction, Attenuation, Absorption, Scattering loses, bending loss, Dispersion: Intra model dispersion, Inter model dispersion, Polarization.

Optical Sources and Detectors: Introduction, LEDs, LASER Diodes, Photo detectors, Photodiodes: Avalanche photodiodes and p–i–n photodiode, Response Time, Heterojunctions, Comparison of Photo Detectors.

Optical fiber connection: Introduction, Fiber alignment and joint loss, Multimode fiber joints, Single mode fiber joints, Fiber splices, Fiber connectors and couplers.

Optical amplifier: Introduction, Optical amplifiers, Basic applications and types, Semiconductor optical amplifiers, Erbium doped fiber amplifiers (EDFA).

Optical Sensor: Introduction, Types and operation, Sensors using single mode fiber, Fiber optic gyroscopes, Chemical sensors, applications.

Optical Networks: Introduction, key network elements, Types, Synchronous optical network (SONET), WDM network, Wavelength routed networks, Optical CDMA.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3		√										

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book	• Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video	• Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Books:

i. I. J. M. Senior : Optical Fiber Communications, Pearson Education
ii. Palaise : Fiber Optic Communication, 4th edition
iii. Gerd Keiser : Optical Fiber Communication, 4th Ed., *MGH*, 2008

2) Reference Books:

i. V.S. Bagad. : Optical fiber communication
ii. Govind P. Agrawal : Fiber-Optic Communication Systems
iii. D. Roddy and Coolen : Electronic Communications

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Course Code:	Course Title:	Credits:
CSE 4122	**Optical Fiber Communication Sessional**	**1.00**

Rationale of the Course: To develop fundamental concepts on optical fiber communication.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Demonstrate** transmission characteristics such as attenuation, dispersion, different losses etc. to realize the propagation.
CLO2	**Compare** the characteristics of different optical sources and detectors to determine the appropriate tools for communication.
CLO3	**Apply** the knowledge of optical fiber for solving real world problems.

Course Content: Based on theory for course Code: **EEE 4121 &** Course Title: **Optical Fiber Communication.**

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√		√								
CLO3			√									

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video • Lab Manual	• Lab Test • Lab Report • Viva • Final Exam

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Lab Attendance & Performance	**10%**
Continuous Assessment (Experiment, Report & Viva)	**40%**

Final Exam (Lab Test, Viva & Project)	**50%**

2) Marks Distribution:
    a. Continuous Assessment: **50%**
    b. Final Exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Books:

i. I. J. M. Senior : Optical Fiber Communications, Pearson Education
ii. Palaise : Fiber Optic Communication, 4th edition
iii. Gerd Keiser : Optical Fiber Communication, 4th Ed., *MGH*, 2008

1) Reference Books:

i. V.S. Bagad. : Optical fiber communication
ii. Govind P. Agrawal : Fiber-Optic Communication Systems
iii. D. Roddy and Coolen : Electronic Communications

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Course Code:	Course Title:	Credits:
CSE 4123	**Simulation and Modeling**	**3.00**

Rationale of the Course: To empower a substitute of actual experimentation that is frequently utilized when leading tests on a genuine framework which incomprehensible or illogical due to cost or time constraints as well as instead uses mathematical knowledge and computer's computation power to solve real-world problems rationally and quickly.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Define** the different modelling terms by analyzing the system or the data that is present.
CLO2	**Understand** different mathematical model and their application in simulation.
CLO3	**Implement** the model and from the results check for the validity of the model and correctness of the assumptions present in the model.

Course Content:
Introduction to Discrete-Event System Simulation: When Simulation is the appropriate tool, When Simulation is not the appropriate tool, merits & demerits of simulation tool, areas of applications, Components of a system, Discrete and continuous system, Model of a system, Types of models. Discrete event system simulation concepts, Steps in simulation study, flow diagram with description.

Simulation Examples in a Spreadsheet: Simulation of Queuing System: Three steps of simulation, calling population, system state, flow diagrams, bar char. Single channel queuing problem with single sever, Simulation of Inventory Systems – basic concepts, Simulation of

Inventory Systems - News dealers problem, Simulation of an order-up-to level inventory system, Simulation of Inventory Systems – M,N inventory problem Concepts in Discrete Events, Reliability Problem: Bearing problem with current method, Reliability Problem: Bearing problem with proposed method, Reliability Problem: Exercise in group.

General Principles: The dump truck problem: basic concepts, system states, event states, Simulation table for dump truck operation.

Verification, Calibration and validation of simulation models: Petri Net: Definition, firing of transitions, state of equations, Petri Net: M/M/1 Queue.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√	√										
CLO2	√											
CLO3		√	√									

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book	• Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book	• Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. Jerry Banks, John S. Carson II, Barry L. Nelson and David M. Nicol : Discrete-Event System Simulation, *Pearsonl*

2) Reference Books:

i. V.P. Singh : System modelling and simulation, *New Age International*

ii. W. Kelton, Randall Sadowski, Nancy Swets : Simulation with Arena, *McGraw-Hill*

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Course Code:	Course Title:	Credits:
CSE 4124	**Simulation and Modeling Sessional**	**1.00**

Rationale of the Course: To empower a substitute of actual experimentation that is frequently utilized when leading tests on a genuine framework which incomprehensible or illogical due to cost or time constraints as well as instead uses mathematical knowledge and computer's computation power to solve real-world problems rationally and quickly.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Demonstrate** the different modelling terms
CLO2	**Simulate** different mathematical model and their application
CLO3	**Implement** the model and from the results check for the validity of the model and correctness of the assumptions present in the model.

Course Content: Based on theory for course Code: **CSE 4123 &** Course Title: **Simulation and Modeling**

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2					√							
CLO3		√	√									

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO2	• Lecture Note • Text Book	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO3	• Lecture Note • Text Book	• Lab Test • Lab Report • Viva • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Lab Attendance & Performance	**10%**
Continuous Assessment (Experiment, Report & Viva)	**40%**
Final Exam (Lab Test, Viva & Project)	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. Jerry Banks, John S. Carson II, Barry L. Nelson and David M. Nicol : Discrete-Event System Simulation, *Pearsonl*

2) Reference Books:

i. V.P. Singh : System modelling and simulation, *New Age International*

ii. W. Kelton, Randall Sadowski, Nancy Swets : Simulation with Arena, *McGraw-Hill*

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Course Code:	Course Title:	Credits:
CSE 4125	**VLSI Design**	**3.00**

Rationale of the Course: To enhance the ability to design large integrated digital electronic circuits using various logic and circuit design techniques and contribute to the electronics engineering and have a better understanding of different characteristics of such circuits.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Describe** mathematical methods and circuit analysis models in analysis of CMOS digital electronics circuits, including logic components and their interconnection.
CLO2	**Design** models of moderately sized CMOS circuits to realize specified digital functions.
CLO3	**Apply** CMOS technology-specific layout rules in the placement and routing of transistors and interconnect, and to verify the functionality, timing, power, and parasitic effects.

Course Content:
VLSI Design Methodology: Top-Down Design Approach, Technology Trends.

MOS Technology: Introduction to Microelectronics and MOS Technology, Basic Electrical Properties and Circuit Design Processes of MOS and Bi CMOS Circuits, MOS, NMOS, CMOS Inverters, Pass Transistor and Pass Gates, DC and Transient Characteristics.

Overview of Fabrication Process: NMOS, PMOS, CMOS, Bi-CMOS Process.

NMOS and CMOS Layout: Color Plate Stick Diagram, and Design Rules.

CMOS Circuit Characteristics: Resistance and Capacitance, Rise and Fall Time, Power Estimation.

Introduction to Bi-CMOS Circuits: Shifter, an ALU Sub-System, Adder, Counter, Multipliers, Multiplexer, Data Path and Memory Structures, Buffer Circuit Design, DCVS Logic.

Design and Test-Ability: Circuit Partitioning, Floor Planning and Placement, Routing, Practical Aspects of Design Tools and Test-Ability MOS Design, Behavioral Description, Structural Description, Physical Description and Design Verification.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2			√									
CLO3		√	√									

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Assignment • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Web Material	• Class Test • Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Web Material	• Class Test • Assignment • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. Pucknell : **Basic VLSI Design: System-on-Chip Design**

2) Reference Books:

i. Neil H.E. Weste, David Harris and Ayan Banerjee : **CMOS VLSI Design- A Circuit and System Perspective**

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Course Code:	Course Title:	Credits:
CSE 4126	**VLSI Design Sessional**	**1.00**

Rationale of the Course: This course motivates to use different software – PSpice, Micro wind, DSCH etc. to model and simulate different digital logic functions and verify their functionalities and other characteristics in order to develop a complete VLSI project following required aim and drawbacks.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Design** models of moderately sized CMOS circuits that realize specified digital functions practically
CLO2	**Develop** CMOS technology-specific layout rules in the placement and routing of transistors and interconnect and verify the functionality, timing, power, and parasitic effects
CLO3	**Apply** practical knowledge to enhance one's ability to complete a significant VLSI design project, having a set of objective criteria and design constraints.

Course Content: Based on theory for course Code: **CSE 4125** Course Title: **VLSI Design**

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1			√									
CLO2			√		√							
CLO3			√						√			

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video • Lab Manual	• Lab Test • Lab Report • Viva • Final Exam

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Lab Attendance & Performance	**10%**

Continuous Assessment (Experiment, Report & Viva)	**40%**
Final Exam (Lab Test, Viva & Project)	**50%**

2) Marks Distribution:
    a. Continuous Assessment: **50%**
    b. Final Exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. Wayne Wolf : **Modern VLSI Design: System-on-Chip Design,** *Prentice Hall*

ii. Neil H.E. Weste, David Harris and Ayan Banerjee **CMOS VLSI Design- A Circuit and System Perspective,** *Pearson*

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Course Code:	Course Title:	Credits:
CSE 4127	**Professional Programming with C#.NET**	**3.00**

Rationale of the Course: C# is a modern, object-oriented programming language intended to create simple yet robust programs. Designed specifically to take advantage of CLI features, C# is the core language of the Microsoft .NET framework.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Identify** classes, objects, members of a class and relationships among them needed for a specific problem
CLO2	**Choose** an engineering approach to solving problems, starting from the acquired knowledge of programming and knowledge of operating systems.
CLO3	**Apply** object-oriented C# design patterns in solving various problems.

Course Content:

Overview of the Microsoft .NET platform: Introduction to the .NET platform, Overview of the .NET framework, benefits of the .NET framework, The .NET framework components, and languages in the .NET framework.

Overview of C#: Structure of a C# program, basic Input /Output operations, recommended practices, compiling, running, and debugging.

Using value-type variables: Common type system, naming variables, using built-in data types, creating user-defined data types, converting data types.

Methods and parameters: Using methods, parameters, overloaded methods.

Arrays: Overview of arrays, creating arrays, using arrays.

Exception Handling: try/catch, finally, Custom Exception, checked unchecked, System Exception

Essentials of object-oriented programming: Classes and objects, using encapsulation & Polymorphism, C# and object- orientation, defining object-oriented systems.

Using reference-type variables: Using reference-type variables, common reference types, object hierarchy, namespaces in the .NET framework, data conversions, multimedia: Type-safe casting.

Creating and destroying objects: Using constructors, initializing data, objects and memory, resource management.

Inheritance in C#: Deriving classes, implementing methods; using sealed classes, interfaces, abstract classes. Aggregation, namespaces, and advanced scope: Using internal classes, methods and data. Using aggregation, namespaces, modules and assemblies.

Operators, delegates, and events: Introduction to operators, operator overloading, creating and using delegates;

Demonstration: Handling events. Properties and indexers: Using properties and indexers.

Attributes: Overview of attributes, defining custom attributes, retrieving attribute values.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2				√								
CLO3			√									

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book	• Class Test • Final Exam • Participation • Assignment
CLO2	• Lecture Note • Text Book	• Class Test • Final Exam • Assignment
CLO3	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Assignment

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. S. Robinson, C. Nagel, K. Watson and J. Glynn, : Professional C#, *Wrox Press Ltd.*
ii. D. S. Allen, S. R. Gilani and J. H. Pedersen : Programming C#.

2) Reference Books:

i. B. Harvey, S. Robinson, J. Templeman and K. Watson : C# Programming
ii. Wrox Publications/Apress Publications : Beginning ASP.Net in C#,

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Course Code:	Course Title:	Credits:
CSE 4128	**Professional Programming with C#.NET Sessional**	**1.00**

Rationale of the Course: To be able to write code in object-oriented C# manner and apply various OOP concepts to solve real world problems

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Implement** command line and GUI programs using classes and objects in C#
CLO2	**Develop** C# programs using OOP principles and proper program structuring
CLO3	**Analyze** real world problems to be solved in an object-oriented manner

Course Content: Based on theory for course Code: **CSE 4127 &** Course Title: **Professional Programming with C#.NET.**

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2			√									
CLO3		√		√								

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video • Lab Manual	• Lab Test • Lab Report • Viva • Final Exam

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Lab Attendance & Performance	**10%**
Continuous Assessment (Experiment, Report & Viva)	**40%**
Final Exam (Lab Test, Viva & Project)	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final Exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. S. Robinson, C. Nagel, K. Watson and J. Glynn, : Professional C#, *Wrox Press Ltd.*

ii. D. S. Allen, S. R. Gilani and J. H. Pedersen : Programming C#.

2) Reference Books:

i. B. Harvey, S. Robinson, J. Templeman and K. Watson : C# Programming
ii. Wrox Publications/Apress Publications : Beginning ASP.Net in C#,

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Course Code:	Course Title:	Credits:
CSE 4000(B)	**Thesis/Project**	**4.00**

Rationale of the Course: To create/develop/design a Thesis/Project from their knowledge they have acquired from their undergraduate program

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Implement** the proposal he/she prepared in the previous term.
CLO2	**Compare** the results he/she produced with existing works
CLO3	**Write** journal/conference paper.

Course Content:

Study of problems in the field of Computer Science and Engineering.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1					√				√		√	
CLO2		√		√								
CLO3												√

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Journal paper • Web Material • Audio/Video	• Proposal presentation • Project presentation • Viva • Participation
CLO2	• Journal paper • Web Material • Audio/Video	• Proposal presentation • Project presentation • Viva • Participation

CLO3	• Journal paper • Web Material • Audio/Video	• Proposal presentation • Project presentation • Viva • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	**(100%)**
Attendance & Performance	**30%**
Report	**20%**
Final exam (Presentation & Viva)	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final Exam: **50%**
3) Make-up Procedures: **Re-take Exam**

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Course Code:	Course Title:	Credits:
CSE 4201	**Computer Graphics**	**3.00**

Rationale of the Course: To introduce the fundamental principles, mechanism of programming skills and develop basic programming skills to program design and development.

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

CLO NO.	**Course Learning Outcomes (CLO) Statements**
CLO1	**Explain** the structure of modern computer graphics systems, basic principles of implementing computer graphics primitives**.**
CLO2	**Identify** and apply geometric view and projection models and transformations of homogeneous coordinates in computer graphics.
CLO3	**Apply** curves and hidden surfaces concepts.

Course Content:
Introduction: Standard graphics primitives, Application of Computer Graphics (Computer Aided Design Animation).

Graphics hardware: Display devices, Raster refresh graphics display, use of frame buffer and look-up table.

Raster scan graphics: Bresenham's line and circle generation algorithms, character generation, and antialiasing.

Coordinate conventions: Device coordinate, normalized device coordinate and world coordinate system.

Polygons: Different types of polygons, point location, Polygon filling, triangulation;

Windowing and Clipping: Window, Viewpoint, zooming, panning, line, text and polygon clipping.

Transformations: Homogeneous coordinates, transformation matrices, transformation in 2D, translation, rotation, scaling, shearing and reflection;

Transformation in 3D: translation, rotation, scaling, shearing and reflection, projection: parallel and perspective, isometric projection; segments with their applications.

Three-dimensional viewing and representation: Curves, surfaces and volumes with cubic and bicubic splines, B-Rep, CSG, spatial occupancy representations;

Hidden lines and surface removal: Depth Comparison, Z-Buffering, Back-face removal, Painters' algorithm.

Rendering: Light models, shading.

Interpolation techniques: constant, Gouraud and Phog, ray tracing, computer ergonomics, information structure, introduction to graphics kernel system.

Introduction to graphics programming: The nature of computer animation, simulation, kinematics, parametrics, dynamics, metamorphosis, displacement, animation.

An overview of multimedia system: Hypermedia: text, audio, video and graphics.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3			√									

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Assignment • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Web Material	• Class Test • Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Web Material	• Class Test • Assignment • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. Xiang : Computer Graphics

ii. Shreiner : Open GL Programming Guide

2) Reference Books:

i. J. D. Foley, A. V. Dam, S. K. Ferner and J. F. Hugles : Computer Graphics Principles and Practice

ii. F. S. Hill : Fundamental of Computer Graphics

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Course Code:	Course Title:	Credits:
CSE 4202	**Computer Graphics Sessional**	**1.00**

Rationale of the Course: This course motivates to develop and modify 2D and 3D visualization and transformation of any geometric object by using graphics library as well as working with texturing, lighting and coloring of such objects to develop different types of digital images with various effects.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Demonstrate** basic idea about OpenGL graphics library.
CLO2	**Design** 2D and 3D graphical geometric objects using OpenGL.
CLO3	**Develop** simple animation, lighting, coloring and texturing

Course Content: Based on theory for course Code: **CSE 4201** Course Title: **Computer Graphics**

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2			√		√							
CLO3			√		√				√			

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video • Lab Manual	• Lab Test • Lab Report • Viva • Final Exam

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Lab Attendance & Performance	**10%**
Continuous Assessment (Experiment, Report & Viva)	**40%**
Final Exam (Lab Test, Viva & Project)	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final Exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. Shreiner : **Open GL Programming Guide**

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Course Code:	Course Title:	Credits:
CSE 4231	**Machine Learning**	**3.00**

Rationale of the Course: Machine learning provides appropriate learning algorithm to best suit the current need and enhance the learning parameters for maximum performance.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Discuss** the different learning paradigms in different environmental setting.
CLO2	**Apply** the appropriate learning algorithm to best suit the current need.
CLO3	**Enhance** the learning parameters to achieve maximum performance.

Course Content:

Introduction to Machine Learning: Definition of Machine Learning, Applications of Machine Learning, Tools Are Used in Machine Learning, Kinds of Problem Solve Using Machine Learning, Different Algorithms Used in Machine Learning, Career in Machine Learning.

Regression analysis: Logistic Regression, Linear Regression;

Supervised and Unsupervised learning: Classification model, regression model, applications of supervised learning, clustering, anomaly detection, applications of unsupervised learning.

Bayesian Learning: Bayes theorem, Naive Bayes algorithm, Gaussian Naïve Bayes.

Tree Based Algorithms: Decision Trees, Random Forest, Boosting, Bagging, Ensemble Methods.

Rule Based Learning: Definition of Rule Based Machine Learning (RBML), kinds of algorithms under Rule Based Learning, Learning Classifier Systems (LCS Association Rule Mining Artificial Immune Systems Comparison of RBML algorithms, applications of different types of RBML

Instance Based Learning: K Nearest Neighbor (KNN), Self-Organizing Map (SOM), Learning Vector Quantization (LVQ).

Neural Nets: Neurons, combining neurons in a neural network, Feedforward, training a neural network, Loss, Loss Calculation, Calculation of Partial Derivative, Stochastic Gradient Descent.

Support Vector Machine: Introduce with Support Vector Machine (SVM), Implementation of SVM, Tune Parameters of SVM, Pros and Cons of Support Vector Machines (SVM) and its Different Applications

Genetic Algorithms: Introduce with Genetic Algorithms, Implementation of Genetic Algorithms, Tune Parameters of SVM, Pros and Cons of Support Vector Machines (SVM) and its Different Applications.

Reinforcement Learning: Introduce with Reinforcement Learning, Features of Reinforcement Learning, elements of Reinforcement Learning, Implementation of Reinforcement Learning, Applications of Reinforcement Learning.

Ensemble Learning: Introduce with Ensemble Learning, Standard Ensemble Learning Strategies, Bagging Ensemble Learning, Stacking Ensemble Learning, Boosting Ensemble Learning.

Hidden Markov Models: Introduce with Hidden Markov Models, Finding Hidden States, Implementation of Hidden Markov Models, Applications**.**

Maximum Likelihood Estimates: Introduce with Maximum Likelihood Estimates**,** Working principle, Applications.

Parameter Estimation: Introduce with Parameter Estimation, why we use it, Applications**.**

Computational learning theory: Introduce with Computational learning theory**,** PAC Learning (Theory of Learning Problems), VC Dimension (Theory of Learning Algorithms)

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2			√									
CLO3	√											

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Web Material	• Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Web Material	• Assignment • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**

Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
    a. Continuous Assessment: **50%**
    b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. Christopher M. Bishop : Pattern Recognition and Machine Learning**,** *Springer*
ii. Tom Mitchell : Machine Learning*, McGraw Hill*

2) Reference Books:

i. M. Morris Mano : Digital Logic and Computer Design, *Prentice Hall*
ii. SergiosTheodoridisand : Pattern Recognition**,** *Elsevier Inc*

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Course Code:	Course Title:	Credits:
CSE 4233	**Natural Language Processing**	**3.00**

Rationale of the Course: To know basic of the natural language processing concepts and its analysis.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Understand** the background of probability, statistics and linguistics and demonstrate regular expressions
CLO2	**Analyze** different normal forms, parsing and dynamic programming algorithm
CLO3	**Construct** different types of language and information-based model

Course Content:
Regular Expressions and Automata: Introduction to NLP, Regular Expression, Finite State Automata

Tokenization: Word Tokenization, Normalization, Sentence Segmentation, Named Entity Recognition, Multi Word Extraction, Spell Checking – Bayesian Approach, Minimum Edit Distance

Morphology: Morphology – Inflectional and Derivational Morphology, Finite State Morphological Parsing, The Lexicon and Morphotactic, Morphological Parsing with Finite State Transducers, Orthographic Rules and Finite State Transducers, Porter Stemmer

Language Modeling: Introduction to N-grams, Chain Rule, smoothing – Add-One Smoothing, Witten-Bell Discounting; Backoff, Deleted Interpolation, N-grams for Spelling and Word Prediction, Evaluation of language models.

Hidden Markov Models and POS Tagging: Markov Chain, Hidden Markov Models, Forward Algorithm,

Viterbi Algorithm, Part of Speech Tagging – Rule based and Machine Learning based approaches, Evaluation

Text Classification: Text Classification, Naïve Bayes' Text Classification, Evaluation, Sentiment Analysis – Opinion Mining and Emotion Analysis, Resources and Techniques

Context Free Grammar: Context Free Grammar and Constituency, Some common CFG phenomena for English, Top-Down and Bottom-up parsing, Probabilistic Context Free Grammar, Dependency Parsing

Computational Lexical Semantics: Introduction to Lexical Semantics – Homonymy, Polysemy, Synonymy, Thesaurus – WordNet, Computational Lexical Semantics – Thesaurus based and Distributional Word Similarity

Information Retrieval: Boolean Retrieval, Term-document incidence, The Inverted Index, Query Optimization, Phrase Queries, Ranked Retrieval – Term Frequency – Inverse Document Frequency based ranking, Zone Indexing, Query term proximity, Cosine ranking, Combining different features for ranking, Search Engine Evaluation, Relevance Feedback

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3			√									

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Web Material	• Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video	• Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments &	**15%**

Presentation	
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**

3) Make-up Procedures: **Re-take Exam**

Learning Materials

Text Book:

i. Dan Jurafsky and James H. Martin : Speech and Language Processing, Prentice Hall, 2009. ISBN: 9780131873216

ii. Daniel M. Bikel and Imed Zitouni : Multilingual natural Language Processing Applications: From Theory to Practice, Pearson Publication

Books Recommended

i. Allen, James : Natural Language Understanding, Benjamin/Cummings, 2ed.

ii. Bharathi, A., Vineet Chaitanya and Rajeev Sangal : Natural Language Processing- "A Pananian Perspective". Prentice Hll India, Eastern Economy Edition.

iii. Eugene Cherniak : Statistical Language Learning, MIT Press, 1993.

iv. Manning, Christopher and Heinrich Schütze : Foundations of Statistical Natural Language Processing. MIT Press.

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Course Code:	Course Title:	Credits:
CSE 4235	**Pattern Recognition**	**3.00**

Rationale of the Course: This course motivates to recognize patterns, regularities and also irregularities in data by using various pattern recognition algorithms and techniques to find useful information for science, business, and organizational decisions as well as contributing to the field of machine learning, data mining and artificial intelligence.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Identify** areas where pattern recognition techniques can offer a solution.
CLO2	**Describe** the strength and limitations of some techniques used in pattern recognition for classification, regression and density estimation problems.
CLO3	**Conduct,** document and present a literature review on a topic related to Machine Learning and Pattern Recognition.
CLO4	**Solve** problems in regression and classification.

Course Content:

Pattern Recognition: Statistical and Neural Pattern Recognition, syntactic and fuzzy theoretic approaches, feature extraction and selection; Parametric and non-parametric classification, clustering. Models of cognition, learning, computer vision and speech understanding systems. Nonlinear classifiers, Parametric estimation techniques; non-parametric estimation techniques; Template matching, Dynamic programming methods.

Machine Learning: Introduction to machine learning, supervised, unsupervised and reinforcement learning, Unsupervised learning algorithms, neural network-based learning algorithms, genetic algorithms and genetic programming, reinforcement learning algorithms, computational learning theory, Correlation methods, Hidden Markov model, Principal component analysis.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1		√										
CLO2		√										
CLO3			√	√								
CLO4			√									

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book	• Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book	• Assignment • Final Exam • Participation
CLO4	• Lecture Note • Text Book	• Assignment • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
    a. Continuous Assessment: **50%**
    b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i.	Christopher M. Bishop	:	Pattern Recognition and Machine Learning, *Springer*
ii.	Tom Mitchell	:	Machine Learning, *McGraw Hill*
iii.	Sergio Theodoridis and Konstantinos Koutroumbas	:	Pattern Recognition, *Elsevier Inc*

2) Reference Books:

i.	R. O. Duda, P.E.D. Hart and G. Stork; John Wiley and Sons	:	Pattern Classification*, wiley*

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Course Code:	Course Title:	Credits:
CSE 4237	**Bioinformatics**	**3.00**

Rationale of the Course: Generates all sorts of data that involves generating protein sequence and predicting protein domains to even producing 3D structures of proteins from computer-based databases of biological information for bioinformatics experiments.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Explain** the knowledge of basic topics regarding bioinformatics.
CLO2	**Describe** the contents and properties of the most important bioinformatics databases and searches.
CLO3	**Enhance** the major steps in pairwise and multiple sequence alignment

Course Content:
Molecular biology basics: DNA; RNA; genes; and proteins; Genome Rearrangements. Sequence similarity; homology and alignment.

Pair-wise alignment: scoring model; dynamic programming algorithms, heuristic alignment, and pair-wise alignment using Hidden Markov Models. Combinatorial pattern matching: Database Search, Rapid String Matching, BLAST, FASTA;

Multiple alignment: scoring model; local alignment gapped and un-gapped global alignment. Motif finding: - motif models; finding occurrence of known sites; discovering new sites.

Gene Finding: predicting reading frames; maximal dependence decomposition. Analysis of DNA microarray data using hierarchical clustering; model-based clustering; expectation-maximization clustering; Bayesian model selection.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3		√										

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Web Material	• Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video	• Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. Neil C. Jones, Pavel A. Pevzner . **An Introduction to Bioinformatics Algorithm,** The MIT Press

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Course Code:	Course Title:	Credits:
CSE 4239	**Big Data Analytics**	**3.00**

Rationale of the Course:
The main goal of this course is to help students learn, understand, and practice big data analytics and machine learning approaches, which include the study of modern computing big data technologies and scaling up machine learning techniques focusing on industry applications. Mainly the course objectives are: conceptualization and summarization of big data and machine learning, trivial data versus big data, big data computing technologies, machine learning techniques, and scaling up machine learning approaches.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Describe** the basic concepts of Big data, architectural components and programming models used for scalable big data analysis.
CLO2	**Identify** big data problems as well as the characteristics of datasets and compare the trivial data and big data for various applications.
CLO3	**Implement** machine learning techniques with the help of different libraries and mathematical and statistical tools with modern technologies like hadoop and mapreduce.

Course Content:

Introduction of Big Data Analytics, Big Data Platforms and Data Storage.

Conceptualization and summarization: Representation of data. Modeling of machine learning techniques. Application of big data computing technologies.

Trivial data versus Big data: Representation learning. Publicly available datasets. Scalability and Scaling up techniques. Report writing using Latex.

Big data computing environment: Modern data analytics technologies like Hadoop and MapReduce. Suitable programming languages like Python, Java and C. Big data friendly machine learning scikit-learn libraries. Software platforms like Matlab or R.

Machine learning techniques: Three phases of machine learning. types of learning. support vector machine. decision trees and random forests. deep learning.

Scaling up machine learning: Dimensionality reduction techniques like principal component analysis and feature hashing. Online processing technique called stochastic gradient descent. Big data machine learning models.

Introduction of Advanced Big Data Analytics, Big Data Foundations, Big Data Analytics Algorithms, Linked Big Data Analytics, Graph Database and Analytics, Streaming Big Data Analytics, Big Data Visualization, Big Data Analytics for AI Finance, Big Data Analytics for AI Health, Full-Brain AI & Green Earth, Financial Advisor & Healthy Life, Massive Data Analysis, Machine Reasoning, Advanced AI Platform, Social & Cognitive Analytics.

Big Data Analytics with Python: Importing Datasets, Cleaning the Data, Data frame manipulation,

Summarizing the Data, Building machine learning Regression models, Building data pipelines. **Data Analysis libraries:** Pandas, NumPy and SciPy libraries. Basics of using Hadoop with MapReduce, Spark, Pig and Hive.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3			√	√								

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Web Material • Audio/video	• Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Web Material • Audio/video	• Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. Seema Acharya, SubhashiniChellappan : "Big Data and Analytics", Wiley Publications, First Edition, 2015

2) Reference Books:

i. Judith Huruwitz, Alan Nugent, Fern Halper, Marcia Kaufman, : "Big data for dummies", John Wiley &Sons, Inc. (2013)

ii. Dirk Deroos, Paul C.Zikopoulos, Roman B.Melnky, Bruce Brown, Rafael Coss : "Hadoop For Dummies",Wiley Publications, 2014

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Course Code:	Course Title:	Credits:
CSE 4241	**Computer Peripherals and Interfacing**	**3.00**

Rationale of the Course: Introduce to interface external components (peripherals, sensors, PPIs, PICs etc.) with computer systems.
Course Learning Outcomes: At the end of the Course, the Student will be able to –

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Identify** the basics knowledge required for microprocessor interfacing
CLO2	**Analyze** the procedure of how interface microprocessor and microcontroller
CLO3	**Apply** their knowledge for real world applications

Course Content:
Basic concepts of microprocessor interfacing: reviews of address decoding concepts, Input and Output port design, decoder, encoder, multiplexer, demultiplexer.

Interfacing peripherals: Peripheral I/O and memory mapped I/O, Interfacing with external memory, microprocessor-controlled data transfer and peripheral controlled data transfer, Peripheral I/O instruction for Intel 8085 Microprocessor and its timing diagram. Interfacing with LED, seven segment display, Push-button keys, Matrix keyboard, AD and DA converter.
Digital Logic: Boolean algebra; De-Morgan's Theorem; logic gates and their truth tables; Canonical form of logic expression, Simplification of logic expression: Algebraic method, K-Map and Quine-Mc Clauskey method; Realization by using NAND/NOR gates.

Programmable Interface device: 8212, Programmable devices with Handshake signals, 6155/8156 multipurpose programmable devices, Interfacing seven segment LED using 8155, 8155 timer, 8155 I/O ports in Handshake modes and its interfacing example, Interfacing 8355/8755 Programmable I/O ports, 8279 programmable keyboard/display interface and its interfacing example, 8255 Programmable peripheral interface, Block diagram of 8255, its different mode of operation, Interfacing A/D converter using 8255, Application of 8259, 8257 PPI. Parity check, BAUD, RS 232 standard, Software versus programmable hardware approach, software controlled asynchronous serial I/O, 8085 serial I/O SOD and SID, Hardware controlled serial I/O using programmable chips, 8251 programmable communication interface and its block diagram, interfacing RS 232 Terminal using the 8251A.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3			√									

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book	• Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video	• Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

Text Book:

i. Rafiquzzaman : Microprocessor and Microcomputer based System Design, CRC-Press

ii. Ramesh Goanker : Microcomputer Interfacing, McGraw-Hill

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Course Code:	Course Title:	Credits:
CSE 4242	**Computer Peripherals and Interfacing Sessional**	**1.00**

Rationale of the Course: To develop various functions and main parameters of an I/O interface.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Apply** the basic algorithmic procedures of computer interfacing.
CLO2	**Design** interfacing of various I/O devices to microprocessor.
CLO3	**Analyze** interfacing of peripherals devices to solve real world problems.

Course Content: Based on theory for course Code: **CSE 4241 &** Course Title: **Computer Peripherals and Interfacing**

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1					√							
CLO2			√						√			
CLO3		√	√									

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Manual	• Lab Test • Lab Report • Viva • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Lab Attendance & Performance	**10%**

Lab Experiment, Lab Report & Lab Viva	**15%**
Mid-Term Assessment (Exam &Viva)	**25%**
Final exam (Experiment, Viva & Project)	**50%**

2) Marks Distribution:
    a. Continuous Assessment: **50%**
    b. Final Exam: **50%**
3) Make-up Procedures: Re-take Exam

Learning Materials

1) Text Book:

i. Rafiquzzaman : Microprocessor and Microcomputer based System Design, CRC-Press

ii. Ramesh Goanker : Microcomputer Interfacing, McGraw-Hill

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Course Code:	Course Title:	Credits:
CSE 4243	**Mobile and Wireless Communication**	**3.00**

Rationale of the Course: To develop fundamental concepts on Mobile and Wireless Communication.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Explain** the basic principles of mobile communication system.
CLO2	**Illustrate** the frequency reuse and handoff strategies.
CLO3	**Analyze** the channel planning of a cellular network and compare various generations of mobile communication standards.

Course Content:

Introduction: Introduction to Cellular Mobile Radio Systems: Limitations of conventional mobile telephone systems, a basic cellular system, performance criteria, operation of cellular systems, planning a cellular system, overview of generation of the cellular system.

Cellular Engineering Fundamentals: Introduction, frequency reuse, channel assignment strategies, handoff strategies: prioritizing handoffs, Practical handoff considerations.

Interference and System Capacity: Co-channel interference, adjacent channel interference, channel planning, power control for reducing interference, Trucking and GoS, improving coverage and capacity in cellular system: cell splitting, sectoring, microcell zone concept.

Intelligent Cell Concept and Applications: Intelligent Cell, the philosophy of implementing power-delivery intelligent cells: delivering power intelligent, radio capacity, power-delivery intelligent cells: zone-divided cells, intelligent microcell, applications of intelligent Microcell Systems, in-building

communication.

Mobile Radio Propagation (Large-Scale) Model: Free space propagation model, Basic propagation mechanisms, Ground reflection (Two-Ray) model, Fresnel zone geometry, Knife-edge diffraction model, Practical Ling Budged Design: Log-distance path loss model, Log-normal shadowing, Outdoor and Indoor propagation models.

Mobile Radio Propagation (Small-Scale) Model: Small-Scale multipath propagation, Factors influencing small-scale fading, Doppler shift, Impulse Response Model of a Multipath Channel, Small-Scale Multipath Measurements, Parameters of mobile multipath channels, Types of small-scale fading, fading effects due to multipath time delay spread and Doppler spread.

Mobile Data Networks: Introduction, Data-Oriented CDPD Network: CDPD, Architecture in CDPD, Mobility Support in CDPD, Protocol layer in CDPD, GPRS and Higher Data Rates: GPRS, Architecture in GPRS, Mobility Support in GPRS, Protocol layers in GPRS, Mobile Application Protocols.

Wireless Systems and Standards: AMPS and ETACS: System overview, call handling and air interface, United States Digital Cellular (IS-54 and IS-136), GSM: Services and features, System architecture, Radio subsystem, GSM channel types, Frame structure, Signal processing in GSM, IS-95: Frequency and channel specifications, Forward and reverse CDMA channels.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3		√		√								

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book	• Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video	• Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**

Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Books:

i. T S Rappaport : Principles of Wireless Communication
: Mobile Cellular Communication

ii. Pahlavan and Krishnamurty

2) Reference Books

i. VK Garg and J E Wilkis : Principles and Application of GSM
ii. VK Garg : IS 95 CDMA and CDMA2000

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Course Code:	Course Title:	Credits:
CSE 4244	**Mobile and Wireless Communication Sessional**	**1.00**

Rationale of the Course: To develop fundamental concepts on Mobile and Wireless communication.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Demonstrate** the different mobile data networks.
CLO2	**Utilize** the idea about cellular fundamentals concept.
CLO3	**Apply** different coding and decoding techniques in order to enhance system performance.

Course Content: Based on theory for course Code: **CSE 4243 &** Course Title: **Mobile and Wireless Communication.**

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3		√										

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video • Lab Manual	• Lab Test • Lab Report • Viva • Final Exam

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Lab Attendance & Performance	**10%**
Continuous Assessment (Experiment, Report & Viva)	**40%**
Final Exam (Lab Test, Viva & Project)	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final Exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

Text Books:

1. T S Rappaport : Principles of Wireless Communication

Reference Books:

1. VK Garg and J E Wilkis : Principles and Application of GSM
2. VK Garg : IS 95 CDMA and CDMA2000

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Course Code:	Course Title:	Credits:
CSE 4245	**Digital Image Processing**	**3.00**

Rationale of the Course: To introduce the fundamentals of image processing and manipulation of television, medical imaging modalities such as X-ray or ultrasound, photography, security, astronomy and remote sensing

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Describe** image formation and the role of human visual system in perception of gray and color image data.
CLO2	**Explain** the basic elements and applications of image processing.
CLO3	**Analyze** image sampling and quantization requirements and implications.
CLO4	**Perform** Gray level transformations for Image enhancement.

Course Content:
Digital Image Fundamentals: Different Types of Digital Images, Sampling and Quantization, Imaging Geometry, Image Acquisition Systems.
Bi-level Image Processing: Basic Concepts of Digital Distances, Distance Transform, Medial Axis Transform, Component Labeling, Thinning, Morphological Processing, Extension to Grey Scale Morphology.

Binarization of Grey Level Images: Histogram of Grey Level Images, Optimal Thresholding using Bayesian Classification, Multilevel Thresholding.

Detection of Edges: First Order and Second Order Edge Operators, Multi-Scale Edge Detection, Canny's Edge Detection Algorithm, Hough Transform for Detecting Lines and Curves, Edge Linking.

Images Enhancement: Point Processing, Spatial Filtering, Frequency Domain Filtering, Multi-Spectral Image Enhancement, Image Restoration.

Image Segmentation: Segmentation of Grey Level Images, Water Shade Algorithm for Segmenting Grey Level Image. Image Representation and Description, Recognition and Interpretation.

Image Compression: Lossy and Lossless Compression Schemes, Prediction based Compression Schemes, Vector Quantization, Sub-Band Encoding Schemes, JPEG Compression Standard, Fractal Compression Scheme, and Wavelet Compression Scheme.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3		√										
CLO4			√									

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Assignment • Final Exam • Participation

CLO2	• Lecture Note • Text Book • Web Material	• Class Test • Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Web Material	• Class Test • Assignment • Final Exam • Participation
CLO4	• Lecture Note • Text Book • Web Material	• Class Test • Assignment • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. Gonzalez : **Digital Image Processing**

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Course Code:	Course Title:	Credits:
CSE 4246	**Digital Image Processing Sessional**	**1.00**

Rationale of the Course: This course is designed to provide fundamental concepts of digital image processing with emphasis in image processing techniques, image filtering design and applications

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Develop** programs in MATLAB for performing specified operations in the above areas of image processing.
CLO2	**Analyze** a wide range of problems and provide solutions related to the design of image

	processing systems through suitable algorithms, structures, diagrams, and other appropriate methods.
CLO3	**Implement** digital image processing applications using MATLAB language

Course Content: Based on theory for course Code: **CSE 4245** Course Title: **Digital Image Processing**

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1			√		√							
CLO2				√					√			
CLO3			√									

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video • Lab Manual	• Lab Test • Lab Report • Viva • Final Exam

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Lab Attendance & Performance	**10%**
Continuous Assessment (Experiment, Report & Viva)	**40%**
Final Exam (Lab Test, Viva & Project)	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final Exam: **50%**

3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. R. C. Gonzalez and R.E. Woods : **Digital Image Processing**, *Pearson Prentice Hall*

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Course Code:	Course Title:	Credits:
CSE 4247	**Real-time Embedded Systems**	**3.00**

Rationale of the Course: This course motivates to introduce sufficient knowledge about embedded processors, real-time task scheduling, schedulable analysis and programming embedded systems.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Describe** the architecture and programming of embedded processor.
CLO2	**Explain** the basic concepts of real time operating system design.
CLO3	**Implement** real-time applications using embedded-system concepts.

Course Content:

Embedded architectures: 16/32/64-bit embedded processors.

Interaction with devices: buses, memory architectures, memory management, device drivers.

Concurrency: software and hardware interrupts, timers.

Real-time principles: synchronization, scheduling, multi-tasking.

Real-time task scheduling: schedule ability analysis, rate and deadline monotonic scheduling, fixed and dynamic priority scheduling; Feed-back control theory and application; Profiling and code optimization.

Embedded software systems: exception handling, loading, mode-switching, programming embedded systems.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3	√											

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book	• Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book	• Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

1. **Marilyn Wolf** : **Computers as Components -** Principles of Embedded Computing System Design**,** *Morgan Kaufmann*
2. **Jane W. S. Liu** : **Real Time Systems,** *Pearson Education*

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Course Code:	Course Title:	Credits:
CSE 4248	**Real-time Embedded Systems Sessional**	**1.00**

Rationale of the Course: To introduce sufficient knowledge required to understand the design of complete embedded systems, including their hardware and software.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Demonstrate** the functionality of development boards to implement
CLO2	**Compile** bug free assembly or C language programs for microcontrollers to a required task
CLO3	**Design** an electronic circuit for diverse I/O devices used in real time embedded applications

Course Content: Based on theory for course Code: **CSE 4247** & Course Title: **Real-time Embedded Systems**

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2			√		√							
CLO3			√		√							

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video • Lab Manual	• Lab Test • Lab Report • Viva • Final Exam

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Lab Attendance & Performance	**10%**
Continuous Assessment (Experiment, Report & Viva)	**40%**
Final Exam (Lab Test, Viva & Project)	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final Exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

1. **Marilyn Wolf** : **Computers as Components -** Principles of Embedded Computing System Design, *Morgan Kaufmann*
2. **Jane W. S. Liu** : **Real Time Systems,** *Pearson Education*

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Course Code:	Course Title:	Credits:
CSE 4251	**Robotics**	**3.00**

Rationale of the Course: Introduces the fundamentals of robotics design and development, the principles of robot kinematics, dynamics, motion planning, trajectory generation and control as well as plan and research complete robots for various industrial applications.

Course Learning Outcomes: At the end of the course, the student will be able to –

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Explain** the concept of key components of robotics technologies.
CLO2	**Solve** problems in spatial coordinate representation and spatial transformation, robot locomotion design, kinematics, motion control, localization and mapping, navigation and path planning
CLO3	**Design** a robotic project on a physical mobile robot platform, with tasks involving project specification

Course Content:

Introduction: Introduction to robotics, overview of robot mechanisms, dynamics, and intelligent controls, planar and spatial kinematics, and motion planning;

Design: Mechanism design for manipulators and mobile robots, multi-rigid body dynamics, 3D graphic simulation; control design, actuators, and sensors;

Working mechanism: Wireless networking, task modeling, human-machine interface, and embedded software mechanical design, 257 rigid body velocity, Jacobean, inverse kinematics, redundant and parallel robots, trajectory control, face control and haptics, Micro and Nano-robotics, mobile robots. Human-robot interaction, Multiagent, fault diagnosis.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3			√									

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Participation
CLO2	• Lecture Note	• Assignment

	• Text Book • Web Material	• Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video	• Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. Saeed B. Niku : Introduction to Robotics: Analysis, Control, Applications, *Wiley*

i. John J. Craig : Introduction to Robotics: Mechanics and Control, *Pearson*

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Course Code:	Course Title:	Credits:
CSE 4252	**Robotics Sessional**	**1.00**

Rationale of the Course: This course motivates to introduce students with robot configuration, robot kinematics, dynamics, motion planning, trajectory generation, demonstration of robot and the application of robotics in industry.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Implement** a robotic project on a physical mobile robot platform, with tasks involving project specification.
CLO2	**Apply** practical knowledge to enhance one's ability to complete a robot design project, having a set of objective criteria and design constraints.
CLO3	**Analyze** a wide range of problems and provide solutions related to the design of genome sequence systems through suitable algorithms, structures, diagrams.

Course Content: Based on theory for course Code: **CSE 4251** Course Title: **Bioinformatics**

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1			√						√			
CLO2		√			√				√			
CLO3		√										

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video • Lab Manual	• Lab Test • Lab Report • Viva • Final Exam

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Lab Attendance & Performance	**10%**
Continuous Assessment (Experiment, Report & Viva)	**40%**
Final Exam (Lab Test, Viva & Project)	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final Exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. Saeed B. Niku : Introduction to Robotics: Analysis, Control, Applications, *Wiley*

ii. John J. Craig : Introduction to Robotics: Mechanics and Control, *Pearson*

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Course Code:	Course Title:	Credits:
CSE 4253	**Internet of Things**	**3.00**

Rationale of the Course: Students will be explored to explored to the inter connection and integration of the physical world and the cyber space. They are also able to design and develop IoT devices

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Understand** the vision of IoT from a global context.
CLO2	**Analyze** the Market perspective of IoT.
CLO3	**Compare** the use of Devices, Gateways and Data Management in IoT

Course Content:

M2M to IoT: The Vision; Introduction; From M2M to IoT; M2M towards IoT-the global context; A use case example; Differing Characteristics.

M2M to IoT - A Market Perspective: Introduction; Some Definitions; M2M Value Chains; IoT Value Chains; An emerging industrial structure for IoT; The international driven global value chain and global information monopolies.

M2M to IoT-An Architectural Overview: Building architecture; Main design principles and needed capabilities; An IoT architecture outline; standards considerations.

M2M and IoT Technology Fundamentals: Devices and gateways; Local and wide area networking; Data management; Business processes in IoT; Everything as a Service (XaaS); M2M and IoT Analytics; Knowledge Management.

IoT Architecture-State of the Art: Introduction; State of the art.

IoT Reference Architecture: Introduction; Functional View; Information View; Deployment and Operational View; Other Relevant architectural views.

Real-World Design Constraints: Introduction; Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.

Industrial Automation: Service-oriented architecture-based device integration; SOCRADES: realizing the enterprise integrated Web of Things; IMC-AESOP: from the Web of Things to the Cloud of Things.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3	√	√										

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material • Audio/Video	• Class Test • Presentation • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Web Material • Audio/Video	• Class Test • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Web Material • Audio/Video	• Class Test • Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

1) Text Book:

i. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle : **From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence,** *Academic Press*

2) Reference Books:

i. Vijay Madisetti and Arshdeep Bahga : **Internet of Things (A Hands-on-Approach),** *VPT*

ii. Francis daCosta : **Rethinking the Internet of Things: A Scalable Approach to Connecting Everything,** *Apress Publications*

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Course Code:	Course Title:	Credits:
CSE 4254	**Internet of Things Sessional**	**1.00**

Rationale of the Course: To provide a practical experience on developing innovative solutions for a variety of industrial context by applying the technology used to design and develop an IoT system.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Identify** the components and setup connections among them to design the IoT architecture for an industrial context.
CLO2	**Evaluate** appropriate communication protocols for the IoT system
CLO3	**Use** modern tools to design and develop prototypes for the IoT system
CLO4	**Apply** the IoT in Industrial Automation and identify Real World Design Constraints.

Course Content:

Based on theory for course Code: **CSE 4253 &** Course Title: **Internet of Things.**

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1		√										
CLO2	√			√								
CLO3					√							
CLO4						√			√			

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Text Book • Lab Manual • Web Material • Audio/Video	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO2	• Text Book • Lab Manual • Web Material • Audio/Video	• Lab Test • Lab Report • Viva • Final Exam • Participation

CLO3	• Text Book • Lab Manual • Web Material • Audio/Video	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO4	• Text Book • Lab Manual • Web Material • Audio/Video	• Lab Test • Lab Report • Viva • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	**(100%)**
Lab Attendance & Performance	**10%**
Continuous Assessment (Experiment, Report & Viva)	**40%**
Final Exam (Lab Test, Viva & Project)	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: Re-take Exam

Learning Materials

1) Text Book:

i. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle : From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, *Academic Press*

2) Reference Books:

i. Vijay Madisetti and Arshdeep Bahga : Internet of Things (A Hands-on-Approach), *VPT*

ii. Francis daCosta : Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, *Apress Publications*

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Course Code:	Course Title:	Credits:
CSE 4255	**Computer Vision**	**3.00**

Rationale of the Course: To understand human visual system and how the understanding of the natural

visual system can be implemented into computers.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Identify** basic concepts, terminology, theories, models and methods
CLO2	**Analyze** accuracy of the methods
CLO3	**Apply** computer vision technique for solving practical problem

Course Content:
Introduction: Introduction to Computer Vision, Case Study-Face Recognition, Linear Algebra/Probability Review.
Image Structure: Linear Filters, Finding Lines-From Detection to Model Fitting, Clustering and Segmentation.
Camera Models: Camera Models, Camera Calibration, Epi-polar Geometry, Stereo & Multi-view Reconstruction**.**
Recognition (Building blocks): Detectors and Descriptors, SIFT & Single Object Recognition, Optical Flow & Tracking.
Recognition (Objects, Scenes, and Activities): Introduction to Object Recognition and Bag-of-Words Models, Object Classification and Detection- A Part-based Generative Model (Constellation Model), Object**.**
Classification and Detection: A Part-Based Discriminative Model (Latent SVM), Human Motion Recognition.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3			√									

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book	• Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video	• Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

Text Book:

i. Computer Vision : Algorithms and Applications by Richard Szeliski
ii. Computer Vision : A Modern Approach by David Forsyth

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Course Code:	Course Title:	Credits:
CSE 4256	**Computer Vision Sessional**	**1.00**

Rationale of the Course: To develop practical and innovative image processing and computer vision applications.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Apply** the basic knowledge of proposed methods practically.
CLO2	**Design** algorithms for image enhancement and restoration.
CLO3	**Analyze** to integrate artificial intelligence and image processing technique to solve real world problems.

Course Content: Based on theory for course Code: **CSE 4255 &** Course Title: **computer vision**.
Mapping of Course Learning Outcomes (CLOs) with the Program Learning Outcomes (PLOs):

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1			√		√							
CLO2			√									
CLO3		√		√								

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book	• Lab Test • Lab Report

	• Audio/Video • Lab Manual • Web Material	• Viva • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video • Lab Manual	• Lab Test • Lab Report • Viva • Final Exam

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Lab Attendance & Performance	**10%**
Continuous Assessment (Experiment, Report & Viva)	**40%**
Final Exam (Lab Test, Viva & Project)	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final Exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials
Text Book:

a. Computer Vision : Agorithms and Applications by Richard Szeliski
b. Computer Vision : A Modern Approach by David Forsyth and Jean Ponce

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Course Code:	Course Title:	Credits:
CSE 4257	**Wireless Networks**	**3.00**

Rationale of the Course: To develop fundamental concepts on Wireless Networks.

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

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Analyze** the radio channel characteristics.
CLO2	**Explain** the different techniques of multiuser system and channel capacity.
CLO3	**Describe** the operational principle of multicarrier modulation.

Course Content:

Introduction: History, Wireless vision, technical issues, Current wireless systems, Wireless spectrum, Standards.

Statistical Multipath Channel: Transmit and receive signal models, Time varying channel impulse response, Narrow band fading model, Wideband fading models, Discrete time model. Space-time channel model.

Multiuser Systems: Multiuser channels: The uplink and downlink, Multiple access: Frequency-Division Multiple Access (FDMA), Time-Division Multiple Access (TDMA), Code-Division Multiple Access (CDMA), Space-division, Hybrid techniques, Random access: Pure ALOHA, Slotted ALOHA, Carrier sense multiple access, Downlink (broadcast) channel capacity: Channel model, Capacity in AWGN, Uplink (multiple access) channel capacity: Capacity in AWGN.

Multi Carrier Modulation: Data transmission using multi carrier, MCM with overlapping sub channel, Sub carrier fading mitigation, cyclic prefix, OFDM, Matrix reorientation of OFDM, Challenges in MCM.

Digital Modulation Performance: SNR and bit/symbol energy, Error probability in AWGN channel for BPSK, QPSK, MPSK, MQAM, FSK, CPFSK and differential modulation; Alternate Q-function; Performance in fading channel, Outage probability, Average probability of error, Combined outage and average error probability, Doppler spread, ISI.

Diversity: Receiver diversity system model, Selection combining, Threshold combining, MRC, EGC, Transmit diversity, Alamouti scheme. Diversity analysis.

Equalization: Equalizer noise enhancement; Equalizer types; ISI free transmission; ZF and MMSE equalizer; MLSE, Decision feedback equalizer; Training and tracking for adaptive equalization.

Spread Spectrum: SS principle, DSSS system model, spreading codes, System model, spreading codes, Synchronization, RAKE receiver, FHSS, Spreading code for Multi-user DSSS, DL & UL channel, Multi-user detection, MC-CDMA, Multiuse FHSS.

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1		√										
CLO2	√											
CLO3	√											

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Web Material	• Class Test • Final Exam • Participation
CLO2	• Lecture Note • Text Book	• Assignment • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video	• Presentation • Final Exam • Participation

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Class Attendance	**10%**
Class Tests, Assignments & Presentation	**15%**
Mid-Term Exam	**25%**
Final exam	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

Text Books:

1. Pahlavan and Krishnamurty : Principles of Wireless Network
2. T.S Rappaport : Wireless Communication: Principles and Practices

Reference Books:

i. A Molisch : Wireless Communication
ii. AJ Goldsmith : Wireless Communication

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Course Code:	Course Title:	Credits:
CSE 4258	**Wireless Networks Sessional**	**1.00**

Rationale of the Course: To develop fundamental concepts on Wireless Networks.

Course Learning Outcomes: At the end of the course, the student will be able to –

CLO NO.	Course Learning Outcomes (CLO) Statements
CLO1	**Gather** knowledge about different modulation techniques.
CLO2	**Design** various communication channels.
CLO3	**Implement** coding and decoding techniques in order to enhance system performance.

Course Content: Based on theory for course Code: **CSE 4257 &** Course Title: **Wireless Networks.**

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

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2			√									
CLO3			√		√							

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

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO2	• Lecture Note • Text Book • Audio/Video • Lab Manual • Web Material	• Lab Test • Lab Report • Viva • Final Exam • Participation
CLO3	• Lecture Note • Text Book • Audio/Video • Lab Manual	• Lab Test • Lab Report • Viva • Final Exam

Assessment and Evaluation

1) Assessment Strategy:

Assessment Method	(100%)
Lab Attendance & Performance	**10%**
Continuous Assessment (Experiment, Report & Viva)	**40%**
Final Exam (Lab Test, Viva & Project)	**50%**

2) Marks Distribution:
   a. Continuous Assessment: **50%**
   b. Final Exam: **50%**
3) Make-up Procedures: **Re-take Exam**

Learning Materials

Text Books:

1. AJ Goldsmith : Wireless Communication
2. T.S Rappaport : Wireless Communication: Principles and Practices

Reference Books:

1. A Molisch : Wireless Communication
2. Pahlavan and Krishnamurty : Principles of Wireless Network

Part D

1 & 2) Grading System:

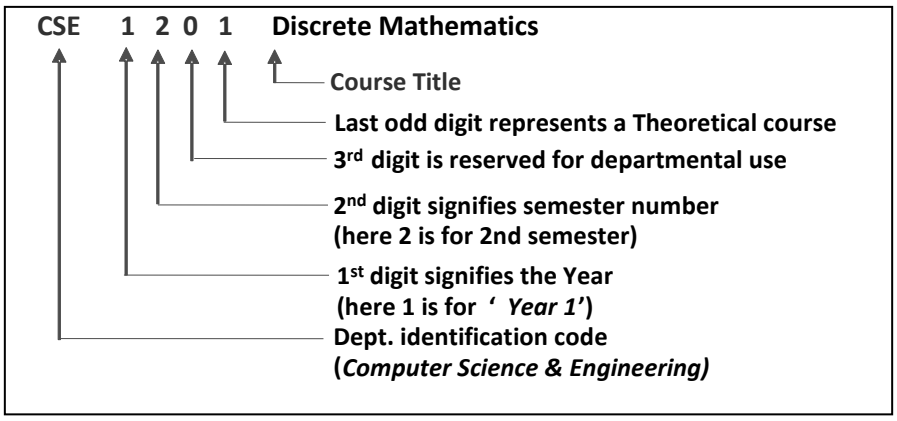
Numerical Grade	Letter Grade	Grade Point	Remarks
80% and above	A+{A Plus)	4.00	Outstanding
75% to less than 80%	A (A Regular)	3.75	Excellent
70% to less than 75%	A- (A Minus)	3.50	Very good
65% to less than 70%	B+ (B Plus)	3.25	Good
60% to less than 65%	B (B Regular)	3.00	Satisfactory
55% to less than 60%	B- (B Minus)	2.75	Above average
50% to less than 55%	C+ (C Plus)	2.50	Average
40% to less than 50%	C (C Regular)	2.25	Below average
40% to less than 45%	D	2.00	Not good
Less than 40%	F	0.00	Fail
	I		Incomplete
	W		with held

Numbering System

Each course is designated by a two or three letter word usually identifying the course offering department followed by a four-digit number with the following criteria without any space between letters and numerical.

I. The first digit will correspond to the year in which the course is normally taken by the students
II. The second digit will correspond the semester in which the course is normally taken by the students,
III. The third digit will be reserved for departmental use for such things as to identify different areas within a department,
IV. The last digit will be odd for theoretical, even for laboratory courses and zero for project / thesis / industrial training / board viva

The course designation system is illustrated by the following example.



3) Calculation of GPA.

Grade Point Average (GPA) is the weighted average of the grade points obtained of all the courses passed/completed by a student. For example, if a student passes/completes *n* courses in a term having credits of C_1, C_2, … , C_n and his grade points in these courses are G_1, G_2, … , G_n respectively then

$$GPA = \frac{\sum_{i=1}^{n} C_i * G_i}{\sum_{i=1}^{n} C_i}$$

The Cumulative Grade Point Average (CGPA) is the weighted average of the GPA obtained in all the terms passed/completed by a student. For example, if a student passes/ completes n terms having total credits of TC_1, TC_2, … , TC_n and his GPA in these terms are GPA_1, GPA_2, … , GPA_n respectively then

$$CGPA = \frac{\sum_{i=1}^{n} TC_i * GPA_i}{\sum_{i=1}^{n} TC_i}$$

A Numerical Example

Suppose a student has completed eight courses in a term and obtained the following grades:

Course	Credit, C_i	Grade	Grade Points, G_i	$Ci*G_i$
CSE 1101	3.00	A-	3.50	10.500
CSE 1102	1.50	A+	4.00	6.000
CSE 1205	3.00	A	3.75	11.250
CSE 1210	1.50	B+	3.25	4.875
PHY 1101	3.00	B-	2.75	8.250
PHY 1102	1.50	C+	2.50	3.750
CHM 1101	3.00	D	2.00	6.000
CHM 1102	1.50	C	2.25	3.375
MAT 1101	3.00	B	3.00	9.000
Total	**21.00**			**63.000**

GPA = 63.000/21.00 = 3.00

Suppose a student has completed four terms and obtained the following GPA:

Year	Semester	Credit Hours Earned, TC_I	GPA Earned, GPA_i	GPA_i*TC_i
1	1	21.00	3.73	78.330
1	2	20.50	3.93	80.565
2	1	19.75	3.96	78.210
2	2	20.25	4.00	81.000
Total		**81.50**		**318.105**

CGPA = 318.105/81.50 = 3.90

4) Course Withdrawal

A student may withdraw any course assign for the semester within 15 days from the date of starting the semester. Permission from the registrar must be obtained for withdrawal. A new student may withdraw his/her registration by a written application before the staring of the classes. The students not attending classes and / or examinations of a semester without withdrawal within the time limit will be required to pay all semester fees and accept the grade 'F' as the result of the semester.

5) Incomplete (I) Courses:

A grade of Incomplete (noted "I" on the transcript) may be assigned when a student in good standing in a course has completed and passed a majority of the work required for a course but, for reasons beyond the student's control, cannot be able to participate in mid-term exam or final exam.

(i) The students are to sit for the examination as per schedule prepared by the Controller office. If any student fails to appear at any or all the course of the mid-term or semester final examination, he/she is to apply to the controller of examination through the Chairman of the respective examination committee within 07 days of the end of examination stating the reasons for such failure. The Controller of the examinations will examine the stated reasons after consultation with the Chairman of examination committee and being satisfied student will be allowed to sit for exam of incomplete course(s) in the next semester on condition that such student(s) is to pay fee(s) for each course.

(ii) No student shall be allowed to appear at the examination in the next semester for incomplete course(s) whose attendance in the classes is less than 60%. If attendance is less than 60% student has to retake that course(s).

(iii) If a student fails to apply for examination in the next semester for incomplete course(s) within 07 days of the end of examination he/she has to retake course(s).

(iv) No student shall be allowed to take any course(s) without completion of pre-requisite course(s). If a student fails to complete pre-requisite course(s) for an assigned course of a particular semester he/she shall withdraw that assigned course of that particular semester and take that assigned course in the next semester after completion of pre-requisite course(s).

6) **About Re-take course and Examination.**

Following rules are to be followed:

i. If any student fails or absent in a Theory or Lab course/s in any semester, s/he has to be re-taken and to be completed the course/s in immediate next semester. Under special circumstances, if any student fails to pass in course/s in his/her retake examination/s, s/he may be allowed for the same in the second/last time by paying taka twice to that of usual for that/those course/s. If any student fails to pass in course/s in his/her second/last time retake examination/s, s/he will not be promoted to the next higher semester.

ii. A student will be allowed to re-take a maximum of two (2) courses (Failed or Absent in previous semester) with his/her regular semester courses. [i.e., Under no circumstances a student/s will be allowed to re-take more than two (2) courses. If so, the student/s will not be promoted to the next higher semester].

iii. Registration (in online platform or in prescribed form available for it in the office of the Registrar) for Re-take courses is to be done in the immediate next semester.

iii. The grade secured by the students in the re-take courses will be considered in preparing his/her SGPA for the previous semester where those courses were actually assigned for completion. In this case SGPA of previous semester will be considered as incomplete.

iv.

7) Grade Improvement

Student will be allowed to improve their result if he/she secured grade less than B but greater than F. This provision will be extended to the student up to 7th semester. For getting such privilege, student must apply for the same to the controller of the examinations within 7 days of publication of the semester result. An extra fee is to be paid for each such course. Student will be allowed to sit for the final examination

only. Excepting the marks obtained in the final examination all other marks secured for continuous assessment will be taken intact in preparing his/her improvement result of the course/s. A student will be allowed at best 2 courses for improvement per semester. The previous grade shall remain valid in case of failure of course grade improvement.

8) Dropout

Graduation in engineering requires 4 academic years to complete. The registration of a student will remain valid for 6 consecutive academic years from the first date of registration. If a student fails to complete graduation within 6 academic years, then his/her registration/studentship will be cancelled and she/he will be treated dropped out from the university. If any dropped out student wishes to continue study, she/he has to enroll again from the first semester by taking admission newly.