Faculty members who contributed to the development of the CSE curriculum:

Abul Lais M.S. Haque, Professor & Dean
Ishtiak Al Mamoon, Associate Professor
Mohammed Shahriar Sabuktagin, Associate Professor
Kakali Chowdhury, Assistant Professor
Zakir Hossain, Assistant Professor
Syed Maruful Huq, Assistant Professor
Partha Pratim Paul, Assistant Professor
Amam Hossain Bagdadee, Assistant Professor
Nadia Binte Asif, Lecturer
Zain Ahmed, Lecturer
Tahmina Tasnim, Lecturer
Md. Samiur Rahman,Lecturer
Zakaria Shams Siam, Lecturer
Zahid Hasan, Lecturer

Consultants:

Dr. Hasan Sarwar, Professor, Department of Computer Science and Engineering, United International University.

Prof. Dr. Engr. Muhibul Haque Bhuyan, Professor, Department of Electrical & Electronics Engineering, American International University-Bangladesh.

Industrial Advisory Panel:

Members

PRESIDENCY UNIVERSITY

Course Curriculum

DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

PROGRAM: *BACHELOR OF SCIENCE IN COMPUTER SCIENCE AND ENGINEERING (CSE)*

Tower Building-11A, Gulshan-2, Dhaka-1212

Bangladesh.

Part A

1. **Title of the Academic Program:** Bachelor of Science in Computer Science and Engineering (CSE)
2. **Name of the University:** Presidency University
3. **Vision of the University:** Presidency University has been established with the aim of providing quality education to its students at the lowest possible expense. The emphasis is given on creating an institution dedicated to excellence in teaching, research, training and community services. One of the main objectives is to develop human resources capable of understanding and facing the socio-economic needs of the country. The university shall also do everything possible to protect and promote Bangladeshi cultural heritage. The university aims at fully equipping each student with the necessary skills to be active participants in the information age. Special emphasis is given on hands-on experience, computer and other IT skills development and research techniques. The university emphasizes critical thinking, problem solving skills, and communication skills in its teaching methods and classroom practices. Presidency University is committed to the principle of equal opportunity and it ensures that all students and employees of the university regardless of race, sex, religion, nationality, origin, social grouping, and age receive benefits of a just and equitable system.
4. **Mission of the University (MSU) :**
   MSU-1: To provide high quality education, at an affordable cost, to address the needs of the professional engineering sector.

   MSU-2: To produce best quality engineering graduates who will be competent to address industrial problems with high ethical standards and effective communication skills.

   MSU-3: To contribute in relevant scientific research which address the needs of the community.

   MSU-4: Creating a collaborative environment between the institution and industry to create opportunities for research and training of students.
5. **Name of the Degree:** Bachelor of Science in Computer Science and Engineering (CSE)
6. **Name of the Faculty offering the program:** School of Engineering
7. **Name of the Department offering the program:** Department of Electrical and Computer Engineering (ECE)
8. **Vision of the Program**

The Department of Electrical and Computer Engineering at Presidency University would like to be the center of excellence, which will produce highly skilled graduates with excellent research abilities and communication skills, who will be able to meet the socio-economic needs of the nation through application of science and technology.

9. **Mission of the Program**
   i. To produce graduates who will lead in their respective fields with their breadth of engineering knowledge and skills.
   ii. To promote research activities to improve the quality of life of our citizens.
   iii. To produce graduates having the ability to solve engineering problems.
   iv. To produce graduates with high ethical and moral values.
   v. To produce graduates with the ability to serve in a culturally diverse setting; at the national and international level.

10. Description of the Program

The rapid change in technology and demand of global market always leads to the one primary question that every student faces after completing their Higher Secondary Program, "What major to choose for undergraduate studies?". And after completing undergraduate studies they face a more challenging question of how they can contribute to the development of the society. Computer Science and Engineering is a field that comprises of theoretical concepts and problem solving capabilities that enables one to incorporate logic, creativity and communication to solve practical problems. The CSE program at Presidency University prepares a graduate to compete in this challenging market. It is very meticulously structured to usher and envelop students with foundations of both scientific and engineering aspects of computing alongside generating social awareness and cultural growth. Along with core CSE courses, Elective courses are offered from senior year that includes many modern topics like Blockchain Systems and Communication Networks, Computer Graphics, Cryptography, Data Science and many more. The CSE program further strengthens students by mandating 36 credit hours of Mathematics and Basic Science. Students must meet the curriculum design by completing 140 credits hours which includes capstone design project in addition to internship/research/entrepreneurship. Students are also required to take non-computing courses to improve their breadth of knowledge and communication skills.

11. Program Educational Objectives (PEO)

PEO 1	**Core Competence**: Graduates will develop in-depth understanding of mathematics, science and engineering principles.
PEO 2	**Growth**: Graduates will further develop their expertise through lifelong engagement in engineering projects, research and training.
PEO 3	**Engagement**: Graduates should be able to apply their communication and soft skills in professional environments to perform as successful team players or leaders.
PEO 4	**Contribution**: Graduates should be able to contribute to the development of the country through the participation in the different areas of engineering.

12. Program Learning Outcomes (PLO)

PO1:	**Engineering Knowledge:**	Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PO2:	**Problem Analysis:**	Identify, formulate, research and analyze complex engineering problems and reach substantiated conclusions using the principles of mathematics, the natural sciences and the engineering sciences.
PO3:	**Design/ development of solutions:**	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety and of cultural, societal and environmental concerns.
PO4:	**Investigation:**	Conduct investigations of complex problems, considering experimental design, data analysis and interpretation and

		information synthesis to provide valid conclusions.
PO5:	**Modern Tool Usage:**	Create, select and apply appropriate techniques, resources and modern engineering and IT tools, including prediction and modeling, to complex engineering activities with an understanding of their limitations.
PO6	**The Engineer and Society**	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.
PO7:	**Environment and Sustainability:**	Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.
PO8:	**Ethics:**	Apply ethical principles and commit to the professional ethics, responsibilities and the norms of the engineering practice.
PO9:	**Individual and Team work:**	Function effectively as an individual and as a member or leader of diverse teams and in multidisciplinary settings.
PO10:	**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.
PO11:	**Project Management and Finance:**	Demonstrate knowledge and understanding of engineering and management principles and apply these to one's work as a team member or a leader to manage projects in multidisciplinary environments.
PO12:	**Lifelong 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.

13. Generic Skills/Graduate Profile (based on Need Assessment)

(To be adopted from National Skills Framework of Bangladesh)

14. Mapping/Alignment University's Mission vs. PEO

Mission	PEO 1	PEO 2	PEO 3	PEO4
1	✓	✓	✓	✓
2		✓		✓
3	✓	✓	✓	
4			✓	✓
5			✓	✓

15. Mapping/Alignment PEO vs. PLO

Sl.	Program Learning Outcomes (PLO)	Program Educational Objective (PEO)			
		PEO1: Core Competence	**PEO2:** Growth	**PEO3:** Engagement	**PEO4:** Contribution
1	PO1: Engineering Knowledge	✓	✓		
2	PO2: Problem Analysis	✓	✓		
3	PO3: Design/ development of solutions	✓	✓	✓	
4	PO4: Investigation	✓	✓		
5	PO5: Modern Tool Usage	✓	✓		
6	PO6: The Engineer and Society			✓	✓
7	PO7: Environment and Sustainability			✓	✓
8	PO8: Ethics			✓	✓
9	PO9: Individual and Team work	✓		✓	
10	PO10: Communication	✓	✓	✓	
11	PO11: Project Management and Finance	✓	✓	✓	
12	PO12: Lifelong learning		✓	✓	

16. Mapping Between Program Learning Outcomes (PLOs) and the Courses

Courses	Program Learning Outcomes (PLO)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Language Courses												
ENG099										✓		
ENG101										✓		
ENG105										✓		
ENG215									✓	✓		
BNG101	✓											
GED												
ACT235						✓					✓	
ECO235	✓										✓	
HIS105	✓											
PHI301						✓		✓				
SOC103						✓					✓	
Science												
CHE101	✓											
CHE102	✓											
PHY107		✓										
PHY108		✓										
PHY109	✓											
PHY110		✓										
Mathematics Courses												
MAT099	✓											
MAT121	✓											
MAT123	✓											
MAT125	✓											
MAT227	✓											
MAT229	✓											
MAT331	✓											
MAT333	✓	✓										
MAT335	✓											
CSE Core Courses												
EDR101	✓											
CSE107	✓	✓			✓							
CSE109	✓											
CSE110	✓				✓							
CSE205	✓	✓	✓									

CSE206	✓	✓	✓		✓	✓			✓			✓
CSE207	✓		✓		✓							
CSE208	✓	✓	✓		✓							
CSE209	✓	✓										
CSE211	✓		✓									
CSE212		✓	✓									
EEE201	✓	✓		✓								
EEE205	✓											
EEE206					✓							
CSE307	✓											
CSE311	✓											
CSE317	✓	✓	✓									
CSE318	✓		✓		✓							
CSE321	✓	✓										
CSE322	✓		✓		✓							
CSE323	✓	✓	✓	✓	✓				✓			
CSE324	✓		✓	✓	✓	✓			✓		✓	
CSE401	✓	✓	✓								✓	
CSE402	✓	✓	✓						✓	✓		
CSE403	✓											
Capstone Design Project												
CSE491		✓	✓	✓				✓		✓	✓	
CSE492					✓	✓	✓					
Research and Practical Training												
INT401		✓		✓								
CSE471		✓	✓					✓				
PME403	✓	✓	✓								✓	

Part B

17. Curriculum Structure

a. **Duration of the program:** 4 years/8 Semesters

b. **Total minimum credit requirement:** 140

c. **Course Distribution**

i. **General Course**

1. **Arts and Humanities:** 15 Credits
2. **Social Sciences:** 15 Credits
3. **ICT:** N/A
4. **Basic science:** 36 Credits

ii. **Core Courses**

1. **Major:** 55 Credits
2. **Minor:** 0 Credit

iii. **Optional/Elective Courses-**

1. **Major:** 9 Credits
2. **Minor**

iv. **Capstone Course/Internship/Thesis/Projects:** 10 Credits

d. **Course List**

BSc in CSE Curriculum			
COURSE_NUM	**COURSE_TITLE**	**CREDIT**	**140**
Language Courses			**15**
ENG099	Basic English (Waived for O/A Level Students)	3	
ENG101	English Reading and Composition	3	
ENG105	Advanced English Reading and Composition	3	
ENG215	Professional English Communication	3	
BNG101	Bangla Literature	3	
GED	**All courses**		**15**
ACT235	Financial and Managerial Accounting	3	
ECO235	Engineering Economics	3	
HIS105	Emergence of Bangladesh	3	
PHI301	Engineering Ethics	3	
SOC103	Sociology	3	
Science			**12**
CHE101	General Chemistry	3	
CHE102	General Chemistry Laboratory	1	
PHY107	General Physics I	3	
PHY108	General Physics I Laboratory	1	
PHY109	General Physics II	3	
PHY110	General Physics II Laboratory	1	

Mathematics Courses			**24**
MAT099	Pre-Math (for non-Math HSC students)	0	
MAT121	Pre-Calculus	3	
MAT123	Calculus I	3	
MAT125	Calculus II	3	
MAT227	Calculus III	3	
MAT229	Calculus IV	3	
MAT331	Engineering Mathematics	3	
MAT333	Linear Algebra	3	
MAT335	Probability and Statistics	3	
CSE Core Courses			**55**
EDR101	Engineering Drawing	1	
CSE107	Introduction to Computer Science	3	
CSE109	Computer Programming	3	
CSE110	Computer Programming Laboratory	1	
CSE205	Object Oriented Programming	3	
CSE206	Object Oriented Programming Laboratory	1	
CSE207	Digital Logic Design	3	
CSE208	Digital Logic Design Laboratory	1	
CSE209	Discrete Mathematics	3	
CSE211	Data Structures and Algorithms	3	
CSE212	Data Structures and Algorithms Laboratory	1	
EEE201	Electrical Circuits I	3	
EEE205	Electronics I	3	
EEE206	Electrical and Electronics Laboratory	1	
CSE307	Computer Architecture	3	
CSE311	Operating Systems	3	
CSE317	Computer Networks and Security	3	
CSE318	Computer Networks and Security Laboratory	1	
CSE321	Microprocessors Based System Design	3	
CSE322	Microprocessors Based System Design Laboratory	1	
CSE323	Database Management Systems	3	
CSE324	Database Management Systems Laboratory	1	
CSE401	Software Engineering	3	
CSE402	Software Engineering Laboratory	1	
CSE403	Internet and Web Technologies	3	

Capstone Design Project			5
CSE491	Capstone Design Project I	2	
CSE492	Capstone Design Project II	3	
Research and Practical Training			5
INT401	Internship (minimum 8 weeks)	1	
CSE471	Directed Research	1	
PME403	Project Management and Entrepreneurship	3	
Electives	**Any 2 courses**		6
I. SOFTWARE & INFORMATION SYSTEMS			
EEE311	Numerical Methods	3	
CSE405	Artificial Intelligence	3	
CSE407	Compiler Design	3	
CSE411	Theory of Automata and Formal Languages	3	
CSE413	Advanced Computer Architecture	3	
CSE415	Cryptography	3	
CSE417	Computer Graphics	3	
CSE419	Simulation and Modelling	3	
CSE421	Multimedia Systems Design	3	
CSE423	Digital Image Processing	3	
CSE425	Pattern Recognition	3	
CSE427	Real Time Computer Systems	3	
CSE429	Management Information Systems	3	
CSE431	Fuzzy Systems and Neural Networks	3	
CSE433	Data Science	3	
CSE435	Deep Learning	3	
CSE437	Machine Learning	3	
CSE445	Internet of Things (IoT)	3	
CSE447	Natural Language Processing	3	
CSE455	Design and Analysis of Algorithms	3	
CSE457	Principles of Programming Languages	3	
CSE449	Big Data	3	
CSE462	Advanced Programming Techniques 1	1	
CSE464	Advanced Programming Techniques 2	1	
CSE466	Advanced Programming Techniques 3	1	
II. HARDWARE SYSTEMS			
CSE439	Embedded Systems	3	
CSE441	Introduction to VLSI Systems	3	
CSE443	Digital System Design	3	
CSE451	Robotics	3	

III. COMPUTER COMMUNICATIONS AND NETWORKS			
EEE441	Digital Signal Processing	3	
EEE443	Telecommunication Engineering	3	
EEE445	Wireless Communication	3	
EEE447	Optical Fiber Communication	3	
EEE449	Microwave Engineering	3	
EEE451	Digital Communication	3	
EEE453	Satellite Communication	3	
CSE453	Data Communication	3	
CSE459	Blockchain Systems and Communication Networks	3	
CSE48x	Special Topic in Computer Science and Engineering	3	
Open Electives	**(Approved by the ECE Department)**		**3**
	Any course from the CSE Electives or any other course not similar to a course in the CSE curriculum	3	

18. Semester/Term/Year/Level wise Courses

Year: 1st Semester: 1st

Course No	Course Title	Credits	Total
ENG099	Basic English	3	
MAT121	Pre-Calculus	3	
BNG101	Bangla Language and Literature	3	16
HIS105	Emergence of Bangladesh	3	
CHE101	General Chemistry	3	
CHE102	General Chemistry Laboratory	1	

Year: 1st Semester: 2nd

Course No	Course Title	Credits	Total
ENG101	English Reading and Composition	3	
MAT123	Calculus I	3	
CSE107	Introduction to Computer Science	3	
SOC103	Sociology	3	17
PHY107	General Physics I	3	
PHY108	General Physics I Laboratory	1	
EDR101	Engineering Drawing	1	

Year: 2nd Semester: 1st

Course No	Course Title	Credits	Total
ENG105	Advanced English Reading and composition	3	
MAT125	Calculus II	3	
CSE109	Computer Programming	3	
CSE110	Computer Programming Laboratory	1	
EEE201	Electrical Circuits I	3	20
PHY109	General Physics II	3	
PHY110	General Physics II Laboratory	1	
ECO235	Engineering Economics	3	

Year: 2nd Semester: 2nd

Course No	Course Title	Credits	Total
ENG215	Professional English Communication	3	
MAT227	Calculus III	3	
EEE205	Electronics I	3	
EEE206	Electrical and Electronics Lab.	1	
CSE205	Object Oriented Programming	3	
CSE206	Object Oriented Programming Lab.	1	21
CSE207	Digital Logic Design	3	
CSE208	Digital Logic Design Lab.	1	
CSE209	Discrete Mathematics	3	

Year: 3rd Semester: 1st

Course No	Course Title	Credits	Total
MAT229	Calculus IV	3	
MAT335	Probability and Statistics	3	
CSE211	Data Structures and Algorithms	3	
CSE212	Data Structures and Algorithms Lab.	1	
CSE307	Computer Architecture	3	
CSE323	Database Management Systems	3	20
CSE324	Database Management Systems Lab.	1	
ACT235	Financial and Managerial Accounting	3	

Year: 3rd Semester: 2nd

Course No	Course Title	Credits	Total
MAT331	Engineering Mathematics	3	
MAT333	Linear Algebra	3	
CSE321	Microprocessor Based System Design	3	
CSE322	Microprocessor Based System Design Lab	1	20
CSE317	Computer Networks and Security	3	
CSE318	Computer Networks and Security Lab	1	
CSE311	Operating Systems	3	
PHI301	Engineering Ethics	3	

Year: 4th Semester: 1st

Course No	Course Title	Credits	Total
CSE401	Internet and Web Technologies	3	
CSE403	Software Engineering	3	
CSE404	Software Engineering Laboratory	1	
CSE4xx/EEE4xx	Elective Course 1	3	
CSE4xx/EEE4xx	Elective Course 2	3	18
CSE491	Capstone Design Project I	2	
PME403	Project Management and Entrepreneurship	3	

Year: 4th Semester: 2nd

Course No	Course Title	Credits	Total
XXXxxx	Open Elective	3	
CSE471	Directed Research	1	
CSE492	Capstone Design Project II	3	8
INT101	Internship (minimum 8 weeks)	1	

Part C

ACT235 Financial and Managerial Accounting
Credits: 03

Course Rationale: Managerial accounting focuses on an organization's internal financial processes, while financial accounting focuses on an organization's external financial processes. Hence, this course focuses on short-term growth strategies relating to economic maintenance while creating financial statements to be shared internal and external stakeholders and the public.

Course Description: This course is an introduction to the basic concepts, objectives, principles & assumptions of financial accounting. It emphasizes on the procedures and practices from the accounting cycle through financial statement presentation with an emphasis on recognizing, valuing, reporting, and disclosing assets, liabilities, & equity.

Recommended Book(s):
1. Jerry J. Weygandt, Paul D. Kimmel, Donald E. Kieso (2015). Accounting Principles (12th Edition), John Wiley & Sons, Inc.
2. Donald E. Kieso, Jerry J. Weygandt, Terry D. Warfield (2013). Intermediate Accounting (15th Edition), John Wiley & Sons, Inc.
3. Walter T. Harrison, Charles T. Horngren, C. William Thomas (2013) , Financial Accounting (9th Edition). Pearson.
4. Kermit D. Larson, John J Wild, Barbara Chiappetta (2004). Fundamental Accounting Principles (17th Edition), McGraw-Hill.

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

CO1	Demonstrate an understanding of the impact of organizations and institutions on the economic environment
CO2	Prepare managerial accounting statements and Design an activity based costing system
CO3	Identify Legal issues concerning financial situations
CO4	Demonstrate decision economic making ability based on trade-off

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						√						
CO2											√	
CO3											√	
CO4						√						

BNG101 Bangla Language and Literature
Credits: 03

Course Rationale: This course covers History of Bengali Literature, Film and Culture Studies, Tagore Literature, Short Stories and Novels, Bengali Linguistics and Grammar, Introduction to Bengali Poetry, Introduction to Bengali Drama, Folklore and Folk literature, Proof correction and Editing, Translation, Computer application in Bengali, Contemporary text analysis and many more.

Course Description: Bengali (aka Bangla) is spoken in northeastern India and Bangladesh by over 200 million speakers, and thus ranks 7th in number of native speakers in the world. It is linguistically related to Sanskrit and has had a rich history as a literary language since the close of the first millennium. This course will provide socio-cultural context of Bangla through the basic tenets of its linguistic features. Texts and poems of several literary maestros make students acquainted with Bangla's rich literary elements in relation to Bangladeshi cultural values. In this course, students will grasp the evolution of ancient Bangla literature "Charyapada manuscript", Medieval Bangla literate ornamented by Poet Kalidas, evaluation of Bengal script from Brammi to Modern Bengal character through Proto-Bengal, modern Bengali language, great evaluation Bengal literature during British colonial period, the formation of Asiatic society in Kolkata and Dhaka, The contribution of Bangla Academy. This course will also give the students brief idea about literary periods or age divisions in the history of Bangla literature and Language including a short literature profile of Bankim, Tagore, Nazrul, Jibananda Das, Mudhusudhan Dutta and other contemporary poet and writers contribution.

Recommended Book(s):

1. Sukumar Sen (1979). History of Bengali (3rd edition). New Delhi: Sahitya Akademi.
2. Sukumar Sen (1993). Islami Bangla Sahitya (in Bengali). Kolkata: Ananda Publishers,
3. Sukumar Sen (1991, reprint 2007). Bangala Sahityer Itihas, Vol.I, (in Bengali). Kolkata: Ananda Publishers
4. Wakil Ahmed (2012). Maladhar Basu. Banglapedia: National Encyclopedia of Bangladesh (2nd Edition.). Asiatic Society of Bangladesh.
5. Mohammad Daniul Haq & Aminur Rahman (2012). Bangla Literature. Banglapedia: the National Encyclopedia of Bangladesh.

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

CO1	Explain the evolution of Bangla literature
CO2	Evaluate major litterateurs in the language
CO3	Identify the role of Bangla literature in the socio-cultural evolution of Bangladesh

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3	√											

CHE101 General Chemistry
Credits: 03

Course Rationale: Chemistry is the study of matter and the changes it undergoes. It is essential for meeting our basic needs of food, clothing, shelter, health, energy, and clean air, water, and soil. Chemical technologies enrich our quality of life in numerous ways by providing new solutions to problems in health, materials, and energy usage. This course will cover the conceptual knowledge on all the above-mentioned topics.

Course Description: Atomic structure, quantum numbers, electronic configuration, periodic table, properties and uses of noble gases, types of chemical bond, properties of bonds, molecular structure of compounds, selective organic reactions. Types of solutions, composition of solutions, phase rules, phase diagrams of mono-component system, properties of dilute solutions, thermo-chemistry, chemical kinetics, chemical equilibrium, ionization of water and pH concepts, electrical properties of solutions.

Recommended Book(s):

1. R.D. Madan, Satya Prakash (1987), Modern Inorganic Chemistry (1st Edition), S Chand & Co Ltd.
2. Dr. Mahbubul Haque , Dr. Mohammad Yousuf Ali Mollah (2016), Principles of Physical Chemistry (1st Edition), Brothers Publications.
3. Esmarch S. Gilreath (1965), Fundamental Concepts of Inorganic Chemistry (1st Edition). McGraw-Hill

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

CO1	Explain the chemical properties of objects
CO2	Analyse the effects of chemical changes
CO3	Explain the effect of chemical properties on electrical devices

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3	√											

CHE102 General Chemistry Laboratory
Co-requisite: CHE101
Credits: 01

Course Rationale: Chemistry is the study of matter and the changes it undergoes. It is essential for meeting our basic needs of food, clothing, shelter, health, energy, and clean air, water, and soil. Chemical technologies enrich our quality of life in numerous ways by providing new solutions to problems in health, materials, and energy usage. This laboratory course will cover the hands-on experience of all the above-mentioned topics.

Course Description: Experiments based on the topics from CHE101 course.

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

CO1	Apply basic techniques used in chemistry laboratory for preparation, purification and identification
CO2	Design and carry out scientific experiments.
CO3	Record and analyze the results of such experiments
CO4	Implement safety rules in the practice of laboratory investigations.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3	√											
CO4	√											

CSE107 Introduction to Computer Science
Credits: 03

Course Rationale: This course introduces to the newly admitted students the world of Computer Science. In particular, it discusses the foundations and fundamental concepts of Computer Science with an emphasis on the design of algorithms and basic hardware.

Course Description: The definition of Computer Science, Binary number system, Octal and Hexadecimal Numbers, Representation of characters in the computer: ASCII codes, Unicode representation of Bengali characters; A brief history of the development of computers; Definition of algorithm, pseudocode, flowchart, concepts of sequential, conditional, and iterative operations with examples; Introduction to programming in python, converting pseudocodes into python programs; Measuring efficiency of an algorithm, concepts of Order (n), sequential search algorithm, concept of Order (n2), selection sort algorithm; Data cleanup algorithms and pattern matching.

Recommended Book(s):

1. G. Michael Schneider & Judith L Gersting (2019), Invitation to Computer Science (8th Edition). Pearson.
2. J. Glenn Brookshear & Dennis Brylow (2015). Computer Science: An Overview (12th Edition). Pearson

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

CO1	Explain fundamental knowledge on basics of computers, hardware, software, and number systems.
CO2	Implement fundamental programming structures including variable declaration, data types, conditional statements, loops, functions/methods, input and output.
CO3	Apply Python programming language to construct basic programs.
CO4	Measure efficiency of an algorithm

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2					√							
CO3					√							
CO4		√										

CSE109 Computer Programming
Prerequisites: CSE107
Credits: 03

Course Rationale: The goal of the course is to provide comprehensive C language training. Students will be able to develop the logics necessary to write C programs and applications. Additionally, by mastering the fundamentals of programming, students will be able to shift to any other language with ease in the future.

Course Description: In this structured programming course, students learn to program in C. The course is aimed at students who are new to the language and who may or may not have experience with other programming languages. Students will learn how C works and its place in the world of programming languages; to work with and manipulate characters, strings and to perform mathematical operations. They will learn to collect user input and output results; use conditional branching, iterators and built-in C functions.

Recommended Book(s):
1. Paul J. Deitel, Harvey M. Deitel (2010). C How to Program (6th Edition). Prentice Hall.

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

CO1	State basic concepts of programming.
CO2	Apply data structures, iteration, conditional structures, built-in functions in problem solutions.
CO3	Develop a computational solution to a problem described in natural language, express the solution in an algorithmic way, and convert the algorithm into a procedural program.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3	√											

CSE110 Computer Programming Laboratory
Co-requisites: CSE109
Credits: 03

Course Rationale: Programming language is the key of automation for today's world. Students get the chance to implement different concepts of C programming at lab class. Besides, they get habituated with programming environment and real life experience.

Course Description: In this structured programming laboratory course students learn to install and use Interactive Development Environment (IDE) tools for the development of C programs. Compose and store source code as files or as projects. Create and include user defined headers files. Learn to write complete programs, compile and execute them. Learn paper based tracing to test segments of algorithm or source code. Use IDE features to read and solve errors. Use debugging options to trace parts of programs.

Recommended Book(s):
1. Paul J. Deitel, Harvey M. Deitel (2010). C How to Program (6th Edition). Prentice Hall.

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

CO1	Use tools that allow proper development of C programs.
CO2	Understand the concepts of memory, conditional statements, iteration, built-in function and user defined functions.
CO3	Develop C source code for a given algorithm using C programming constructs.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					√							
CO2	√											
CO3	√											

CSE205 Object Oriented Programming
Prerequisites: CSE109
Credits: 03

Course Rationale: OOP language allows to break the program into small bit-sized problems that can be solved easily. Students will learn to bind together the data and the functions that operate on them so that no other part of the code can access this data except that function.

Course Description: Introduction to OOP, Object Oriented properties, Java Virtual Machine, Packages; Writing a Simple Program; Language Components: Primitive data types, Comments, Control Statements, Operators , Cast and Conversions; Introducing Classes; Declaring Objects, NEW operator; Introducing Methods, Method Overloading, Constructors, Constructor Overloading; Garbage Collection, The Finalize Method(), Static Method();Introduction to Inheritance; Subclass, Superclass, Usage of Super, Dynamic Method Dispatch; Abstract Class; Usage of Final with Inheritance; Object Class; Packages & Interfaces; Exception Handling, Using GUI.

Recommended Book(s):
1. Herbert Schildt (2006). Java: The Complete Reference (7th Edition). McGraw-Hill Osborne Media.
2. Danny Poo, Kiong Derek, Ashok Swarnalatha. (2008) Object Oriented Programming and Java (2nd Edition). Springer

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

CO1	Explain the attributes of Object Oriented Programming (inheritance, encapsulation, polymorphism, etc.) and concepts of OOP such as method overloading, method overriding, static and dynamic binding, abstract class, interface, modifiers.
CO2	Explain the benefits of object oriented design and understand when it is an appropriate methodology to use.
CO3	Apply the concepts of class, method, constructor, instance, data abstraction, function abstraction, inheritance, overriding, overloading, and polymorphism in programming.
CO4	Apply the concepts of exception handling, graphical user interface (GUI), event-driven programming, multi-threaded programming, generics.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√	√										
CO3			√									
CO4			√									

CSE206 Object Oriented Programming Laboratory
Co-requisites: CSE205
Credits: 01

Course Rationale: Students will learn to develop graphical user interfaces based on object-oriented modules.

Course Description: Introduction to OOP, Object Oriented properties, Java Virtual Machine, Packages; Writing a Simple Program; Language Components: Primitive data types, Comments, Control Statements, Operators , Cast and Conversions; Introducing Classes; Declaring Objects, NEW operator; Introducing Methods, Method Overloading, Constructors, Constructor Overloading; Garbage Collection, The Finalize Method(), Static Method();Introduction to Inheritance; Subclass, Superclass, Usage of Super, Dynamic Method Dispatch; Abstract Class; Usage of Final with Inheritance; Object Class; Packages & Interfaces; Exception Handling, Using GUI.

Recommended Book(s):

1. Herbert Schildt (2006). Java: The Complete Reference (7th Edition). McGraw-Hill Osborne Media.
2. Danny Poo, Kiong Derek, Ashok Swarnalatha. (2008) Object Oriented Programming and Java (2nd Edition). Springer

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

CO1	Explain the benefits of object oriented design and understand when it is an appropriate methodology to use.
CO2	Design a programming solution using the object oriented programming concepts, graphical user interface (GUI), event-driven programming, multi-threaded programming and generics in Java.
CO3	Write efficient and effective applications in Java using object-oriented programming techniques including classes, objects, methods, instance variables, composition, inheritance and polymorphism.
CO4	Use Java SDK and Java IDE tools to develop Java applications with debugging.
CO5	Work in a project team to support as a team member to develop applications.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√										
CO2			√		√							
CO3			√									
CO4	√				√							
CO5						√			√			√

CSE207 Digital Logic Design
Prerequisites: CSE107, EEE201
Credits: 03

Course Rationale: The basic understanding of how a digital computer works is important for all computer scientists and engineers. This course is intended for second year students. It discusses the basic building blocks of a digital system and its applications, for example, in the design of Random Access Memory (RAM).

Course Description: Switching circuits, truth tables, logic gates, Boolean algebra and some of its properties, simplification of Boolean functions, Canonical and Standard forms; Karnaugh map method, Combinational Circuit, half adder/full adder circuits; code conversion circuits; magnitude comparator; Decimal adder, Excess-3 adder. Introduction to Verilog HDL.
Digital components: Decoder, Encoder, Multiplexer, Demultiplexer, Variations in Digital components, Applications of Digital components; Boolean function implementation using Digital components; Programmable Logic Devices (PROM, PLA, PAL).
Introduction to Sequential Circuits; SR, JK, T, and D type flip flops; State Table and State Diagram; Design of sequential circuits; Registers, Shift Registers, Synchronous and asynchronous up/down Counters; Concept of Memory and Addressing; Construction of RAM using Binary Cells; Error Detection and Correction Codes, Introduction to Sequential Programmable Logic Devices (SPLD, CPLD, FPGA).

Recommended Book(s):

1. M Morris Mano and Michael D. Ciletti (2018). Digital Design (6th Edition). Prentice Hall.
2. R. J. Tocci, Neal Widmer, and Greg Moss (2014). Digital Systems: Principles and Applications (11th Edition). Pearson Education.

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

CO1	Apply principles of Boolean algebra to logic functions.
CO2	Use Karnaugh maps to realize two-level minimal/optimal combinational circuits with up to 4-5 variables.
CO3	Construct gate-level implementation of a combinational logic function using fundamental logic gates (AND/OR/NOT), Multiplexers, Decoders, Encoders and Programmable logic gates (ROMs, PLAs and PALs)
CO4	Analyze and Design sequential circuits built with various flip-flops, registers, counters
CO5	Use Verilog to construct simple Digital Logic Circuits

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3			√									
CO4			√									
CO5					√							

CSE208 Digital Logic Design Laboratory
Co-requisites: CSE207
Credits: 01

Course Rationale: The basic understanding of how a digital computer works is important for all computer scientists and engineers. This course is intended for second year students where they will get practical experiences on basic building blocks of a digital system and its applications, for example, in the design of Random-Access Memory (RAM).

Course Description: In this course, students will perform experiments to verify the theories and concepts learned in CSE 207. Topics include: Basic logic gates, adder, subtractor, multiplexer, demultiplexer, encoder, decoder, flip flop etc.

Recommended Book(s):

1. M Morris Mano and Michael D. Ciletti (2018). Digital Design (6th Edition). Prentice Hall.
2. R. J. Tocci, Neal Widmer, and Greg Moss (2014). Digital Systems: Principles and Applications (11th Edition). Pearson Education.

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

CO1	Apply knowledge ICs to implement digital circuits and systems.
CO2	Use Karnaugh maps to design combinatorial circuits
CO3	Analyze, Design and Construct various combinatorial and sequential circuits
CO4	Use Verilog to design and simulate simple Digital Logic Circuits

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2		√										
CO3			√		√							
CO4					√							

CSE209 Discrete Mathematics
Prerequisites: CSE107, MAT123
Credits: 03

Course Rationale: The course entitled 'Discrete Mathematics' helps the students better realize how to think of any computational problem in terms of logic while solving that problem. It has several applications on computer science, mathematics, engineering and other domains. Instead of focusing on any particular programming language, this course helps the students write a better or efficient code in any given programming language which is crucial in several real-life computer science and engineering applications.

Course Description: Introduction to Logic: Basic Definitions and notations, Appropriate use of quantifiers, Tautologies and contradiction; Sets: Notation, Operation and relations; Finite and Infinite sets, Inclusion and Exclusion; Functions & Relations: Basic definitions and Properties, Binary relations, Equivalence relation and partitions; Mathematical induction: The well ordering principle, proofs; Recursion: Recursively defined sequences, linear recurrence relations with constant co-efficient. Algorithms: Basic concept, analysis, Euclidean algorithm, sorting algorithm; Counting techniques: Fundamental counting, permutation and combination, Divide and Conquer algorithm, introduction to functions; Graph theory: Fundamental concept; weighted graphs, path and circuits, Euler and Hamiltonian paths, Planar graph; Trees: Basic definition of trees; Spanning trees, Weighted Trees.

Recommended Book(s):

1. Kenneth H. Rosen (2006). Discrete Mathematics and its application (6th Edition). McGraw-Hill Education.
2. Ralph P. Grimaldi (2004). Discrete and Combinatorial Mathematics (5th Edition) Pearson
3. Oscar Levin (2019). Discrete Mathematics: An Open Introduction (3rd Edition).

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

CO1	Explain the basic principles and operations of sets, permutations, relations, graphs, trees.
CO2	Prove simple mathematical properties of sets, relations, functions, graphs, and trees.
CO3	Construct mathematical arguments using propositional logic and predicate logic, quantifiers, and rules of inference as well as verify them.
CO4	Implement various algorithms in appropriate situations.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3	√											
CO4		√										

CSE211 Data Structures and Algorithms
Prerequisites: CSE109
Credits: 03

Course Rationale: The course entitled 'Data Structures and Algorithms' helps the students design time-efficient as well as memory-efficient computer programs for a given computational problem using various data structures and algorithms. Having a strong knowledge of data structures and algorithms is crucial for working on a large-scale software engineering-based project.

Course Description: Course Description: Growth Rates and Introduction to Asymptotic Analysis; Abstract Lists and Implementation: Link List and arrays; Stacks and Queues; Abstract Sorted List Implementations: Binary Search Tree; Priority Queue: Heaps; Sets/Maps: Hash Tables; Linear Probing; Sorting Algorithms: Bubble, Insertion, Quick, Heap; Graph Algorithms and Trees; Strings: Reversing; Palindrome; Counting.

Recommended Book(s):
1. Michael H. Goldwasser, Michael T. Goodrich, and Roberto Tamassia (2003). Data Structures and Algorithms in Python. (1st Edition), Wiley

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

CO1	Demonstrate the knowledge of basic data structures for storage and retrieval of ordered or unordered data using arrays, linked lists, binary trees, heaps, graphs, stacks, and queues.
CO2	Evaluate the advantages and disadvantages of fundamental data structures and various algorithms including greedy, divide-and-conquer, dynamic programming, and backtracking.
CO3	Apply appropriate data structure and algorithm in a given problem using object oriented design principles.
CO4	Develop the concept of asymptotic analysis using Big-O notations and determine the run time and memory usage of algorithms to compare different algorithmic solutions.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3			√									
CO4			√									

CSE212 Data Structures and Algorithms Laboratory
Co-requisites: CSE211
Credits: 01

Course Rationale: The course entitled 'Data Structures and Algorithms Laboratory' helps the students design time-efficient as well as memory-efficient computer programs for a given computational problem using various data structures and algorithms. This laboratory course introduces python programming language which is currently known as the most popular programming language. Gaining practical experience on different data structures and algorithms in the laboratory will greatly help the students for working on a large-scale software engineering-based project in the future.

Course Description: Python Primer, Object Oriented Programming, Algorithm Analysis, Recursion, Array-Based Sequences, Stack, Queues, and Deques, Linked List, Trees, Priority Queues, Maps, Hash, and Skip Lists, Search Trees, Sorting and Selection, Graph Algorithms, Text Processing, Memory Management and B-Algorithms.

Recommended Book(s):
1. Michael H. Goldwasser, Michael T. Goodrich, and Roberto Tamassia (2003). Data Structures and Algorithms in Python. (1st Edition), Wiley

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

CO1	Design and implement efficient algorithms for a specified application
CO2	Identify and apply the suitable algorithm for the given real-world problem

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√										
CO2		√	√									

CSE307 Computer Architecture
Prerequisites: CSE207
Credits: 03

Course Rationale: The basic understanding of how a digital computer works is important for all computer scientists. This course is intended for third-year students where it explains in details the complete internal circuit design of a simple computer.

Course Description: Fundamental of the building blocks: Register Transfer Language, Data transfer between registers, ALU Design, Logical and Arithmetic Shifts, Design of a basic computer: Different Addressing Modes, Concept of direct and indirect addressing, Instruction

Sets, Memory Reference Instructions (MRI) and non-Memory Reference Instructions (non-MRI) and their Implementation, I/O and Interrupt handling, Design of the Accumulator and the Control Unit of the basic computer, Hard-wired and Microprogrammed Control.
Introduction to RISC Architecture, ALU Design, Data Path, Introduction to MIPS Assembly language, Programming in MIPS, Simple Arithmetic Operations, Integer Multiplication and Booth's Algorithm, Integer Division, Floating point representation in IEEE754 Formats, Introduction to Pipelining, Data Hazards and Control Hazards and their Remedies.

Recommended Book(s):

1. M. Morris Mano (1992). Computer System Architecture (3rd edition). Pearson.
2. John L. Hennessy, David A. Patterson (2015). Computer Organization and Design (5th Edition). Morgan Kaufmann publisher.
3. William Stallings (2019). Computer Organization and Architecture (11th Edition). Pearson

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

CO1	Understand how the data movements inside a computer can be expressed through Register Transfer Language
CO2	Explain various components of basic computer and how it can be made fully functional through the complete design of ALU, Control Unit and the I/O interfaces
CO3	Understand the hardware of RISC architecture and MIPS assembly language together with operations it can perform including multiplication of signed integers
CO4	Explain the concept of pipelining together with data hazards and control hazards and their remedies

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3	√											
CO4	√											

CSE311 Operating Systems
Prerequisites: CSE205, CSE211, CSE307
Credits: 03

Course Rationale: The goal of this course is to give students an understanding of how Operating Systems work. It covers general concepts that are common to most Operating Systems. The course build and understanding of the relation between hardware and software.

Course Description: Purpose of an Operating System. Computer System Organization and Architecture. Operating System Services. User Interface. System Calls and System Programs. Process Concept and Interprocess Communication, Context Switching. Multithreaded Programming. Process Scheduling and Algorithms. Deadlock Characterization, Starvation, Detection, Prevention and Recovery. Memory Management – Swapping and Paging. Storage

Management – File Concept, Directory and Disk Structure. Physical vs. Logical view. Shell commands for Windows/Linux. System Programs and Threading Programs.

Recommended Book(s):

1. A. Silberschatz, P. B. Galvin, G. Gange (2009). Operating System Concepts (8th Edition). Wiley.

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

CO1	Explain the basic concepts and functions of Operating Systems
CO2	Outline various threading models, process synchronization and deadlocks
CO3	Compare the performance of various CPU scheduling algorithms
CO4	Explain memory, file and I/O management

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3	√											
CO4	√											

CSE317 Computer Networks and Security
Prerequisites: CSE307
Credits: 03

Course Rationale: After successful completion of the computer network course, students learned the architecture, core components of the network, various communication and data routing mechanisms within the secured network system. This course also provides the knowledge of logical and physical addressing techniques of networked elements.

Course Description: This course is an introduction to the broad field of data communication, computer network and information security. We will cover both computer network and security (including such topics as security policies, access control, cyber protection, etc.), along with some relevant background in basic cryptography. We will use a top-down approach to study the Internet Protocol stack. We will first study different OSI different layer mainly physical, data link and network layer. Brief ideas about routing and communication protocols are also added in this course. Along with this, switching technology, data communication and telecommunication architecture are also taught. Throughout this course, we will learn Internet protocols (IP) architecture, mobile and PSTN network architecture. Explore major security issues and trends in the study of cybercrime and computer related security. This course also describes the risk to desktop computers, servers, and mobile computing devices and also discusses strategy for enhancing computer security. Examine risks to network and web service security. Identify employment trends that focus on security within the information technology industry.

Recommended Book(s):

1. Andrew S. Tannenbaum (2003). Computer Networks (4th Edition). Prentice Hall.
2. Behrouz A Forouzan (2006). Data communication and Networking (4th Edition). Tata McGraw-Hill Publisher.

3. Charlie Kaufman, Radia Perlman, and Mike Speciner (2002). Network Security: Private Communication in a Public World (2nd Edition). Prentice Hall.

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

CO1	Apply the principals of communication network and security fundamental to understanding data, PSTN and cellular network model.
CO2	Design a basic network architecture using MAC and IP configuration knowledge.
CO3	Design VPN and firewall policy considering secured network device and security mechanisms
CO4	Examine and Design secured private wireless networks for web and mobile services
CO5	Review contemporary literature on network model and security

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√		√									
CO3	√		√									
CO4			√									
CO5		√										

CSE318 Computer Networks and Security Laboratory
Co-requisites: CSE317
Credits: 01

Course Rationale: This laboratory course educates a student how to design, manage and maintain computer networks practically. This course also prepares students to become future network and information security engineers.

Course Description: In this computer network laboratory course, students received a hands-on training on CAT-6 cable configuration, IP configuration, layer 2 switch interfacing, basic configuration of router. The students are also familiarization and assigned to develop a local wireless and wired LAN, learn how to conduct the network performance test by test drive. Afterwards, students learn to use nmap and wire shark and other TCP/UDP packet inspection software, Cisco packet tracer, basic network and information security simulation design with NS2/Omnet++, AttackIQ. Additionally a very basic ethical hacking training will be provided.

Recommended Book(s):

1. Wendell Odom (2019), CCNA 200-301 Official Cert Guide, Volume 1 (1st Edition). Cisco Press.
2. Laura Chappell, Gerald Combs (2012). Wireshark Network Analysis: The Official Wireshark Certified Network Analyst Study Guide (2nd Edition), Laura Chappell University.
3. Daniel Graham (2021), Ethical Hacking: A Hands-on Introduction to Breaking In. No Starch Press

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

CO1	Demonstrate a broad knowledge of the area of computer networking, network equipment and LAN/WLAN setup requirement.
CO2	Design LAN/WLAN, implement and test the operation, packet inspection and packet analysed of a basic wired and wireless network.
CO3	Design basic Gauntlet Firewall, route planning and router configuration for SOHO
CO4	Evaluate the network and network security by using simulator

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2			√									
CO3					√							
CO4					√							

CSE321 Microprocessors Based System Design
Prerequisites: CSE207
Credits: 03

Course Rationale: A system designed using a microprocessor as its CPU is called a microcomputer. It is a computer processor where the data processing logic and control is included on single integrated circuit. This course develops the theoretical knowledge of students to design such processor based on microprocessor.

Course Description: Review of registers, counters, busses etc. Fundamental concepts of microprocessors by introducing the architecture and memory organization of SAP1. Internal and external architecture of 8086 microprocessor, which has a CISC ISA. Instruction Set and Addressing Modes of 8086 microprocessor. 8086 Assembly Language semantics and implementation. Brief Architecture of RAM and Peripheral Devices. Interfacing with peripheral devices and memory systems

Recommended Book(s):
1. Mohamed Rafiquzzaman (1995), Microprocessors and Microcomputer-Based System Design (2nd edition). CRC Press.
2. Douglas V. Hall (1986), Microprocessors and Interfacing: Programming and Hardware (1st Edition), McGraw Hill

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

CO1	Explain the Intel 8086 Microprocessor Architecture
CO2	Understand and Write 8086 Assembly Language Programs
CO3	Explain and Implement the Interfacing of Microprocessor with Peripheral Devices
CO4	Explain and Implement the Interfacing with A/D converters

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3		√										
CO4		√										

CSE322 Microprocessors Based System Design Laboratory
Co-requisites: CSE321
Credits: 01

Course Rationale: A system designed using a microprocessor as its CPU is called a microcomputer. It is a computer processor where the data processing logic and control is included on single integrated circuit. This course develops the practical skill of students to design such processor based on microprocessor.

Course Description: Review of registers, counters, busses etc. Fundamental concepts of microprocessors by introducing the architecture and memory organization of SAP1. Internal and external architecture of 8086 microprocessor, which has a CISC ISA. Instruction Set and Addressing Modes of 8086 microprocessor. 8086 Assembly Language semantics and implementation. Brief Architecture of RAM and Peripheral Devices. Interfacing with peripheral devices and memory systems.

Recommended Book(s):
1. Mohamed Rafiquzzaman (1995), Microprocessors and Microcomputer-Based System Design (2nd edition). CRC Press.
2. Douglas V. Hall (1986), Microprocessors and Interfacing: Programming and Hardware (1st Edition), McGraw Hill

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

CO1	Understand the fundamentals of assembly level programming of microprocessors & microcontrollers
CO2	Apply the programing knowledge for arithmetic and logical operations in 8086
CO3	Develop the programs on Bit manipulations instructions
CO4	Develop the programs on Branch/Loop instructions
CO5	Create programs on arrays and addressing modes
CO6	Develop the programs regarding String manipulation and searching
CO7	Contrast how different I/O devices can be interfaced to processor and will explore several techniques of interfacing

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3			√									
CO4			√									
CO5			√									

CO6			√									
CO7					√							

CSE323 Database Management Systems
Prerequisites: CSE211
Credits: 03

Course Rationale: Nowadays database applications are incorporated in every small or large software. The course focuses on relational database management systems and its development, steps of implementing E-R models and database theory which in turn will play significant role in developing an efficient DBMS.

Course Description: Introduction to Database System; The Relational Model; Relational Algebra & Relational Calculus; The SQL Language; Database Application Development; Conceptual Database Modeling using Entity-Relationship Model; Schema quality through the study of functional dependencies and normalization; Database transactions; Database Security and Integrity; Data Storage and Querying; Relation between Database and Knowledgebase; Correlation between semantic web and parallel database; Incorporation of database with a windows application.

Recommended Book(s):
1. Ramez Elmasri, Shamkant B. Navathe (2010), Fundamentals of Database Systems (6th edition), Pearson.
2. Raghu Ramakrishnan and Johannes Gehrke (2002). Database Management Systems (3rd Edition). McGraw-Hill.

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

CO1	Explain the design methodology for databases and verifying their structural correctness
CO2	Interpret the physical and logical database designs, database modelling, relational, hierarchical, and network models
CO3	Explain and apply data manipulation language to query, update, and manage a database.
CO4	Develop and analyze the essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server) and data warehousing.
CO5	Design and build a simple database and demonstrate competence with the fundamental tasks involved with modelling, designing, and implementing a DBMS.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2		√		√								
CO3			√		√							
CO4	√	√										
CO5					√				√			

CSE324 Database Management Systems Laboratory
Co-requisites: CSE323
Credits: 01

Course Rationale: This course introduces the core principles and techniques required in the design and implementation of database systems. Main focus is given on SQL and its basics. Students will also learn to design front-end applications.

Course Description: Introduction to Database System; The Relational Model; Relational Algebra & Relational Calculus; The SQL Language; Database Application Development; Conceptual Database Modeling using Entity-Relationship Model; Schema quality through the study of functional dependencies and normalization; Database transactions; Database Security and Integrity; Data Storage and Querying; Relation between Database and Knowledgebase; Correlation between semantic web and parallel database; Incorporation of database with a windows application.

Recommended Book(s):
1. Ramez Elmasri , Shamkant B. Navathe (2010), Fundamentals of Database Systems (6th edition) , Pearson.
2. Raghu Ramakrishnan and Johannes Gehrke (2002). Database Management Systems (3rd Edition). McGraw-Hill.

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

CO1	Explain the design methodology for databases and verifying their structural correctness.
CO2	Implement databases and applications software primarily in the relational model
CO3	Adapt and interpret query languages, primarily SQL, and other database supporting software.
CO4	Emphasize the importance of normalization in databases.
CO5	Work in group settings to design and implement database projects.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2			√									
CO3			√		√							
CO4				√		√						
CO5									√		√	

CSE401 Software Engineering
Prerequisites: CSE109, CSE205, CSE211, CSE323
Credits: 03

Course Rationale: The course entitled 'Software Engineering' is designed to help the students to understand how to develop a software system development process. It also provides them with the fundamental principles of system development with object-oriented technology. This course introduces the students to various software process models, project

management, software requirements and design as a problem-solving activity, key elements of analysis and design, which are crucial to know for working in large software industries.

Course Description: Concepts of Software Engineering; Software Process: Process Models, Planning, Cost Estimation and Project Control; Analysis Concepts and principles: requirement analysis, Analysis modeling, data modeling; Design concepts and principles: Architectural design, User Interface design, Object Paradigm, Introduction to Specific Object-Oriented Design Techniques, Component Based Development; UML diagrams; Information System Development Environment: Information System Analysis, Role of System Analyst, SDLC, Modern Approaches to System Development, Different Types of IS. Software Project Planning, Risk Analysis and management, Project Scheduling and Tracking. Software repair, specification and correction, Maintenance cost models, documentation. System Planning and Selection: Project Feasibility Analysis, BPP, SOW, SOPS; Determining System Requirements: Interview, Questionnaires, Directly Observing Users; Structuring System Requirements: Process Modeling, Context DFD, 0-Level DFD, n-Level DFD, Primitive DFD, DFD Decomposition, DFD Balancing, Logic Modeling; Designing Human Interface: Forms and Reports; Testing: Unit Testing, Integration Testing, Validation Testing, System Testing, Acceptance Testing, White Box and Black Box testing, Basis Path Testing, Testing for specialized environment, Installation, Maintenance; Software Quality Assurance, Quality factors, Software quality measures; Concepts of Software reliability, availability and safety. Software Engineering based Projects and group works.

Recommended Book(s):

1. Ian Sommerville (2015). Software Engineering (10th edition). Addison Wesley.
2. Roger S. Pressman, Bruce Maxim (2014), Software Engineering: A Practitioner's Approach (8th Edition).McGraw Hill.

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

CO1	Explain the software engineering process and project management
CO2	Choose appropriate software process model depending on the user requirements.
CO3	Use project management concepts.
CO4	Students can apply the knowledge, techniques, and skills in the development of a software product.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2		√										
CO3											√	
CO4			√									

CSE402 Software Engineering Laboratory
Co-requisites: CSE401

Course Rationale: The course aimed to provide the students hands-on experience with different aspects of Software Engineering including requirements identification, behavioral and structural design, implementation, testing, and so on. Thus, the students who will be working on these aspects of an assigned project will be able to get a feel of the real-life software development process.

Course Description: This course introduces concepts and techniques relevant to the production of large software systems. Students are taught a programming method based on the recognition and description of useful abstractions. Topics include modularity, specification, data abstraction, object modeling, design patterns, and testing. Students complete several programming projects of varying size, working individually and in groups. They are responsible for the organization and scheduling of software engineering projects, object-oriented programming, and design. Each team designs, codes, and debugs program components and synthesizes them into a tested, documented program product.

Recommended Book(s):
3. Ian Sommerville (2015). Software Engineering (10th edition). Addison Wesley.
4. Roger S. Pressman, Bruce Maxim (2014), Software Engineering: A Practitioner's Approach (8th Edition).McGraw Hill.

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

CO1	To understand the software engineering methodologies involved in the phases for project development.
CO2	To gain knowledge about open-source tools used for implementing software engineering methods.
CO3	To develop product-prototypes implementing software engineering methods.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√							√	√		
CO2			√									
CO3			√									

CSE403 Internet and Web Technologies
Prerequisites: CSE317
Credits: 03

Course Rationale: This course aims to give students an understanding of the Internet and how it works. It introduces the underlying technologies that govern the Internet.

Course Description: Client Server Relation, Circuit switching and Packet switching, Internet organization, protocol and layers, Website types: Static, dynamic, CMS, WCMS. Web application, HTTP, Domain, Domain categories and name breakdown. Domain and IP relations, Broweser protocols, URL concepts, Web Hosting and Domain name relation, Hierarchy of DNS Servers, DNS lookup - iterative and recursive, DNS Records and

Messages. Internet Protocol and Transmission Control Protocol. Concepts of Computing, Internet of Things. Classless IP addressing and Subnet Mask and Network Prefix. Internet Layer, Transport Layer, Data Link Layer. Internet Routing Protocols.

Recommended Book(s):

1. William Stallings (2008), Computer Networking with Internet Protocols and Technology (1st Edition). Pearson.
2. Andrew S. Tanenbaum (2009). Computer Networks (4th Edition). Prentice Hall.

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

CO1	Explain the working of the World Wide Web, Internet and Client Server architecture
CO2	Describe various concepts of the Internet.
CO3	Calculate packet routing using knowledge of Routing Protocols.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3	√											

CSE405 Artificial Intelligence
Prerequisites: CSE107, CSE205, CSE211, CSE411
Credits: 03

Course Rationale: AI is going to change the world more than anything in the history of mankind. This course aims to provide a general introduction to AI (Artificial Intelligence) including Its techniques and its main sub-fields. It gives an overview of underlying ideas as well.

Course Description: Introduction to old and new AI techniques; Historical Development of AI; Logic: Propositional Logic, First-Order Logic, Inference in First-Order Logic, Knowledge representation and reasoning, Resolution Principle. Search: Search Techniques in AI, Informed and Uninformed Searches, Depth-First Search, Breadth-First Search, Heuristic Search, Best-First Search, Optimal Search, A* Search, Implementation Complexity, Constraint Satisfaction Problems; Game Playing; Planning; Probabilistic reasoning; Natural language processing; Introduction to Machine Learning, Bayesian Networks, Neural Networks; Programming Languages for AI Research: Historical Overview, Features of AI Programming Languages, Solving problems in AI languages; Major AI Programming Languages LISP, PROLOG;

Recommended Book(s):

1. Stuart J. Russell, Peter Norvig (2020). Artificial Intelligence: A Modern Approach (4th Edition). Pearson.

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

CO1	Describe the modern view of AI as the study of agents that perceives the environment and perform actions.
CO2	State about concepts of search and exploration methods.
CO3	Use AI techniques for knowledge representation.
CO4	Describe concepts of adversarial search.
CO5	State about AI related works.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3			√									
CO4	√											
CO5	√											

CSE407 Compiler Design
Prerequisites: CSE411
Credits: 03

Course Rationale: This is one of the fundamental courses of computer science program. This course learned a student the process of computer program compilation and how human understandable computer program has converted into machine readable phases.

Course Description: Introduction to compiling; Basic issues; compiler design architecture; compiler design overview, compiler design, phases of compiler Lexical analysis; Syntax analysis; Syntax-directed translation; Semantic analysis: type-checking; parsing, Grammar analysis, Run-time environments; Intermediate code generation; Code generation; Code optimization.
Assignment: Source code and installer of two C compiler and two Python compilers will be provided. Students need to install and run simple program to compare those compilers. A comprehensive report must be submitted to fulfill the requirements of this course.

Recommended Book(s):
1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman (2006), Compilers: Principles, Techniques, and Tools (2nd Edition). Addison Wesley.

2. Thomas W. Parsons (1992), Introduction to Compiler Construction (1st Edition). W. H. Freeman.

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

CO1	Describe various phases of modern compiler and its features.
CO2	Build lexical and syntax analyzers and use them in the construction of parsers.
CO3	Express the grammar of a programming language.
CO4	Apply the code optimization techniques to improve the performance of a program in terms of speed and space.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2			√									
CO3		√										
CO4			√									

CSE411 Theory of Automata and Formal Languages
Prerequisites: CSE107, CSE109
Credits: 03

Course Rationale: The aims of this course are to understand basic theory of computation concepts that lies at the backbone of all state-of-the-art applications and program design. Students should understand the capabilities and limits of computation.

Course Description: Introduction to theoretical computer science: Brief history of theoretical computer science Overview of course; Finite State Machines: Types, Purpose, Applications; Introducing DFA; DFA Construction and Accepted Languages, Regular Languages; NFA; From DFA to NFA; From NFA to DFA; NFA with epsilon transition; More closure properties on Regular language; Regular Expressions (RE); From RE to NFA; From NFA to RE; DFA state minimization; The pumping Lemma for RL; Proving non-regularity using the Pumping Lemma; Context-free grammars and languages; Context-free languages subsume regular languages; Pumping Lemma for CFLs; Pushdown automata; Closure properties of CFLs; Deterministic PDAs; Turing machines; Universal Turing machine; Self-reference and incompleteness; Undecidability of the Halting problem.

Recommended Book(s):
1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman (2006). Introduction to Automata Theory, Languages, and Computation (3rd Edition). Pearson.

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

CO1	Understand the core concepts in automata theory and formal languages.
CO2	Design grammars and automata (recognizers) for different language classes
CO3	Formulate pushdown automata and the equivalent context free grammars.
CO4	Construct Turing machines

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3	√											
CO4					√							

CSE413 Advanced Computer Architecture
Prerequisites: CSE307
Credits: 03

Course Rationale: The evolution of computer architecture has been rapid and relentless. This course is intended for the graduating students to accurately explaining through real-world examples on how architects analyze, measure, and compromise to build working systems.

Course Description: Review of Memory Hierarchy Design, Cache Performance, Virtual Memory Instruction Set Principles, Memory Addressing, Type and Size of Operands, Instructions for Control Flow Fundamentals of Quantitative Design and Analysis; Benchmark, Measuring, Reporting, and Summarizing Performance; Quantitative Principles of Computer Design Instruction Level Parallelism: Concepts and Challenges, Dynamic Scheduling, Tomasulo's Algorithm, Hardware-based Speculation, Multiple Issues and Static Scheduling Selected Topics from (a) Data-level Parallelism in Vector, SIMD, and GPU Architecture, (b) Thread-level Parallelism, (c) Warehouse-Scale Computers to Exploit Request-level and Data-level Parallelism, and (d) Domain-Specific Architecture

Recommended Book(s):
1. John L. Hennessy and David A. Patterson (2017). Computer Architecture: A Quantitative Approach (The Morgan Kaufmann Series in Computer Architecture and Design) (6th Edition). Morgan Kaufmann.
2. William Stallings (2019). Computer Organization and Architecture (11th Edition). Pearson.

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

CO1	Understand the various techniques to enhance a processors ability to exploit Instruction-level parallelism (ILP), and its challenges.
CO2	Explain exploiting ILP using dynamic scheduling, multiple issue, and speculation.
CO3	Describe multithreading by using ILP and supporting thread-level parallelism (TLP).
CO4	Identify the performance and efficiency in advanced multiple-issue processors.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3	√											
CO4			√									

CSE415 Cryptography
Prerequisites: CSE317
Credits: 03

Course Rationale: Cryptography is the study of mathematics that aims to encrypt data for security purposes. This course aims to give students an understanding of the various algorithms used in cryptographic systems. Student can use this knowledge to develop or improve secured systems.

Course Description: This course provides an introduction to modern cryptography and communication security. It focuses on how cryptographic algorithms and protocols work and how to use them. The course covers the concepts of block ciphers and message authentication codes, public key encryption, digital signatures, and key establishment, as well as common examples and uses of such schemes, including the AES, RSA-OAEP, and the Digital Signature Algorithm. Basic cryptanalytic techniques and examples of practical security solutions are explored to understand how to design and evaluate modern security solutions.

Recommended Book(s):
1. Behrouz A. Forouzan (2007). Cryptography & Network Security (McGraw-Hill Forouzan Networking) (1st Edition). McGraw-Hill Education.
2. Charlie Kaufman, Radia Perlman, and Mike Speciner (2002). Network Security: Private Communication in a Public World (2nd Edition). Prentice Hall.

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

CO1	Explain the goals of information security, and describe the policy, prevention mechanisms of Information System.
CO2	Create digital signature as measure of authenticity and non-repudiation
CO3	Implement Hashing and Digital Signature techniques
CO4	Select appropriate techniques and apply them to solve a given problem

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3			√									
CO4		√										

CSE417 Computer Graphics
Prerequisites: CSE109, CSE211**,** MAT333
Credits: 03

Course Rationale: This course aims to teach students how digital images can be represented or computationally modified using mathematical calculations and programming techniques.

Course Description: Introduction: History of computer graphics, graphics architectures and software; Imaging: pinhole camera, human vision, synthetic camera, modeling vs rendering; OpenGL: architecture, displaying simple two-dimensional geometric objects, positioning systems, working in a windowed environment; Color: Color perception, color models (RGB,

CMY, HLS), color transformations; Color in OpenGL. RGB and Indexed color; Geometric transformations: affine transformations (translation, rotation, scaling, shear), homogeneous coordinates, concatenation, current transformation and matrix stacks; Three dimensional graphics: classical three dimensional viewing, specifying views, affine transformation in 3D, projective transformations; Viewing and Clipping; Rasterization: line drawing via Bresenham's algorithm, clipping, polygonal fill; Introduction to hidden surface removal (z buffer); Shading: illumination and surface modeling, Phong shading model, polygon shading.

Recommended Book(s):

1. Andries Van Dam, Steven K. Feiner, John F. Hughes, and James D. Foley (1995). Computer Graphics: Principles and Practice (2nd Edition). Addison-Wesley Professional.
2. Peter Shirley, Michael Ashikhmin, and Steve Marschner (2005). Fundamentals of Computer Graphics (2nd Edition). A K Peters/CRC Press.

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

CO1	Explain the basic principles of implementing computer graphics primitives.
CO2	Describe shading and texture mapping algorithms
CO3	Design and apply two dimensional and three dimensional graphics and transformations.
CO4	Create effective OpenGL programs to create interactive computer graphics including different shapes.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3					√							
CO4					√							

CSE419 Simulation and Modeling
Prerequisites: CSE205, CSE209, MAT335
Credits: 03

Course Rationale: Simulation and Modeling is the use of a physical or logical representation of a given system to generate data and help determine decisions or make predictions about a system. Students of this course are exposed to various simulation models and techniques that they can use for research in academia or industry.

Course Description: Simulation modeling basics: systems, models and simulation; Classification of simulation models; Steps in a simulation study; Concepts in discrete-event simulation: event-scheduling vs. process interaction approaches, time-advance mechanism, organization of a discrete-event simulation model; Continuous simulation models; combined discreet-continuous models; Monte Carlo simulation; Simulation of queuing systems. Building valid and credible simulation models: validation principles and techniques, statistical procedures for comparing real-world observations and simulated outputs, input modeling; Generating random numbers and random variates; Output analysis. Simulation languages; Analysis and modeling of some practical systems. The Couse also ornamented with Quantum Mechanical Methods, Building Valid, Credible Simulation Models, Random

Numbers and Variats Generation, Input Modeling, Building Valid, Credible Simulation Models and output Modeling

Recommended Book(s):

1. W. David Kelton, Randall P. Sadowski and Nancy B. Zupick (2014). Simulation with Arena (6th Edition). McGraw Hill.
2. Jerry Banks, John Carson, Barry Nelson, and David Nicol (2009). Discrete-Event System Simulation (5th Edition). Pearson.
3. Averill M. Law (2014). Simulation Modeling and Analysis (McGraw-Hill Series in Industrial Engineering and Management) (5th Edition). SEM.

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

CO1	Describe the structure and dynamic behavior of various types of systems.
CO2	Generate random numbers and random variates using different techniques
CO3	Apply simulation scheme for particular system
CO4	Implement simulation models with an object oriented simulation language and a commercial integrated software tool such as Arena

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3			√									
CO4					√							

CSE421 Multimedia Systems Design
Prerequisites: CSE311, CSE323
Credits: 03

Course Rationale: A Multimedia System Design is the study of processing multimedia data across various applications. This course focuses on processing, storage, generation, manipulation and rendition of Multimedia information.

Course Description: The studies of this course are included as follows:
Multimedia system-introduction, voice and video coding and compression standards, Database issues in multimedia – indexing and storing multimedia data, disk placement, disk scheduling, searching for multimedia document. Networking issues in multimedia - Quality-of service guarantees, resource reservation traffic specification, monitoring, queuing system, complex queuing (AQM, IETF RFC), transmission admission control; multicasting issues; Protocols for controlling sessions; Security issues in multimedia real-time audio video streams; Multimedia applications – audio and video conferencing, video on demand (VoD) and voice over IP.

Recommended Book(s):

1. Ze-Nian Li and Mark S. Drew (2003). Fundamentals of Multimedia (United States Ed Edition). Prentice Hall.
2. Ralf Steinmetz and Klara Nahrstedt (1995). Multimedia: Computing, Communications and Applications (US Ed Edition). Prentice Hall.

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

CO1	Analyze text, image, audio and video data
CO2	Identify technical aspects of multimedia web applications including VoD and VoIP
CO3	Evaluate the implications of copyright in the use of multimedia;
CO4	Apply compression techniques necessary for different media types based on the multimedia system context

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3								√				
CO4					√							

CSE423 Digital Image Processing
Prerequisites: CSE209, CSE211, MAT125, MAT333
Credits: 03

Course Rationale: Digital image processing helps to improve the appearance of an image, to extract quantitative information from an image and to calibrate an image in photometric or geometric terms. This course aims to focus one algorithms and technologies that make Digital Image Processing possible.

Course Description: Definition for Multimedia System, Text, Images and graphics: Basic concepts, Computer image processing, Data Compression Techniques: JPEG; H.261 (px64); MPEG; Intel's DVI; Microsoft AVI; Audio compression; Fractal compression, Video compression, Multimedia file standards: RTF; TIFF: RIFF: MIDI: JPEG. Multimedia Storage and Retrieval Technology: Magnetic media technology; optical media technology; Basic technology. Electronic Publishing: Concepts and future of Electronic Publishing.

Recommended Book(s):
1. Rafael C. Gonzalez and Richard E. Woods (2017). Digital Image Processing (4th Edition). Pearson.

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

CO1	Understand fundamental concepts of a digital image processing system
CO2	Analyze images in the frequency domain using various transforms
CO3	Identify various compression techniques
CO4	Implement fundamental image processing techniques in MATLAB and OpenCV

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3	√											
CO4					√							

CSE425 Pattern Recognition
Prerequisites: CSE209, MAT333
Credits: 03

Course Rationale: Pattern recognition is the ability to detect arrangements of characteristics or data that yield information about a given system or data set. This course focuses on various models and techniques that allow patter recognition in computer systems.

Course Description: Introduction and General Pattern Recognition Concepts, Introduction to Statistical Pattern Recognition, Supervised Learning using Parametric and Non Parametric Approaches, Linear Discriminant Functions and The Discrete and Binary Feature Cases, Syntactic Pattern Recognition: Syntactic Recognition Via Parsing and Other Grammars. Graphical Approach to Syntactic Pattern Recognition, Learning Via Grammatical Inference, Neural Pattern Recognition: Introduction to Neural Pattern Associates and Matrix Approaches and Unsupervised Learning in Neural Pattern Recognition.

Recommended Book(s):
1. J. T. Tou and R. C. Gonzalez (1977). Pattern Recognition Principles (2nd Edition). Addison-Wesley.
2. Richard O. Duda, Peter E. Hart, and David G. Stork (2000). Pattern Classification (2nd Edition). Wiley-Interscience.

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

CO1	Understand basic concepts in pattern recognition
CO2	Explain pattern recognition algorithms that utilizes supervised and unsupervised learning
CO3	Design systems and algorithms for pattern recognition.
CO4	Implement typical pattern recognition algorithms in MATLAB.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3			√									
CO4					√							

CSE427 Real Time Computer Systems
Prerequisites: CSE205, CSE209, CSE311
Credits: 03

Course Rationale: Real Time Computer Systems are computer systems that react to events by performing tasks within a specific time interval, usually in the order of milliseconds. This course provides an overview of the various technologies, models and protocols used in such Real Time Computer Systems.

Course Description: The design of this course as follows: Concepts and Misconceptions, Multidisciplinary Design Challenges, Birth and Evolution of RealTime Systems; Basic Processor Architecture, Memory Technologies, Architectural Advancements, Peripheral Interfacing, Microprocessor versus Microcontroller, Distributed Real-time Architectures.; From Pseudo-kernels to Operating Systems, Theoretical Foundations of Scheduling, System Services for Application Programs, Memory Management Issues, Selecting Operating Systems.; Coding of Real-Time Software, Assembly Language, Procedural Languages, Object-Oriented Languages, Overview of Programming Languages, Automatic Code Generation, Compiler Optimizations of Code; Requirements Engineering for Real-Time Systems, Formal Methods in System-Specification, Semiformal Methods in System Specification, The requirements Document; Qualities of Real-Time Software, software Engineering Principles, Procedural Design Approach, Object-Oriented Design Approach, Object-Oriented Design Approach, Life Cycle Mode; Real-Time Performance Analysis, Applications of Queuing Theory, I/O Performance, Analysis of Memory organization; Metrics in Software Engineering, Predictive Cost Modeling, Uncertainty in Real-Time Systems, Design for Fault Tolerance, Software Testing and Systems Integration, Performance Optimization Techniques; future trend in Real time computing: Hardware (Heterogeneous Soft Multi-Cores and their issues, Fieldbus networks and Distributed Nodes), Operating Systems (Coordinating Tasks, Virtual Machines), Programming Languages (UML++), Systems Engineering (Automatic Verification, Distance Collaboration), and Applications (Local/Wide networks, Biometric ID Devices with remote access, High-speed Wireless Communications).

Recommended Book(s):

1. Sriram V. Iyer and Pankaj Gupta (2003). Embedded Realtime Systems Programming (1st Edition). Mc Graw Hill India.
2. Jane W.S. Liu (2000). Real-Time Systems (1st edition). Prentice Hall.

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

CO1	Explain fundamental principles for programming of real time systems with time and resource limitations.
CO2	Develop task scheduling, resource management and fault tolerant applications of Real-Time Systems
CO3	Use real time system programming languages and real time operating systems for real time applications
CO4	Build a be able to do small development-projects,

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2			√									
CO3					√							
CO4									√			

CSE429 Management Information Systems
Prerequisites: CSE323
Credits: 03

Course Rationale: This course is combination of applicable corporate managerial process and information system. After completion of this course, leaner would understood how information system, networking and communication techniques automated the conventional corporate and office management process.

Course Description: The purpose of this course is to introduce business informatics and management data manipulation in organization. This course is organized in following manners: Introduction to Information Systems in Business, Fundamental Information Systems; Managerial Overview; Computer Hardware and Software, Computer Systems, End User and Enterprise Computing Application Software; Data and Telecommunications-Telecommunication and the Internetworked Enterprise; Database Management: Managing Data Resources; the Internet and Electronic Commerce; Information Systems for Managerial Decision Support; Fundamentals of Strategic Advantage ; Strategic Application and Issues in Information Technology; Enterprise and Global Management; ERP overview; Managing Information Resources and Technologies; Implementation of Business Change with IT; Security and Ethical Challenges. Ethical and Societal Challenges of Information Technology

Recommended Book(s):
1. Kathy Schwalbe (2018). Information Technology Project Management (9th Edition). Cengage Learning.

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

CO1	Learn the principles of MIS and different aspects of MIS to idea on real world corporate scenario including ethical challenges.
CO2	Apply the knowledge of database management and telecommunication network to cop up with modern MIS driven Industry and electronic commerce.
CO3	Learn and Design an ERP system for MIS.
CO4	Analyze and develop a distributed network driven database model for SOHO (small office home office).
CO5	Review contemporary research on MIS.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√							√				
CO2	√											
CO3	√		√									
CO4			√		√							
CO5		√										

CSE431 Fuzzy Systems and Neural Networks
Prerequisites: CSE317, CSE411, EEE311
Credits: 03

Course Rationale: Fuzzy systems is the study of human actions and reasoning. Neural Network is the study of the emulating the basic functions of the human brain based on its physical structure. This course aims to introduce these concepts to students who can use this knowledge for higher research or development of intelligent systems.

Course Description: Biological nervous system: the brain and neurons, Introduction to artificial neural network and fuzzy systems, Theory and application of Artificial neural networks and fuzzy logic; Multi-layer perception: Back propagation algorithm, Self organization map, Radial basis network, Hop field network, Recurrent network, Fuzzy set theory, 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 Boltzmann machine, Adaptive Resonance Theory (ART) network. Learning Vector Quantization (LVQ) networks, Logic control: Adaptive fuzzy neural network; Genetic algorithm and evolution compacting, Applications to control. Introduction to Game theory, two person's cooperative theory and bargaining problem

Recommended Book(s):

1. Jacek M. Zurada (1992). Introduction to Artificial Neural Systems (1st Edition). West Group.
2. Patrick K. Simpson (1990). Artificial Neural Systems: Foundations, Paradigms, Applications, and Implementations (Neural Networks, Research and Applications) (1st Edition). Pergamon Pr.

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

CO1	Understand principles of neural networks and fuzzy logic fundamentals
CO2	Design and implement a neural network simulation
CO3	Solve problems that include uncertainty with using Fuzzy Set Theory
CO4	Develop models for different applications using fuzzy system and Matlab

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2			√									
CO3			√									
CO4					√							

CSE433 Data Science
Prerequisites: CSE205, MAT335
Credits: 03

Course Rationale: Data Science aims to use Statistics as Machine learning to better explain statistical patters. This course provides a basic understanding of Data Science by using different programming techniques.

Course Description: Fundamentals of the emerging and interdisciplinary field of data science; Key concepts adopted from statistics and machine learning, useful techniques for graph analysis and parallel programming, and the practical application of data science for such tasks as building recommender systems or performing sentiment analysis. Topics and features: provides numerous practical case studies using real-world data throughout the book; supports understanding through hands-on experience of solving data science problems using Python; describes techniques and tools for statistical analysis, machine learning, graph analysis, and parallel programming; reviews a range of applications of data science, including recommender systems and sentiment analysis of text data; provides supplementary code resources and data at an associated website.

Recommended Book(s):
1. Laura Igual, Santi Seguí, Jordi Vitrià, Eloi Puertas, Petia Radeva, Oriol Pujol, Sergio Escalera, Francesc Dantí, and Lluís Garrido (2017). Introduction to Data Science: A Python Approach to Concepts, Techniques and Applications (Undergraduate Topics in Computer Science) (1st Edition). Springer.

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

CO1	Demonstrate proficiency with statistical analysis of data
CO2	Develop data-based models.
CO3	Apply data science concepts and methods to solve problems in real-world contexts
CO4	Implement data science concepts using Python.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3			√									
CO4					√							

CSE435 Deep Learning
Credits: 03

Course Rationale: Deep learning is the branch of Artificial Intelligence that imitates the human brain by learning from the way data is structured naturally. This course introduces student to engineering concepts of neural networks that aims to build self-governing machines.

Course Description: This course will provide a comprehensive introduction to deep neural networks. Major topics include multilayer perceptrons, convolutional neural networks, recurrent neural networks, practical aspects of training deep neural networks and generative probabilistic modeling with deep neural networks. Students will learn basic concepts of deep learning as well as hands on experience to solve real-life problems. This course requires a strong background in linear algebra, probability and statistics and machine learning. Python will be used for all the assignments. Technologies like PyTorch and NumPy will be discussed.

Recommended Book(s):
1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville (2016). Deep Learning (Adaptive Computation and Machine Learning series) (Illustrated Edition). The MIT Press.

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

CO1	Understand the introductory concepts of neural networks
CO2	Identify and apply various types of deep neural networks.
CO3	Understand the concept of dimensionality reduction.
CO4	Examine the theory of optimization and generalization.
CO5	Apply various neural networks through various case studies and study its applications.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2				√								
CO3		√										
CO4		√										
CO5			√									

CSE437 Machine Learning
Credits: 03

Course Rationale: Machine learning is the branch of Artificial Intelligence that outlines how machines can learn from experience in order to perform better.. In this course, students are exposed to algorithms and concepts that allow machines to learn and improve their performance

Course Description: Machine Learning is an area within Artificial Intelligence that has as its aim the development and analysis of algorithms that are meant to automatically improve a system's performance. Such improvement might include: (1) learning to perform a new task; (2) learning to perform a task more efficiently or effectively; or (3) discovering and organizing new facts that can be used by a system that relies upon such knowledge.
This course will cover the following topics. Journey from Statistics to Machine Learning. Supervised Learning. Unsupervised Learning and Preprocessing. Representing Data and Engineering Features. Model Evaluation and Improvement. Algorithm Chains and Pipelines. Working with Text Data.

Recommended Book(s):
1. Andreas C. Müller and Sarah Guido (2016). Introduction to Machine Learning with Python: A Guide for Data Scientists (1st Edition). O'Reilly Media.
2. Pratap Dangeti (2017). Statistics for Machine Learning: Techniques for exploring supervised, unsupervised, and reinforcement learning models with Python and R (1st Edition). Packt Publishing.

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

CO1	Understand the fundamental issues and challenges of machine learning including data, model selection, model complexity, etc.
CO2	Explain the strengths and weaknesses of many popular machine learning approaches.
CO3	Develop skills of using recent machine learning software for solving practical problems.
CO4	Design and implement various machine learning algorithms in a range of real-world applications

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3					√							
CO4			√									

CSE439 Embedded Systems
Prerequisites: CSE311
Credits: 03

Course Rationale: Embedded devices are prevalent in technologies ranging from vehicles to household devices. This course introduces the fundamentals of embedded systems. The course will also take an approach to programming to develop such systems.

Course Description: This course will cover the basics of embedded system organization, system on programmable-chip technologies and real-time systems. It provides the advanced knowledge required for embedded computer design and development as well as real-time operating systems. Students are introduced to software development concepts applicable to real-time and embedded systems. Particularly ARM Cortex M3 will be studied as a representative embedded processor and embedded software development is carried out for

ARM Cortex CPUs. The students will be able to grasp the main principles of embedded system design and understand the concept of hardware-software co-design, system on programmable chip (SoPC), real-time operating systems and scheduling techniques. Embedded system co-specification and partitioning is also introduced in the course. SystemC or other languages (e.g. UML, C, etc.) can be employed to present a unified view of the embedded systems. SystemC is introduced as a representative Co-specification language. Embedded hardware-software design and development tools (such as Altera Quartus II and SOPC builder) will be introduced.

Recommended Book(s):

1. Daniel W. Lewis (2013). Fundamentals of Embedded Software with the ARM Cortex M3 (2nd Edition). Pearson.
2. T. Martin (2013). The Designer's Guide to the Cortex-M Processor Family: A Tutorial Approach (1st Edition). Newnes.
3. M. Wolf (2016). Computer as Components: Principles of Embedded Computing System Design (4th Edition). Morgan Kaufmann.
4. J. Yiu (2009). The Definitive Guide to the ARM Cortex-M3 (2nd Edition). Newnes.
5. Alan Burns and Andy Wellings (2001). Real-time Systems and Programming Languages. (3rd Edition). Addison-Wesley.

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

CO1	Describe the differences between the general computing system and the embedded system and recognize the classification of embedded systems
CO2	Evaluate different embedded system architectures
CO3	Develop closed and open embedded/Linux based systems for ARM processors
CO4	Design and program an embedded system at the basic level

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3					√							
CO4			√		√							

CSE441 Introduction to VLSI Systems
Prerequisites: CSE207
Credits: 03

Course Rationale: This goal of this course is to teach the Complementary Metal-Oxide Semiconductor (CMOS) technology and how this technology can be used to create Integrate Circuits.

Course Description: Complementary Metal-Oxide Semiconductor (CMOS) technology and theory; CMOS circuit and logic design; layout rules and techniques; circuit characterization and performance estimation; CMOS subsystem design; Very-Large-Scale Integrated (VLSI) systems design methods; VLSI Computer Aided Design (CAD) tools; laboratory experience in custom VLSI chip design on workstations using concepts of hierarchy; final project

involving specification, design and evaluation of a VLSI chip or VLSI CAD program; and written report and oral presentation on the final project.

Recommended Book(s):

1. John P. Uyemura (2001). Introduction to VLSI Circuits and Systems (1st Edition). John Wiley & Sons Inc.

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

CO1	Describe the evolution of integrated circuits(ICs) and compare the general characteristics of different MOS technologies
CO2	Explain the operation and the advantages of CMOS technology
CO3	Analyse circuits using both analytical and CAD tools
CO4	Design VLSI circuits and systems utilizing modern IC design methodologies and design automation tools

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3					√							
CO4					√							

CSE443 Digital System Design
Credits: 03

Course Rationale: Digitals technologies are becoming more prevalent by the day. This course aims to educate students on digital systems and its working. Students will be able to design basic digital systems with integrated circuits.

Course Description: This course explains how to go about designing complex, high-speed digital circuits and systems. The use of modern EDA tools in the design, simulation, synthesis and implementation is explored. Application of a hardware description language such as Verilog to model digital systems at Behavior and RTL level is studied. Field programmable gate arrays (FPGA) are used in the laboratory exercises as a vehicle to understand complete design-flow of an integrated circuit. Advanced methods of logic minimization and state-machine design are discussed. Design and implementation of digital system building blocks such as arithmetic circuits, datapaths, microprocessors, I/O modules, UARTs, frequency generators, memories etc. is included. BIST and Scan techniques for testing of digital systems are also covered. Laboratories and projects are an integral part of this course that culminates in a comprehensive design exercise.

Recommended Book(s):

1. Stephen Brown & Zvonko Vranesic (2013). Fundamentals of Digital Logic with Verilog Design, (3rd Edition). McGraw-Hill.

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

CO1	Understand the digital system design principles and descriptive techniques
CO2	Analyze and design functional building blocks and control and timing concepts of digital systems
CO3	Design and implement digital circuits under realistic constraints and conditions.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3			√		√							

CSE445 Internet of Things (IoT)
Credits: 03

Course Rationale: Internet of Things (IoT) is concept that all kinds devices can be connected to the Internet thus allowing all these devices to be controlled remotely. This course elaborates on the different technologies of IoT and the communication protocols they use.

Course Description: Introduction to IoT things: IoT protocols, Communication Models, IoT enabling Technologies, Levels and Deployment; Domain Specific IoTs, IoT and M2M: Difference between M2M and IoT, SDN and NFV for IoT; IoT System Management and NETCONF-YANG; IoT platforms design methodology; IoT Systems: Logical Design using Python; IoT Physical Device and Endpoints; IoT Physical Servers and Cloud Offerings; Case Studies Illustrating IoT Design;

Recommended Book(s):
1. Arshdeep Bahga and Vijay Madisetti (2014). Internet of Things (A Hands-on-Approach) (1st Edition). VPT.

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

CO1	Understand the application areas of IOT
CO2	Explain the revolution of Internet in Mobile Devices, Cloud & Sensor networks
CO3	Transfer IoT data to the cloud and in between cloud providers
CO4	Design an IoT device to work with a Cloud Computing infrastructure.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3					√							
CO4			√		√							

CSE447 Natural Language Processing
Prerequisites: CSE105
Credits: 03

Course Rationale: Natural Language Processing is a course that helps students learn how a computer can recognize or mimic natural (human) language. Students learn engineering concepts that enables the mapping of natural language onto a computer system such that the computer system can create or recognize human languages.

Course Description: Introduction to the field of natural language processing (NLP)- the creation of computer programs that can understand, generate, and learn natural language. The topics include the three major subfields of NLP: syntax (the structure of an utterance), semantics (the truth-functional meaning of an utterance), and pragmatics/discourse (the context-dependent meaning of an utterance). The course will introduce both knowledge-based and statistical methods for NLP, and will illustrate the use of such methods in a variety of text- and speech-based application areas.

Recommended Book(s):
1. Dan Jurafski, James H. Martin, Andrew Kehler, Keith Vander Linden, and Nigel Ward (1999). Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition (1st Edition). Prentice Hall.

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

CO1	Understand approaches to syntax and semantics in NLP.
CO2	Describe machine learning techniques used in NLP, including hidden Markov models and probabilistic context-free grammars
CO3	Use NLP methods to analyse sentiment of a text document.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3					√							

CSE449 Big Data
Prerequisites: CSE205, MAT335
Credits: 03

Course Rationale: The course gives an overview of the Big Data phenomenon, focusing then on extracting value from the Big Data using predictive analytics techniques.

Course Description: This course serves as an introductory course for students who are expecting to face Big Data storage, processing, analysis, visualization, and application issues on both workplaces and research environments. This course is designed to provide students with fundamental understanding of Big Data and help develop skills necessary to handle and implement various aspects of big data projects. Students, while taking the course, will have a unique exposure to big data technologies that will provide them with skills necessary to

implement data science projects in Hadoop as well as support teams executing big data projects. Students will gain knowledge on analyzing Big Data. They will gain knowledge on this fast-changing technological direction. Get insight on what tools, algorithms, and platforms to use on which types of real world use cases.

Recommended Book(s):

1. Paul Zikopoulos, Chris Eaton, Dirk Deroos, Tom Deutsch, George Lapis (2017), Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data (1st Edition). McGraw Hill Education.
2. Vignesh Prajapati (2013), Big Data Analytics with R and Hadoop (Illustrated Edition). Packet Publishing Limited.

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

CO1	Understand Big Data and its analytics in the real world
CO2	Analyze the Big Data framework like Hadoop to efficiently store and process Big Data to generate analytics
CO3	Design of Algorithms to solve Data Intensive Problems
CO4	Design and Implementation of Big Data Analytics using pig and spark to solve data intensive problems and to generate analytics

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2		√										
CO3			√									
CO4			√									

CSE451 Robotics
Credits: 03

Course Rationale: Recent trends show that robots are aiding in various manufacturing companies, medical practices and even at homes. This course covers the principles of mechanics and electronics that allow robots to perform it manipulative tasks.

Course Description: Robotics classification, Sensors-Position sensors, Velocity sensors, Proximity sensors, Touch and Slip Sensors, Force and Torque sensors. Grippers and Manipulators-Gripper joints, Gripper force, Serial manipulator, Parallel Manipulator, selection of Robot-Selection based on the Application Kinematics-Manipulators Kinematics, Rotation Matrix, Homogenous Transformation Matrix, Direct and Inverse Kinematics for industrial robots for Position and orientation. Differential Kinematics and static- Dynamics-Lagrangian Formulation, Newton-Euler Formulation for RR & RP Manipulators, Trajectory Planning-Motion Control- Interaction control, Rigid Body mechanics, Control architecture

position, path velocity and force control systems, computed torque control, adaptive control, and Servo system for robot control. Programming of Robots and Vision System- overview of various programming languages. Application of Robots in production systems- Application of robot in welding, machine tools, material handling, and assembly operations parts sorting and parts inspection.

Recommended Book(s):

1. K. S. Fu, R.C. Gonzalez, C.S.G. Lee(1987). Robotics: Control, Sensing, Vision, and Intelligence, McGraw-Hill.

2. Richard D. Klafter, Thomas A. Chmielewski, Michael Negin (1989), Robotic Engineering: An Integrated Approach, Prentice Hall.

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

CO1	Classify robots based on joints and arm configurations.
CO2	Design application specific End Effectors for robots.
CO3	Compute forward and inverse kinematics of robots and determine trajectory plan.
CO4	Program robot to perform typical tasks including Pick and Place, Stacking and Welding.
CO5	Design and select robots for Industrial and Non-Industrial applications.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3		√										
CO4			√									
CO5	√											

CSE453 Data Communication
Credits: 03

Course Rationale: This course talks about methodologies of communication between devices. Students of the course also learn the structure, formation of computer network and the strategies of data propagation process in the networking system.

Course Description: This course covers fundamental concepts of data communications, with problem-solving tutorials on networking related calculations and in-depth discussion and research on leading edge network technologies. The syllabus includes the basic understandings on computer networks and communication protocols as well as expanded coverage of WANs, including TCP/IP, ATM, frame relay, packet switching, and circuit switching, and LANs, including Fast Ethernet.

Recommended Book(s):

1. Behrouz A Forouzan (2012). Data Communications and Networking (5th Edition). McGraw Hill.

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

CO1	Explain basic concepts of network and communication theories.
CO2	Explain and study different network and communication technology architecture
CO3	Design and Evolve conceptual network architecture and planning
CO4	Investigate and predict the different network and communication parameters in real time scenario.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3		√		√								
CO4					√					√		

CSE455 Design and Analysis of Algorithms
Prerequisites: CSE211
Credits: 03

Course Rationale: This course help student understand and develop algorithms at an advanced level. They are introduced to different algorithms that can be used to solve various computational problems. They also gain skills to develop computational complexity of algorithms in terms time and space.

Course Description: Time Complexity Review, Order Notation, Recurrence Relations, Master's Theorem, Divide and Conquer, Matrix Multiplication, Binary exponentiation, MergeSort, QuickSort, Greedy Algorithms, Huffman Coding, Activity Scheduling (e.g., maximum number of non-overlapping activities), Fractional Knapsack Floyd-Warshall Algorithm. Dynamic Programming, Longest Common Subsequence, 0-1 Knapsack, Coin Change, Graphs, Graph Traversal (BFS/DFS), Topological Sort, Minimum Spanning Tree: Prim's and Kruskal's Algorithms, Shortest Path: Djikstra and Bellman-Ford Complexity Classes, Polynomial Reductions, P and NP, NP-Complete and NP-Hard.

Recommended Book(s):

1. Thomas H. Cormen, Charles E. Leiserson, Ronald Rivest, and Clifford Stein (2009). Introduction to Algorithms (3rd Edition). MIT Press.
5. Donald E. Knuth (1997). The Art of Computer Programming, Vol. 1: Fundamental Algorithms (3rd Edition). Addison-Wesley Professional.
6. Donald E. Knuth (1997). The Art of Computer Programming, Volume 2: Seminumerical Algorithms (3rd Edition). Addison-Wesley Professional.
7. Donald E. Knuth (1998). The Art of Computer Programming: Volume 3: Sorting and Searching (2nd Edition). Addison-Wesley Professional.
8. Donald E. Knuth (2011). The Art of Computer Programming: Combinatorial Algorithms Volume 4A (1st Edition). Addison-Wesley.

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

CO1	Understanding basic ideas about various algorithms
CO2	Analyze the efficiency of algorithms using time and space complexity
CO3	Synthesize efficient algorithms in common engineering design situations.
CO4	Apply important algorithmic design paradigms and methods of analysis.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3			√									
CO4			√									

CSE457 Principles of Programming Languages
Prerequisites: CSE109, CSE205, CSE201
Credits: 03

Course Rationale: There exist many programing languages in the world. This course helps understand the common characteristics of most languages but enlightens on the different features as well. The course focuses on programming paradigm that defines how computation is expressed and how features of different programming languages impact their performance.

Course Description: Evolution of the Major Programming Languages with a description of its Syntax and Semantics; Lexical and Syntax Analysis; Names, Bindings, and Scopes; Data Types; Expressions and Assignment Statements; Statement-Level Control Structures; Subprograms, Implementing Subprograms; Abstract Data Types and Encapsulation Constructs; Support for Object-Oriented Programming; Concurrency; Exception Handling and Event Handling; Functional Programming Languages and Logic Programming Languages

Recommended Book(s):
1. Robert W. Sebesta (2018). Concepts of Programming Languages (12th Edition). Pearson.
2. Allen B. Tucker and Robert Noonan (2006). Programming Languages: Principles and Paradigms (2nd Edition). McGraw -Hill Education.

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

CO1	Describe languages and program behavior
CO2	Compare programming languages, assess programming languages critically and scientifically
CO3	Analyze behavior of simple programs in imperative languages using concepts such as binding, scope, control structures, subprograms and parameter passing mechanisms.
CO4	Implement concepts of ADT and object oriented programming for large scale software development.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3	√											
CO4					√							

CSE459 Blockchain Systems and Communication Networks
Prerequisites: Senior status (100 credits completed) with minimum GPA of 3.0
Credits: 03

Course Rationale: World finance has taken a turn into the digital world. This course builds an understanding of how bitcoin or other cryptocurrency forms the blockchain system that function over computer networks.

Course Description: Introduction: Need for Distributed Record Keeping, Modeling faults and adversaries, Byzantine Generals problem, Consensus algorithms and their scalability problems, Technologies Borrowed in Blockchain – hash pointers, consensus, byzantine fault-tolerant distributed computing, digital cash; Basic Distributed Computing: Atomic Broadcast, Consensus, Byzantine Models of fault tolerance; Basic Crypto primitives: Hash functions, Puzzle friendly Hash, Collison resistant hash, digital signatures, public key crypto, verifiable random functions, Zero-knowledge systems; Blockchain 1.0: Bitcoin blockchain, the challenges, and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language and their use; Blockchain 2.0: Ethereum and Smart Contracts, The Turing Completeness of Smart Contract Languages and verification challenges, Using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts; Blockchain 3.0: Hyperledger fabric, the plug and play platform and mechanisms in permissioned blockchain; Privacy, Security issues in Blockchain: Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation, attacks on Blockchains – such as Sybil attacks, selfish mining, 51% attacks - -advent of algorand, and Sharding based consensus algorithms to prevent these

Recommended Book(s):

1. Mubashir Husain Rehmani (2021). Blockchain Systems and Communication Networks: From Concepts to Implementation (1st Edition). Springer

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

CO1	Understand the basic Cryptographic primitives used in Blockchain.
CO2	Develop decentralized applications and data storage, over and beyond its rol.e as the technology underlying the cryptocurrencies
CO3	Create a distributed and replicated ledger of events, transactions, and data generated through various IT processes with strong cryptographic guarantees of tamper resistance, immutability, and verifiability.
CO4	Develop the communication skills by presenting different topics on blockchain.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2		√										
CO3			√									
CO4										√		

CSE462 Advanced Programming Techniques 1
Prerequisites: CSE109, CSE205, CSE201
Credits: 01

Course Rationale: This course will help students who are interested to develop their computer programming skills will learn various programming techniques.

Course Description: The course will aim to increase the programming ability of students by introducing them to various advanced algorithms. They will learn to analyze their code structure and optimize their code based on their analysis and algorithmic knowledge. They will get the opportunity to learn ideas and solve complex problems.

Reference Book(s):
1. Donald E. Knuth (1997). The Art of Computer Programming: Fundamental Algorithms (3rd Edition). Addison-Wesley.
2. Donald E. Knuth (1997). The Art of Computer Programming: Semi numerical Algorithms (3rd Edition). Addison-Wesley.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein (2022). Introduction to Algorithms (4th Edition). The MIT Press.

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

CO1	Use tools that allow proper development of programs.
CO2	Understand the concepts of programming limitations and built-in function.
CO3	Develop source code for a given algorithm using programming constructs.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					√							
CO2	√											
CO3	√											

CSE464 Advanced Programming Techniques 2
Prerequisites: CSE109, CSE205, CSE201
Credits: 01

Course Rationale: This course will help students who are interested to develop their computer programming skills will learn various programming techniques.

Course Description: The course will introduce various sorting techniques that will help students to solve programs that deal with large number of data sets, series and progression. They will also learn searching techniques that will enable them to traverse through graphs or other complex data structures. Student willing to take up competitive programming will find this course to be beneficial.

Reference Books:
1. Donald E. Knuth (1998). The Art of Computer Programming: Sorting and Searching (2nd Edition). Addison-Wesley.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein (2022). Introduction to Algorithms (4th Edition). The MIT Press.

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

CO1	Use tools that allow proper development of programs.
CO2	Understand the concepts of built-in data structures and sorting/searching techniques for traversal.
CO3	Develop source code for a given algorithm using programming constructs.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					√							
CO2	√											
CO3	√											

CSE466 Advanced Programming Techniques 3
Prerequisites: CSE109, CSE205, CSE201
Credits: 01

Course Rationale: This course will help students who are interested to develop their computer programming skills will learn various programming techniques.

Course Description: This will be an introductory course in getting students to get exposed to Combinatorial Algorithms for investigating combinatorial structures. They will learn Generation by constructing combinatorial structures of a particular type. Enumeration by computing the number of different structures of a particular type. Searching to find combinatorial structures and optimizing problems by using combinatorial search techniques.

Reference Book(s):

1. Donald E. Knuth (2011), Combinatorial Algorithms, Part 1 (1st Edition). Addison-Wesley.
2. Donald E. Knuth (2023), Combinatorial Algorithms, Part 2 (1st Edition). Addison-Wesley.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein (2022). Introduction to Algorithms (4th Edition). The MIT Press.

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

CO1	Use tools that allow proper development of programs.
CO2	Implement and use Combinatorial Algorithms.
CO3	Develop source code for a given algorithm using programming constructs.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					√							
CO2	√											
CO3	√											

CSE471 Directed Research
Credits: 01

Course Rationale: Directed Research is an opportunity for students to get involved with research under the supervision of a faculty member. This experience is particularly valuable for students interested in pursuing higher education in their respective area of interest.

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

CO1	Analyze the ethics concerning research involving human subjects
CO2	Devise a research project with proper methodology, scale, scope, and time limitations
CO3	Develop a hypothesis based on a real-world scenario of a focus area

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1								√				
CO2			√									
CO3		√										

CSE491 Capstone Design Project I
Credits: 02

Course Rationale: This course is designed to give students a feel of the challenges that is encountered while solving a real world problem. Challenges can range from social problems to technological difficulties.

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

CO1	Develop an idea to solve a real world problem
CO2	Investigate similar problems to reach a feasible solution
CO3	Create an approximate budgeting of time and cost for the project
CO4	Demonstrate consideration of the ethical issues concerning the project
CO5	Requirement collection from diversified community and society
CO6	Design a prototype for the solution

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√										
CO2				√								
CO3											√	
CO4								√				
CO5										√		
CO6			√									

CSE492 Capstone Design Project II
Credits: 03

Course Rationale: This course is designed to give students a feel of the challenges that is encountered while implementing the solution to a real world problem. Students also learn to assess the implemented solution.

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

CO1	Design and implement the system using modern tools
CO2	Analyze the impact of the proposed/developed solution on the environment
CO3	Demonstrate the impact of the developed system on the society and inclusion of professional engineering practices

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					√							
CO2							√					
CO3						√						

ECO235 Engineering Economics
Credits: 03

Course Rationale: Everything in engineering has to be carried out economically and optimally - whether designing an equipment, choosing between alternatives, operating a plant, marketing a product or maintaining a plant, all of which involve a decision-making process. The course focuses on economic and cost analysis of engineering projects, giving insights on modern techniques and methods used on economic feasibility studies relating to design and implementation of engineering projects.

Course Description: Definition of Economics, Nature and Scope of Economics, Micro versus Macro Economics. Basic Economic Problems, Solution of these Problems, Production Possibility Curve. Demand and supply: Concept of Demand and supply, Law of Demand and supply, determinants of Demand and supply, Movement along Demand and supply Curves, Shifting of Demand and supply Curves, Market Demand Curve, Market Equilibrium. Consumer's Surplus and Producer's Surplus. Shift of Equilibrium. Consumer's Equilibrium, Substitute; National Income: definition, concepts, roles. GNP. GDP. NNO. Personal Income, Disposal Income, Normal vs Real GNP. Methods of Measuring National Income-Product. Expenditure. Income and Value added approach. Circular Flow of Income and Expenditure-two sector Economy. Money: Definition and Function of Money, Kinds of Money. Money and the Price Level. After Tax Analysis (ATA) using the income statement format. Risk analysis and assessment. Services engineering, billing, HR, operations, maintenance, planning, customer relations, changing technologies, regulation policies, solution engineering, outsourcing, strategy development. Principles of engineering project management.

Recommended Book(s):

1. Dominic Salvator (1992), Theory and Problems of Microeconomics Theory (3rd Edition). McGraw-Hill Inc.
2. Eugene A. Diulio (1990), Theory and Problems of Macroeconomic Theory (2nd Edition). McGraw-Hill Inc.

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

CO1	Understand major principles of economic analysis for decision making among alternative courses of action in engineering.
CO2	Understand the measures of national income, the functions of banks and concepts of economic globalization
CO3	Analyse the impact of depreciation, taxation and other economic factors on feasibility of projects
CO4	Use the concepts of cash flows, time value of money in evaluation of investments and projects in real life

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3											√	
CO4											√	

EDR101 Engineering Drawing
Credits: 03

Course Rationale: Engineers need to have knowledge on ‘dimensioning’ and other techniques to accurately draw and design projects in all technical fields. This course will introduce students to basic technical drawing to discover the instruments and equipment used as well as the fundamentals of dimensions and the uniform standard for all technical drawing.

Course Description: Lines and lettering; plane geometry: drawing of linear and curved geometric figures, e.g. pentagon, hexagon, octagon, ellipse, parabola, hyperbola; solid geometry: concept of isometric view and oblique view, theory of projections; drawing of isometric view of 3d objects such as cube, prism, pyramid, cone and cylinder; projections of cube, prism, cone, cylinder; developments of cube, pyramid, cone, cylinder; plan, elevations and sections of one storied and duplex building.

Recommended Book(s):

1. K. Venkata Reddy (2008), Textbook of Engineering Drawing (1st Edition). BS Publications.
2. N. D. Bhatt (2012), Engineering Drawing (1st Edition), Charotar Publishing House.

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

CO1	Comprehend the basics of civil engineering drawing
CO2	Interpret the drawing's elevation views and section views
CO3	Apply concepts of engineering drawing for performing the task related to civil engineering

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3	√											

EEE201 Electrical Circuits I
Prerequisites: PHY109**,** MAT123
Credits: 03

Course Rationale: World runs on electricity which is useful for the people to provide comfort and produce all the essential items using large machines in factories. This course aims to develop student's understanding related to electric circuits.

Course Description: Electrical Circuits is an introductory course in Electrical Engineering, providing an introduction to simple electrical circuits as well as the technical skills to analyze such simple circuits. The course has been designed to introduce fundamental principles of circuit theory commonly used in engineering research and science applications. It is a course suitable for students pursuing further studies in electrical or telecommunications engineering as well as some other related engineering disciplines including computer engineering. The contents include Voltage, Current, Resistor, Ohm's Law, Kirchhoff's Law, series and parallel circuits, Mesh and Nodal analysis, Superposition, Source Transformation, Thevenin's and Norton's theorems, Capacitor, Inductor and responses of First Order circuits.

Recommended Book(s):

1. C. K. Alexander and M. N. O. Sadiku (2007). Fundamentals of Electric Circuits (3rd Edition). McGraw Hill.
2. R. Boylestad. (1996). Introductory Circuit Analysis (8th edition), Prentice Hall

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

CO1	Apply knowledge of mathematics, science, and engineering to the analysis and design of electrical circuits.
CO2	Identify, formulate, and solve engineering problems in the area of various types of circuits.
CO3	Compute various circuit parameters by applying various laws and theorems of electrical circuits

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2		√										
CO3				√								

EEE205 Electronics I
Prerequisites: EEE201
Credits: 03

Course Rationale: Electronic engineers work at the forefront of practical technology, improving the devices and systems we use every day. From solar-energy systems to mobile phones, we innovate to meet society's communication, tech and energy needs. To meet the demand of workforce, this course is offered to provide students a technical knowledge on electronics.

Course Description: Semiconductors: Electron and holes in an intrinsic semiconductor, donor and acceptor impurities. Energy band structure in solids, insulators, semiconductors and metals. Diode: Operational principle of ideal diode, p-n junction diode, current-voltage characteristics of a diode, simplified dc and ac diode models. Half wave and full wave bridge rectifiers, rectifiers with filter capacitor, characteristics of a Zener diode and its applications. Zener shunt regulator, limiting and clamping circuit. Metal-Oxide-Semiconductor Field-Effect-Transistor (MOSFET): Structure and physical operation of MOSFETs, body effect, current- voltage characteristics of MOSFETs, biasing discrete and integrated MOS amplifier circuits, MOSFET as switch, single stage MOS amplifiers. Bipolar junction transistor (BJT): Basic structure, BJT characteristics and regions of operation, DC analysis, biasing the BJT for discrete circuits, small signal equivalent circuit models, small signal low frequency h parameter model, BJT as a switch. Single stage BJT amplifier circuits and their configurations, RC coupled two stage BJT amplifiers.

Recommended Book(s):

1. Adel Sedra, Kenneth C. Smith (2004). Microelectronic circuits (5th Edition). McGraw-Hill

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

CO1	Explain the operating principle and terminal characteristics of P-N Junction Diodes, BJTs, and MOSFETs.
CO2	Analyze diode, BJT, and MOSFET circuits with DC sources.
CO3	Solve different Rectifier Circuits, Clipping and Clamping circuits, BJT and MOSFET amplifier circuits.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3	√											

EEE206 Electrical and Electronics Laboratory
Prerequisites: CSE207, EEE201
Credits: 01

Course Rationale: This course is utilized for performing experiments related to fundamentals of Electrical and Electronics Engineering, Engineering. This Lab covers all the basic devices that serve as the most basic building block of almost all electronic and electrical devices and creates foundation of what is to be learned throughout the engineering curriculum.

Course Description: In the practical section, it provides hands-on experience in building and testing circuits. It is packaged in such a way that students, having taken this course, can go away and build and analyze some practical, useful devices afterwards. Concurrent lab applies classroom theory, teaches use of multi-meters and power supplies, and introduces the oscilloscope, breadboarding, schematic reading and troubleshooting.
The significance of the Electrical Circuit Simulation Lab is renowned in the various fields of engineering applications. For an Electrical Engineer, it is obligatory to have the practical ideas about the Electrical Circuits and Simulation. The objective of the Simulation laboratory is to impart hands on experience in verification of circuit laws and theorems, measurement of circuit parameters, study of circuit characteristics using PSPICE. It also gives practical exposure to the usage of different circuits with different conditions.
In this course, students will also perform experiments to verify practically the theories and concepts learned in CSE307 and EEE205. Students will also design simple systems using software like PSpice and MATLAB.

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

CO1	Build and simulate basic electrical DC and AC circuits and preform fundamental circuit lab equipment.
CO2	Build and simulate electronic circuits and perform measurements using electronic equipment.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					√							
CO2					√							

EEE311 Numerical Methods
Prerequisites: CSE109, MAT229, MAT333
Credits: 03

Course Rationale: Numerical analysis is employed to develop and analyze numerical methods for solving problems that arise in other areas of mathematics, such as calculus, linear algebra, or differential equations which are heavily involved in Electrical engineering.

Course Description: Introduction to Numerical analysis, Numerical solution of Algebraic and Transcendental Equation; Interpolation; Introduction to C, Programming techniques and numerical calculation; Curve Fitting; Numerical Differentiation and Integration; Matrices and Error Analysis

Recommended Book(s):
1. S. S. Sastry (2012). Introductory Methods of Numerical Analysis (5th Edition). PHI.
2. Steven C. Chapra, Raymond P. Canale (2014). Numerical Methods for Engineers (7th edition). McGraw Hill.

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

CO1	Apply various techniques of analyzing accuracy of numerical representations and finding roots
CO2	Use the linear systems solution techniques in solving electrical engineering problems
CO3	Explore the basic concepts of numerical optimization, interpolation, differentiation and integration
CO4	Use appropriate programming and simulation tools to perform computational experiments

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2			√									
CO3		√										
CO4					√							

EEE441 Digital Signal Processing
Prerequisite: EEE313
Credits: 03

Course Rationale: The main functionality of digital systems is the ability to process digital signal. This course builds a thorough understanding of how digital signals are created, processed and read by various digital systems.

Course Description: Introduction to digital signal processing (DSP): Discrete-time signals and systems, analog to digital conversion, impulse response, finite impulse response (FIR) and infinite impulse response (IIR) of discrete-time systems, difference equation, convolution, transient and steady state response. Discrete transformations: Discrete Fourier series, discrete-time Fourier series, discrete Fourier transform (DFT) and properties, fast Fourier transform (FFT), inverse fast Fourier transform, Z transformation - properties,

transfer function, poles and zeros and inverse Z transform. Correlation: circular convolution, auto-correlation and cross correlation. Digital Filters: FIR filters - linear phase filters, specifications, design using window, optimal and frequency sampling methods; IIR filters - specifications, design using impulse invariant, bi-linear Z transformation, least-square methods and finite precision effects.

Recommended Book(s):

1. John G. Proakis and Dimitris G. Manolakis (2007). Digital Signal Processing- Principles, Algorithms and Applications (4th Edition).Pearson.

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

CO1	Implement discrete time (DT) linear time invariant (LTI) systems using various structures
CO2	Apply different tools and techniques for processing DT signals and analyzing systems.
CO3	Analyze DT signals and LTI systems in time, frequency and z-domain

Mapping of CO vs. PO:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3		√										

EEE443 Telecommunication Engineering
Prerequisite: EEE321
Credits: 03

Course Rationale: Telecommunication allows people to be global connected. This course teaches students on basic telephony and advances to engineering concepts that make telecommunication possible.

Course Description: Introduction: Principle, evolution, 'networks, exchange and international regulatory bodies. Telephone apparatus: Microphone, speakers, ringer, pulse and tone dialing mechanism, side-tone mechanism, local and central batteries and advanced features. Switching system: Introduction to analog system, digital switching systems - space division switching, blocking probability and multistage switching, time division switching and two-dimensional switching. Traffic analysis: Traffic characterization, grades of service, network blocking probabilities, delay system and queuing. Modem telephone services and network: Internet telephony, facsimile, integrated services digital network, asynchronous transfer mode and intelligent networks. Introduction to cellular telephony and satellite communication.

Recommended Book(s):

1. John C. Bellamy (2000). Digital Telephony (3rd Edition). Wiley-Interscience.

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

CO1	Assess various modern telephone apparatus and identify them.
CO2	Apply different switching systems according to the needs.
CO3	Examine various traffic analyses.
CO4	Design next generation telephone system and networks.

Mapping of CO vs. PO:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2		√										
CO3		√										
CO4			√									

EEE445 Wireless Communication
Prerequisite: EEE321
Credits: 03

Course Rationale: Wireless communications can ensure network connectivity in mobile devices or remote areas. This course aims teach students on the engineering concepts of radio signals and the different hardware technologies that are used to build such systems.

Course Description: Cellular Radio System: Frequency reuse, co channel interference, cell splitting; Mobile Radio propagation: Propagation characteristics, models for radio propagation, antenna at cell site and mobile antenna; Frequency Management and Channel Assignment: Spectrum, fixed channel assignment; non-fixed channel assignment, traffic and channel assignments; Handoffs and Dropped Calls: Reasons and types, forced handoffs, mobile assisted handoffs and dropped call rate; Diversity Techniques: Concept of diversity branch and signal paths; carrier to noise and carrier to interference ratio performance; Digital Cellular Systems: Global system for mobile, time division multiple access and code division multiple access.

Recommended Book(s):

1. John W. Mark and Weihua Zhuang(2002). Wireless Communications and Networking (1st Edition), Prentice Hall
2. William C.Y. Lee (2005). Wireless and Cellular Telecommunications (3rd Edition), McGraw Hill

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

CO1	Discuss evolution of different technologies used for wireless communication systems and standards.
CO2	Explain the architecture, functioning, protocols, capabilities and application of various wireless communication networks
CO3	Demonstrate an ability explain multiple access techniques and evaluation of design challenges, constraints and security issues of wireless communication.

Mapping of CO vs. PO:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3		√										

EEE447 Optical Fiber Communication
Prerequisite: EEE319, EEE321
Credits: 03

Course Rationale: The use of optical fiber ranges from networks to medical instruments. Optical fiber communication course aims to teach students about various optical fiber technology and the underlying engineering concepts that enable such communication.

Course Description: Introduction. Light propagation through optical fiber: Ray optics theory and mode theory. Optical fiber: Types and characteristics, transmission characteristics, fiber joints and fiber couplers. Light sources: Light emitting diodes and laser diodes. Detectors: PIN photo-detector and avalanche photo-detectors. Receiver analysis: Direct detection and coherent detection, noise and limitations. Transmission limitations: Chromatic dispersion, nonlinear refraction, four waves mixing and laser phase noises. Optical amplifier: Laser and fiber amplifiers, applications and limitations. Multi-channel optical system: Frequency division multiplexing, wavelength division multiplexing and co-channel interference

Recommended Book(s):

1. John M. Senior (2009). Optical Fiber Communications, Principles and practice, (3rd Edition). Pearson.

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

CO1	Explain the Transmission Characteristics of fiber.
CO2	Explain the construction and characteristics of optical sources and detectors.
CO3	Compute various types of fiber loss, linear and nonlinear effects and compute the losses with mode, volume
CO4	Compare the different types of optical amplifier in basis of their principles and applications, Receiver analysis.

Mapping of CO vs. PO:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3	√											
CO4	√											

EEE449 Microwave Engineering
Prerequisite: EEE321
Credits: 03

Course Rationale: Microwave technology plays a significant role in special types of networks. This course aims to develop an understanding of how microwave engineering work and how it can be applied across networks.

Course Description: This course is designed to provide students with fundamental of RF principles, principles, construction, characteristics of different antenna types, their performance and trade-offs, commonly used antennas in microwave and SATCOM systems, characteristics of basic RF equipment familiarization – transmitters/receivers, antennas, transmission lines, test equipment, filters, couplers, terminations, RF link design, operation and budgeting, categories of satellites and their applications, satellite orbit types and their trade-offs, satellite link performance, common problems and corrections, terrestrial microwave systems performance.

Recommended Book(s):

1. D.M. Pozar (2011). Microwave Engineering (4th Edition), John Wiley & Sons Inc.
2. Timothy Pratt (2002), Satellite Communication (2nd edition): John Wiley & Sons Inc.
3. C. A. Balanis Antenna (2016).Theory Analysis and Design (4th Edition). John Wiley & Sons Inc.
4. Samuel Y. Liao (1996), Microwave Devices and Circuits (3rd Edition). Prentice Hall.
5. Tri T. Ha (1990), Digital Satellite Communication (2nd Edition), McGraw Hill
6. Kaveh Pahlavan and P. Krishnamurthym (2002), Principles of Wireless Networks: A Unified Approach. Patience Hall India.
7. Raj Padya (1999), Mobile & Personnel Communication (1st Edition), IEEE Press.

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

CO1	Understand and design microwave transmission lines and analyze different types of antennas.
CO2	Understand the concepts of stability operating principles of basic passive and active microwave devices.
CO3	Discuss the fundamental principles and useful satellite orbits of satellite communication.
CO4	Ability to calculate orbital determination, link budgets and multiple access techniques like FDMA, CDMA, TDMA in satellite communications with antenna design.

Mapping of CO vs. PO:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3			√									
CO4				√								

EEE451 Digital Communication
Prerequisite: EEE321
Credits: 03

Course Rationale: In recent era, most communication systems are digital because of its superiority over prior systems. This course aims to given students an understanding of the underlying concepts and theories that forms such digital systems.

Course Description: This course is aimed to enlighten students with the concepts of probability and random process, principles of source coding, characterization of communications signals, optimum receivers for AWGN channels, channel capacity and coding, signal design for band-limited channels, communication through band-limited linear filter channels and some overviews of multicarrier systems and spread spectrum signals.

Recommended Book(s):
1. J. G. Proakis (1995), Digital Communications, (3rd Edition). McGraw-Hill.
2. J. G. Proakis and M. Salehi (2005), Communication Systems(1st Edition) , Prentice-Hall.
3. Symon Haykin (2001), Digital Communications (2nd Editon), Wiley

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

CO1	Analyze various continuous angle modulation and pulse modulation and demodulation techniques with digital modulation.
CO2	Attain the knowledge about AM, FM Transmitters and Receivers
CO3	Understand the channel parameter in communication

Mapping of CO vs. PO:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2		√										
CO3				√								

EEE453 Satellite Communication
Prerequisites: None
Credits: 03

Course Rationale: Satellites play a major role in relaying information across the globe. This course intends to teach students the basic understanding of satellites and its communication mechanisms.

Course Description: The course introduces the students to the basic concept in the field of satellite communication. This will enable the students to know how to place a satellite in an orbit and about the earth & space segment. The satellite services like broadcasting are also studied thoroughly.

Recommended Book(s):
1. Dennis Roddy (2001), Satellite Communication (3rd Edition), McGraw Hill Publications.
2. M. Richaria (1999), Satellite Communication Systems Design Principles (2nd edition), Pearson Publications.
3. Wilbur L. Pritchard, Henri G. Suyderhoud, Robert A. Nelson (1993), Satellite Communication Systems Engineering Facsimile (2nd Edition), Prentice Hall.

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

CO1	Understand principle, working and operation of various sub systems of satellite as well as the earth stations.
CO2	Apply various communication techniques for satellite applications
CO3	Analyze and design satellite communication link
CO4	Learn advanced techniques and regulatory aspects of satellite communication
CO5	Understand role of satellite in various applications

Mapping of CO vs. PO:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2		√										
CO3			√									
CO4		√										
CO5												√

ENG099 Basic English
Credits: 03

Course Rationale: It is a foundation course that will prepare the students by strengthening their English grammatical knowledge and bridging the gap between acquired knowledge and application for a better understanding of the English language as it is the primary means of pursuing higher education at the university level.

Course Description: This course aims to enable the students to recognize and understand the grammatical rules and structures as a valuable tool to use English language effectively. The syllabus includes the basic and fundamental grammar of English. Along with strengthening students' grammatical knowledge and skills, this course will help them to enrich their vocabulary by allowing them to practice a wide range of grammatical exercises and tasks.

Suggested Textbook(s):

1. Eastwood, J. (1999). Oxford Practice Grammar (2nd ed.). Oxford University Press.
2. Azar, B. T. (2002). Fundamentals of English Grammar (3rd ed.). Prearson Education.

Reference Book(s):

1. Hewings, M. (2013). Advanced Grammar in Use (3rd ed.). Cambridge University Press.
2. Azar, B. T. (2016). Understanding and Using English Grammar (5th ed.). Prearson Education.
3. Freeborn, D. (1995). A Course Book in English Grammar. (2nd ed.). Palgrave Macmillan.
4. Murphy, R. (2015). English Grammar in Use (4th ed.). Cambridge University Press.

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

CO1	apply accurate and appropriate grammatical rules and structures like tense, subject-verb agreements, right form of verbs, modal verbs, phrasal verbs, appropriate use of prepositions & article while making sentences or writing successful paragraphs or essays in English.
CO2	identify and use grammatical properties of English like parts of speech, phrases, clauses, conditionals, linking words, gerund, infinitive and participle while reading texts or other materials in English.
CO3	apply variety of sentence structures like direct-indirect speech, active-passive voice, interrogative, negative statements etc. to ornament their writing style and speaking.
CO4	employ their grammatical knowledge to translate sentences from native language to targeted language or targeted language to native language.
CO5	apply knowledge of up-to-date academic and idiomatic vocabularies and phrases to meet the need of modern world.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1										√		
CO2										√		
CO3										√		
CO4										√		
CO5										√		

ENG101 English Reading and Composition
Prerequisite: ENG099
Credits: 03

Course Rationale: The course focuses on the improvement of English reading and composition skills of the students entering the University for studying through the medium of English. It will help the students to read and write using appropriate strategy and structure and with a good sense of purpose and audience in the academic context.

Course Description: The course is designed to improve English reading and composition skills to prepare the students entering the University for studying through the medium of English. Reading fluency and comprehension will be increased as they study and practice effective strategies of reading and read many interesting stories, articles, passages and texts written in English. Along with strengthening students' reading skills, this course will help them to enrich their vocabulary by reading a variety of adapted and authentic texts in group, pair and individual works. At the same time, grammatical items like subject verb agreement and tense will be highlighted sometimes by practical exercises. Similarly, to cope with academic environment students will be engaged in essential writing activities and tasks such as writing dialogues, paragraphs and opinions on different current issues. The learner will begin with writing simple, compound, and complex sentences. Then, they will use these kinds of sentences to write different kinds of paragraphs. Students will learn to recognize and use sentence patterns and to write coherent paragraphs containing a topic sentence, idea development, and a strong conclusion.

Suggested Textbook:

1. Engelhardt, D. (2013). Practice Makes Perfect Intermediate ESL Reading and Comprehension (1st ed.). McGraw-Hill.

Reference Book(s):

2. Creme, P. and M. Lea. (2008). Writing at University: A guide for students (3rd ed.). Open University Press.
3. Langan, J. (2005). English Skills (8th ed.). McGraw-Hill.

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

CO1	apply their knowledge about reading strategies and techniques like skimming, scanning, summarizing and predicting etc. while exploring a variety of materials in the English language.
CO2	apply their reading skill to read, create meaning, analyze, evaluate and give explanations to the reading materials.
CO3	apply their knowledge of writing coherent paragraphs containing a topic sentence, idea development, and a strong conclusion more effectively and accurately in general and academic contexts.
CO4	apply their knowledge of organizing, composing, editing, revising, and proofreading and a good sense of purpose and audience in their writing process.
CO5	recognize and correct basic grammatical errors, rewrite and complete sentences using their knowledge of grammar.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1										√		
CO2										√		
CO3										√		
CO4										√		
CO5										√		

ENG105 Advanced English Reading and Composition
Prerequisite: ENG101
Credits: 03

Course Rationale: In this modern age, studying is not confined to only textbooks and classrooms. The students need to explore the intellectual world through research work, surveys, experiments and so on that requires an advanced level of reading and writing skills. This course will help them to get prepared for that.

Course Description: This course is an advanced-level English course enables the students to meet their academic as well as professional needs by improving their reading and composition skills. Students will improve their reading skills by exploring a variety of genres in the English language and by developing abilities to read, to skim, to scan and analyze various longer passages, essays, fictions, non-fictions, and other authentic texts. This course is designed to help the students to apprehend the immediate surface meaning of texts through intensive reading, to read extensively to develop the skill of prediction, comprehension of main ideas, and the importance of inferencing while reading. The aim of the course is also improving students' writing abilities so that they can meet their academic needs. In addition to improving their organizing, composing, editing, revising, and proofreading skills, students will expand their vocabulary, and develop a sense of purpose and audience in writing. Students will be exposed to various modes of writing, particularly argumentation-persuasion, description, narration, compare - contrast, cause – effect etc. Emphasis will be given on the essay form and the qualities that make it successful.

Suggested Text(s):

1. Mikulecky, B. S. & Jeffries, L. (2007). Advanced Reading Power 4 (2nd ed). Pearson Education.
2. Mikulecky, B. S. & Jeffries, L. (2011). More Reading Power (3rd ed). Longman.
3. Taylor, G. (2009). A Student's Writing Guide (1st ed.). Cambridge University Press.

Reference Book(s):

1. Goatly, A. (2000). Critical Reading and Writing: An Introductory Coursebook (1st ed.). Routledge.
2. Imhoof, M. & Hudson, H. (1975). From Paragraph to Essay (1st ed.). Longman, London.

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

CO1	apply their knowledge about reading strategies and techniques while exploring a variety of genres in the English language like academic texts, E-books, newspaper articles/ research papers, fictions, non-fictions, and other authentic texts.
CO2	apply their knowledge of writing coherent essays containing thesis statement, specific evidence, organized and connected supporting ideas, and a strong conclusion along with introduction by following the writing process.
CO3	apply their knowledge of writing descriptive, narrative, cause and effect, persuasive, argumentative essays.
CO4	apply their knowledge of paraphrasing and summarizing materials from appropriate academic sources along with explaining various data and statistics.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1										√		
CO2										√		
CO3										√		
CO4										√		

ENG215 Professional English Communication
Prerequisite: ENG105
Credits: 03

Course Rationale: After any academic journey the professional phase begins where English language is dominant and this course facilitates a learning environment designed with practical communicative experiences needed in the workplace.

Course Description: The course aims to aid students in developing their English skills needed to communicate effectively with a wide variety of specialized and non-specialized audience in professional life. It aids them in acquiring basic communication strategies required for professional development and advancement. The key topics to be explored include professional standards, the role of the audience, barriers to effective communication, non-verbal communication, formal-informal communication, oral presentation, job interview and meeting; writing newspaper articles; official letters; memorandums and reports; and preparing tenders, office orders, job-specific CV, résumé and cover letters. This course is also intended to help students strengthen English communication skills by facilitating their improvement in listening and speaking. Students develop their listening and speaking skills to attend classes, seminars, official meetings and conferences effectively as well as speak clearly at workplace and make formal presentation and public speech.

Suggested Text(s):

1. Locker, K. O. (2006). Business and Administrative Communication (7th ed). McGraw- Hill.
2. Whalen, D. J. (2007). The Professional Communications Toolkit (2nd ed). SAGE Publications.

Reference Book(s):

1. Carlin, D & Payne, J. (1995). Public Speaking Today (2nd ed.) National Textbook Company.
2. Bonet, D. (2001). The Business of Listening: A Practical Guide to Effective Listening (3rd ed.). Crisp Learning.
3. Hood, J. H. (2013). How to Book of Writing Skills (2nd ed). Wordcraft Global Pty Ltd.

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

CO1	demonstrate well-developed skills in writing structurally effective, grammatically accurate and contextually appropriate business letters and official documents like memorandums, reports, tenders and office order.
CO2	demonstrate higher level listening and speaking skills to attend classes, seminars, official meetings and conferences effectively and express one's full personality and potential for advancement in professional settings.
CO3	deliver effective public speech and formal presentation (both individually prepared and collaborative; both/either in face-to-face classes or in online forums) using modern electronic devices.
CO4	apply communication strategies & non-verbal tools in communication process to give and receive clear messages and instructions in professional context.
CO5	identify their strength and weakness for current job market and prepare job-specific CV, résumé and cover letters.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1										√		
CO2									√	√		
CO3									√	√		
CO4									√	√		
CO5										√		

HIS105 Emergence of Bangladesh
Credits: 03

Course Rationale: The Independence of Bangladesh has a connection with the Proclamation of Independence of 1971 which is considered to be one of the bases of our national liberation and present legal system. This course discusses the background of the nationalistic struggle against British colonial rule in India, which then led to partition in 1947 give students the glimpse of idea behind the emergence of Bangladesh.

Course Description: The Background of the Language Movement (1948 and 1952), Role of Students, 21st February 1952, Election of 1954 and the United Front (Jukto Front), 21 Points Movement, Constitution of 1956, Martial Law in 1958, Movement against Military Rule, Presidential autocracy of Ayub Khan & the Constitution of 1962, Indian-Pakistan War in 1965, Discrimination Towards East Pakistan, Six Point Program of Awami League (1966)—Principal Features- Propagation of the Program throughout East Pakistan and the Role of Bangabandhu Sheikh Mujibur Rahman. Agartala Doctrine & the trial of Sheikh Mujibur Rahman (1968-'69), Mass upsurge of 1969 and 11 Point Movement of the students of 1969, Fall of Ayub Khan, Yahya Khan and the second phase of Army Rule; The rise of

Bangabandhu as a charismatic leader & the General Election of 1970; Aftermath of the Election: Non-cooperation Movement; Historic 7th March Speech of Bangabandhu at Race Course; Crackdown and Genocide of March 25 and the beginning of the Liberation War; Formation of the Mujibnagar Government, Freedom Fighters, War Strategy and War Sectors; Contributions of political Figures in Achieving Independence; Liberation War of Bangladesh; Killing of the Bengali intellectuals; The Birth of Independent Bangladesh; History of the Name of Bangladesh, National Flag, National Anthem, National Monuments.

Recommended Book(s):

1. Bangabandhu Sheikh Mujibur Rahman (2012), The Unfinished Memoirs. Dhaka: The University Press Limited.
2. Rounaq Jahan (1994), Pakistan: Failure in National Integration. Dhaka: The University Press Limited.

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

CO1	Identify the chronology of political & constitutional development of Bangladesh.
CO2	Understand the economic and political disparity between the two wings of Pakistan.
CO3	Describe the war strategies and emergence of Bangladesh.
CO4	Identify and explain the inevitability of the emergence of Bangladesh as a sovereign state.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3	√											
CO4	√											

INT401 Internship *(Minimum 8 weeks)*
Credit: 01

Course Rationale: An internship is a professional learning experience in a real office setting that offers meaningful, practical work related to a student's field of study or career interest.

Course Description: Students must take Internship as a partial fulfillment of the requirements of their degree of B. Sc. in EEE. They must complete this work within one semester under the supervision of a Faculty Member. The internship should be done in an organization that is approved by the supervisor. After completion of their work they must submit an Internship Report on their work and must present his report by appearing at an oral presentation and examination. The training work may include the study and/or design and implementation of a practical and/or real-life system or solving a problem in the field of electrical and electronic engineering.

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

CO1	Develop an idea to solve a real-world problem
CO2	Investigate similar problems to reach a feasible solution

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√										
CO2				√								

MAT099 Pre-Math
Credits: 00

Course Rationale: One need to understand the fundamental, basic concepts of math to survive in the world. For engineers, the significance of math is unimaginable. In this course, basic math will be taught how to use the numbers logically.

Course Description: Set and function, Polynomial and polynomial equations, Matrix and determinant, Fundamental concepts of trigonometry, Trigonometrical ratios of associated and compound angles, Circular function, inverse circular function, Properties of triangle, Coordinates, Straight line, Circle, Parabola, Ellipse, Function and limit, Differentiation, Integration

Recommended Book(s):
1. S.U. Ahmed and M.A. Jabbar (2019), HSC Higher Mathematics 1st & 2nd paper (6th Edition), Alpha Prokashani

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

CO1	Identify set, function and polynomial equations
CO2	Interpret matrix, determinants and trigonometric functions
CO3	Solve the 2-D geometric problems like straight line, circle, parabola and ellipse
CO4	Illustrate differentiation and integration

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3	√											
CO4	√											

MAT121 Pre-Calculus
Credits: 03

Course Rationale: Precalculus is originally intended for students who would progress to Calculus. A review of the mathematics curriculum at different trucks of students is conducted in order to upgrade the students in similar level of those particular courses.

Course Description: The real number system, Solving equations algebraically, The coordinate plane, lines; Solving equations graphically and numerically, Applications of equations, Linear models; Functions, graphs of functions, Common and natural logarithmic functions, Properties of logarithms, Algebraic solutions of exponential and logarithmic equations, Exponential, logarithmic, and other models, Cramer's rule, Angles and their measurement, The sine, cosine, and tangent functions, Inverse trigonometric functions, Trigonometric equations, Trigonometric functions of angles, Applications of right triangle trigonometry, The complex plane and polar form for complex numbers, circles and ellipses, Plane curves and parametric equations, Polar co-ordinates, Limits of functions, Properties of limits.

Recommended Book(s):
2. Thomas W. Hungerford & Douglas J. Shaw (2009), Contemporary Precalculus: A Graphing Approach (5th Edition), Brooks/Cole Publishing Co

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

CO1	Identify the real number system, coordinate plane, lines, functions and graphs of functions
CO2	Interpret the common and natural logarithmic functions and algebraic solutions of exponential and logarithmic equations
CO3	Solve the equations algebraically, graphically, numerically and by Cramer's rule
CO4	Illustrate the trigonometric and inverse trigonometric functions, circles, ellipses, parametric equations and polar coordinates, complex plane, polar form for complex numbers and limits of functions
CO5	Apply the algebraic equations in linear model and right triangle trigonometry in real life problems

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3	√											
CO4	√											
CO5	√											

MAT123 Calculus I
Prerequisites: MAT121
Credits: 03

Course Rationale: Calculus is one of the most important branches of mathematics for students to learn. This course aims to provide a bridge for the student from high-school or lower-division mathematics courses to upper-division mathematics. The student will be challenged to grow in mathematical maturity, and to develop and strengthen problem-solving skills.

Course Description: Limits, Computing limits, Limits at infinity, End behavior of a function, Continuity, Continuity of trigonometric, Exponential and inverse functions, Tangent lines and rates of change, The derivative function, Introduction to techniques of differentiation, The product and quotient rules, Derivatives of trigonometric functions, The chain rule, Implicit differentiation, Derivatives of logarithmic functions, Derivatives of exponential and inverse trigonometric functions, Related rates, Local linear approximation, Differentials, L'Hôpital's rule, Indeterminate forms, Analysis of functions I: Increase, decrease, and concavity; Analysis of functions II: Relative extrema; Graphing polynomials, Analysis of functions III: Rational functions, cusps, and vertical tangents, Absolute maxima and minima, Applied maximum and minimum problems, Rectilinear motion, Newton's method, Rolle's theorem; Mean-value theorem

Recommended Book(s):

1. Howard Anton, IRL Bivens and Stephen Davis (2012), Calculus (10^{th} Edition), Laurie Rosatone

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

CO1	Identify the type of a given function, approximate its limit both numerically and graphically as well as its various types of continuity at a given point
CO2	Interpret tangent lines, rate of change and the differentiability of functions using the concepts of limits and continuity and illustrate L'Hospital's rule to determine the limit of indeterminate forms
CO3	Demonstrate the ability to differentiate various types of functions comprising both the implicit and explicit type using different methods and apply differentiation to determine the rate of change and maxima and minima of functions.
CO4	Analyze rectilinear motion using the tools of calculus, discuss the procedures for graphing rational functions, cusps and vertical tangents and illustrate Newton's method to find the roots of equation

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3	√											
CO4	√											

MAT125 Calculus II
Prerequisites: MAT123
Credits: 03

Course Rationale: Completion of this course will yield students to be well-versed in research activities that utilize the understanding of integration.

Course Description: An overview of the area problem, The indefinite integral, integration by substitution, The definition of area as a limit; Sigma notation, The definite integral, The fundamental theorem of calculus, Rectilinear motion revisited using integration, Average value of a function and its applications, Evaluating definite integrals by substitution, Logarithmic and other functions defined by integrals; Area between two curves, Volumes by slicing, Disks and washers, Volumes by cylindrical shells, Length of a plane curve, Area of a surface of revolution, Work, moments, Centers of gravity, and centroids, Fluid pressure and force, Hyperbolic functions and hanging cables; An overview of integration methods, Integration by parts, Integrating trigonometric functions, Trigonometric substitution, Integrating rational functions by partial fractions, Using computer algebra systems and tables of integrals, Numerical integration, Simpson's rule, Improper integrals, Modeling with differential equations, Separation of variables, Slope fields; Euler's method, First-order differential equations and applications.

Recommended Book(s):

1. Howard Anton, IRL Bivens and Stephen Davis (2012), Calculus (10^{th} Edition), Laurie Rosatone

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

CO1	Identify the type of a given integral and evaluate the integrals associated with different types of functions either by using the integral table or substitution technique; interpret the geometric meaning of integral and apply this concept to solve geometric and physical problems.
CO2	Explain how to evaluate integrals to find the length of curves, the area between curves, the area of surfaces of revolution, volumes by slicing disks and washers, volumes by cylindrical shells
CO3	Demonstrate the ability to evaluate the definite integrals of trigonometric, logarithmic and exponential functions, improper integrals, Simpson's rule and rational functions by partial fractions
CO4	Classify and solve various types of first order differential equations and apply it in mathematical model

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3	√											
CO4	√											

MAT227 Calculus III
Prerequisites: MAT125
Credits: 03

Course Rationale: Calculus is the mathematical 'backbone' for dealing with problems where variables change with time or some other reference variable. A basic understanding of calculus is essential for further study and the development of confidence in solving practical engineering problems. It is concerned with two basic operations, differentiation and integration, and is a tool used by engineers to determine such quantities as rates of change and areas.

Course Description: Sequences, Monotone sequences, Infinite series, Convergence tests, The comparison, Ratio, and root tests, Alternating series, Absolute and conditional convergence, Maclaurin and Taylor polynomials, Maclaurin and Taylor series; Power series, Convergence of Taylor series, Differentiating and integrating power series; Modeling with Taylor series, Parametric equations, Tangent lines and arc length for parametric curves, Polar coordinates, Tangent lines, arc length, and area for polar curves, Conic sections, Rotation of axes, Second-degree equations, Conic sections in polar coordinates, Rectangular coordinates in 3-Space, Spheres, Cylindrical surfaces, Vectors, Dot product, projections, Cross product, Parametric equations of lines, planes in 3-Space, Quadric surfaces, Cylindrical and spherical coordinates, Introduction to vector-valued functions, Calculus of vector-valued functions, Change of parameter, Arc length, Unit tangent, Normal, and Binormal vectors, Curvature, Motion along a curve, Kepler's laws of planetary motion.

Recommended Book(s):

1. Howard Anton, IRL Bivens and Stephen Davis (2012), Calculus (10th Edition), Laurie Rosatone

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

CO1	Describe the ideas concerning sequence, monotone sequences of numbers; define the sum of infinite series and determining whether the series converges or diverges;
CO2	Explain the accuracy of local linear approximations by using higher-order polynomials as approximating functions by Taylor's and Maclaurins polynomials
CO3	Demonstrate the ability to find slopes, tangent lines, arc lengths of parametric curves and analyze second degree equations to simplify conic sections; illustrate cylindrical and spherical coordinates to study the rotational motion about an axis to derive three basic laws of planetary motion, known as Kepler's law
CO4	Analyze basic operations of vectors; use vectors to derive equations of planes in 3-space and then use these equations to solve various geometric problems; illustrate parametric curves, arc length and vector valued functions

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3	√											
CO4	√											

MAT229 Calculus IV
Prerequisites: MAT227
Credits: 03

Course Rationale: Calculus is the mathematical 'backbone' for dealing with problems where variables change with time or some other reference variable. A basic understanding of calculus is essential for further study and the development of confidence in solving practical engineering problems. It is concerned with two basic operations, differentiation and integration, and is a tool used by engineers to determine such quantities as rates of change and areas.

Course Description: Functions of two or more variables, Limits and continuity, Partial derivatives, Differentiability, Differentials, and local linearity, The chain rule, Directional derivatives and gradients, Tangent planes and normal vectors, Maxima and minima of functions of two variables, Lagrange multipliers; Double integrals, Double integrals over nonrectangular regions, Double integrals in polar coordinates, Surface area; Parametric surfaces, Triple integrals, Triple integrals in cylindrical and spherical coordinates, Change of variables in multiple integrals, Jacobians, Centers of gravity using multiple integrals, Vector fields, Line integrals, Independence of path, Conservative vector fields, Green's theorem, Surface integrals, Applications of surface integrals, Flux, The divergence theorem, Stokes' theorem.

Recommended Book(s):

1. Howard Anton, IRL Bivens and Stephen Davis (2012), Calculus (10^{th} Edition), Laurie Rosatone

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

CO1	Compute Differentiability, Differentials and local linearity.
CO2	Illustrate directional derivatives and gradients, tangent planes and normal vectors.
CO3	Compute double and triple integrals with application.
CO4	Apply Green's Theorem, Stoke's Theorem to find line integrals along simple closed contours on the plane & the boundary of a surface.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3	√											
CO4	√											

MAT331 Engineering Mathematics
Prerequisites: MAT229
Credits: 03

Course Rationale: Completion of this course will yield students to be well-versed in Machine Learning or Artificial Intelligence based research activities that utilize the understanding of the knowledge of engineering mathematics.

Course Description: Complex numbers and their geometric representation, Polar form of complex numbers, Powers and roots, Derivative, Analytic function, Cauchy–Riemann equations. Laplace's equation, Exponential function, Trigonometric and hyperbolic functions. Euler's formula, Logarithm, Basic concepts of Modeling, Euler's method, Separable ODEs, modeling, Exact ODEs, Integrating factors, Linear ODEs, Bernoulli's equation, Population dynamics, Orthogonal trajectories, Existence and uniqueness of solutions for initial value problems, Homogeneous linear ODEs of second order, Homogeneous linear ODEs with constant coefficients, Differential operators, Euler–Cauchy equations, Existence and uniqueness of solutions. Wronskian, Modeling: Electric circuits, Solution by variation of parameters, Homogeneous linear ODEs, Homogeneous linear ODEs with constant coefficients, Nonhomogeneous linear ODEs, Basic concepts of PDEs, Laplace transform, Linearity, First shifting theorem (s-shifting), Transforms of derivatives and integrals, Unit step function (Heaviside function). Second shifting theorem (t-shifting), Impulse and Dirac's Delta Function, Partial Fractions, Convolution theorem, Differentiation and Integration of Transforms, ODEs with Variable Coefficients, Laplace Transform with General Formulas, Table of Laplace Transforms,

Recommended Book(s):

1. Erwin Kreyszig (2011), Advanced Engineering Mathematics(10^{th} Edition), Laurie Rosatone

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

CO1	Identify Complex numbers and their geometric representation, linear, Non-linear, order and degree & ordinary and partial differential equations.
CO2	Illustrate general solution of a first order, linear, exact and non-exact, constant coefficient, homogeneous and initial value problems of differential equations.
CO3	Interpret undetermined coefficients, variation of parameters to solve second order differential equations.
CO4	Compute Laplace transforms of several types of differential equations.
CO5	Comprehend the physical interpretation of shifting theorem.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3	√											
CO4	√											
CO5	√											

MAT333 Linear Algebra
Prerequisites: MAT125
Credits: 03

Course Rationale: Linear algebra facilitates the solution of many engineering problems. Techniques in linear algebra are used to represent and also solve real problems in various fields. This course introduces such techniques and solutions that can solve real problems using a mathematical approach.

Course Description: Matrix operations, Algebraic properties of matrices, Transpose, Inverse, System of linear equations, Elementary matrices and a method for finding A^{-1}, More on linear systems and invertible matrices, Diagonal, triangular, and symmetric matrices, Applications of Linear systems, Network analysis (traffic flow), Electrical circuits; Determinants, Determinants by cofactor, Expansion, Evaluating determinants by row reduction, Properties of determinants, Cramer's rule, General vector spaces, real vector spaces, subspaces, Linear dependence and independence, Basis and dimension, Change of basis, Row space, column space, and null space, Rank, nullity, and the fundamental matrix spaces, Eigenvalues and eigenvectors, Diagonalization, Complex vector spaces, Application to differential equations, Inner product spaces, Angle and orthogonality in inner product spaces, Gram–Schmidt process, General linear transformations, Applications of linear algebra: The earliest applications of linear algebra, Graph theory, Games of strategy, Leontief economic models, Forest management, Computer graphics, Computed tomography, cryptography, genetics, age-specific population growth, Harvesting of animal populations, A Least squares model for human hearing, Internet search engines.

Recommended Book(s):

1. Howard Anton & Chris Rorres (2014), Elementary Linear Algebra (11th Edition), Laurie Rosatone

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

CO1	Identify transpose, adjoint, diagonal, triangular, symmetric and invertible matrices
CO2	Solve the system of equations by inverse matrix and Gausiian elimination & apply those in network analysis, traffic flow and other real problems
CO3	Interpret determinant, vector space and subspaces, linear dependence and independence, basis and dimension, eigenvalues and eigenvectors and diagonalization of matrices
CO4	Illustrate linear transformation, rank nullity, inner product space, Gram-Schimdt orthogonalization process
CO5	Apply linear algebra in graph theory, games of strategy, Leontief economic models, forest management and other branches of sciences, engineering, and economics

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2		√										
CO3	√											
CO4	√											
CO5		√										

MAT335 Probability & Statistics
Prerequisites: MAT227
Credits: 03

Course Rationale: Completion of this course will yield students to be well-versed in industrial as well as Machine Learning based research activities that utilize the understanding of basic statistics, and probabilistic algorithms.

Course Description: Basic Statistics, Measures of central tendency, Measures of Variation, Skewness, Moment and kurtosis, Correlation, Introduction to Linear Regression, The Simple Linear Regression Model, Least Squares and the Fitted Model, Sample Space, Events, Probability of an event, Additive rules, Conditional probability, Independence and the product rule, Bayes rule, Concept of a Random Variable, Discrete Probability Distributions, Continuous Probability Distributions, Joint Probability Distributions, Mean of a Random Variable, Variance and Covariance of Random Variables, Binomial and Multinomial Distributions, Negative Binomial and Geometric Distributions, Poisson Distribution and the Poisson Process, Normal Distribution, Areas under the Normal Curve, Applications of the Normal Distribution, Normal Approximation to the Binomial, Gamma and Exponential Distributions, Chi-Squared Distribution, Beta Distribution, Sampling Distributions, t-Distribution, F-Distribution.

Recommended Book(s):

1. Ronald E. Walpole, Raymond H Myers, Sharon L Myers and Keying Ye (2012), Probability & Statistics for Engineers and Scientists (9th Edition), Prentice Hall

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

CO1	Comprehend descriptive statistics.
CO2	Analyse basic charts and graphs.
CO3	Comprehend statistics including probability, and also analyze hypothesis tests.
CO4	Apply computer technology to compute descriptive and inferential statistics

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3	√											
CO4	√											

PHI301 Engineering Ethics
Credits: 03

Course Rationale: Engineering ethics is an essential course for engineers to know what is ethically permissible and what is not ethically permissible as far as engineering is concerned. This course would enable a student to aspire ethics in all the aspects of life.

Course Description: The focus of the course is on developing moral reasoning and increasing ethical awareness within the engineering profession by introducing students to critical issues in engineering ethics. Students will analyze case studies that include both historic cases and new cases focused on emerging technologies in several engineering disciplines. They will use a framework for analyzing ethical dilemmas which are particular to engineering. Developing moral reasoning skills is essential for future engineers, and is gaining greater visibility as industries, professional organizations, and funding agencies begin to recognize their value to engineering professionalism.

Recommended Book(s):

1. Mike W. Martin, Roland Schinzinger (2004), Ethics in Engineering (4th Edition), McGraw-Hill
2. Charles E. Harris, Michael S. Pritchard, Michael J. Rabins (1999), Engineering Ethics: Concepts and Cases (2nd Edition). Wadsworth Publishing.
3. Deborah G. Johnson (1990), Ethical Issues in Engineering (1st Edition). Prentice Hall.

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

CO1	Develop concepts about professional ethics, various moral & social issues, and industrial standards, code of ethics and role of professional ethics in engineering field
CO2	Explain the ethical issues related to information technology, their causes, and those moral rules which may have been compromised in a particular context
CO3	Analyze the capabilities of surveillance technologies as they impact privacy, the scope of intellectual property issues and the available protection measures
CO4	Identify the actions that should be taken upon discovery of a security intrusion

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						√						
CO2								√				
CO3								√				
CO4						√						

PHY107 General Physics I
Credits: 03

Course Rationale: This course covers understanding the basic principles of kinematics, dynamics, heat & thermodynamics, wave & oscillation, and physical optics.

Course Description: Heat and Thermodynamics: Heat and Temperature, Zeroth law of thermodynamics, Thermometers, Thermocouple, First law of thermodynamics and its application, molar specific heat of gases, Isothermal and adiabatic process, work done by a gas, Heat transfer mechanism, Kinetic theory of gases: Avogadro's number, ideal gas law, explanation of gas laws, kinetic interpretation of temperature, Equipartition of energy, mean free path, Vander Walls equation of state, Entropy and Second law of thermodynamics: reversible and irreversible processes, Carnot cycle, Carnot's theorem, efficiency and entropy.
Mechanics: Newton’s law, Motion along a straight line, Motion in two and three dimension, Force, Kinetic energy and Potential energy, Conservation of energy, linear momentum, torque and angular momentum, Young’s modulus, Gravitation, Bernoulli's equation, Pascal's principle, Archimedes principle.
Physical Optics, Waves and oscillations: Theories of light: Light as a wave, Law of Refraction, Huygens's principle and construction, Polarization, Interference of light: Young's double slit experiment, Coherent and Incoherent source, Intensity in double slit interference, Interference from thin films, The Michelson Interferometer, Diffraction of light: Fresnel and Fraunhoffer diffraction, Single slit diffraction, Double slit diffraction, diffraction grating, X-ray diffraction. Simple Harmonic Motion: Force law and Energy for Simple Harmonic Motion, An angular Simple Harmonic Oscillator, Uniform circular motion, Damped

Harmonic Motion, Wave -I: Transverse and Longitudinal waves, Sinusoidal Waves, Equation of a traveling wave, Superposition and interference of waves, Standing and Progressive waves, Resonance, Wave-II: Sound Waves, Beats, Phase velocity, Group Velocity, The Doppler Effect.

Recommended Book(s):

1. David Halliday, Robert Resnick, Jearl Walker (2013), Fundamentals of Physics (10th Edition), Wiley

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

CO1	Apply the first and second laws of thermodynamics to various gas processes and cycles
CO2	Comprehend the definitions of kinematics
CO3	Illustrate physical characteristics of SHM and obtaining solution of the oscillator using differential equations, as well as distinguish with damped harmonic motion
CO4	Solve wave equations for different modes of waves and clarify the significance of these waves.
CO5	Explain sound waves and Doppler effect

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√										
CO2		√										
CO3		√										
CO4		√										
CO5		√										
CO6		√										

PHY108 General Physics I Laboratory
Co-requisite: PHY107
Credits: 01

Course Rationale: The course is designed to understand the use of mechanistic and mathematical models to describe physical phenomena related to mechanics, thermodynamics, waves, and fluids. The course will ensure students' involvement in instrumentation and experimental techniques, methods for quantitative data analysis, and measurement uncertainty.

Course Description: Experiments based on PHY107.

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

CO1	Perform experiment
CO2	Analyse the results found in the experiment
CO3	Comprehend the error calculation

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√										
CO2		√										
CO3		√										

PHY109 General Physics II
Prerequisite: PHY107
Credits: 03

Course Rationale: The goal of the course is to develop an understanding of the fundamental laws of physics, electricity, and magnetism, the underlying structure of matter, and an introduction to contemporary physics.

Course Description: Electricity and Magnetism: Electric charge, Coulomb's law, Electric field(E), Electric field due to a point charge and dipole, Electric flux, Gauss's law and its application, Electric potential(V), Relation between E & V, Capacitor & Capacitance, Dielectric and its atomic view, Current, Current density, Resistance and Resistivity, Atomic view, Ohm's law, Single Loop Circuit, Multi-loop Circuit, Magnetic Fields: Magnetic field, The Hall Effect, A charged particle circulating in a magnetic field, Magnetic force on a current carrying wire, Torque on a current carrying coil, Orientational energy of a magnetic dipole, Boit-Savart law, Ampere's law, Induction and Inductance: Electromagnetic induction, Magnetic flux, Faraday's law, Lenz's law, Self Induction, Mutual Induction, Maxwell's equations, Magnetic properties of matter, Classification of magnetic materials and their properties, Magnetization curves, Electromagnetic wave. Structure of Matter: Solid, liquid and gases, Classification of solids: Crystalline, amorphous, ceramics and polymers, Crystal structure: Periodic array of atoms, Lattice translation vectors, Primitive lattice Cell, Simple cubic lattice, BCC lattice, FCC lattice, Packing fraction, Wave diffraction and the reciprocal lattice: X-ray diffraction, Bragg's law, reciprocal lattice, Brillouin zones, Effect of temperature on the Fermi Dirac distribution, Plasticity and elasticity, Distinction between metal, insulator and semiconductor. Modern Physics: Michelson Morley's experiment, Galilean transformation, Lorentz-transformation, relative velocity, Special theory of relativity, Postulates & application, Length contraction and time dilation, Mass-energy relation, Photoelectric effect, Compton Effect, De-Broglie wave, Black body radiation, Heisenberg's Uncertainty principle, Matter waves, Electron in an infinite potential well, Quantum Tunneling, Atom models, Radioactivity, Half time , Mean life time, Isotopes, Isotones, Isobar, Isomers, Constituent of nucleus, Nuclear mass defect and binding energy, Various decay modes, Nuclear fission and fusion, Chain reaction.

Recommended Book(s):

1. David Halliday, Robert Resnick, Jearl Walker (2013), Fundamentals of Physics (10th Edition), Wiley
2. Charle Kittel (2004), Introduction to Solid State Physics (8^{th} Edition), John Wiley and Sons
3. Arthure Beisure (1969), Perspective of Modern Physics (1st Edition), McGraw Hill

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

CO1	Describe electrical quantities such as electric charge, electric field, electric flux and the electric potential of distributions of electric charge and different combinations of electric charges using Coulomb's law and Gauss' law.
CO2	Comprehend the magnetic field due to currents in wires, coils, solenoids using Biot-Savart law and Ampere's law.
CO3	Apply Faraday's law of induction and Lenz's law to analyze induced emf and current as well as the phenomenon of self-induction and mutual induction.
CO4	Discuss the basics of the crystal structure.
CO5	Identify the basic concepts of relativity and distinguish between particle properties of waves and wave properties of particles.
CO6	Explain atomic structure and nuclear structure to show nuclear fission and fusion.

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3	√											
CO4		√										
CO5		√										
CO6		√										

PHY110: General Physics II Laboratory
Co-requisite: PHY110
Credits: 01

Course Rationale: The course is intended for the basic understanding of Electricity and Magnetism from experiments. Besides learning measurement techniques, the student will be trained on raw data collection and analysis. The laboratory experiments performed in this course complement the material in General Physics II.

Course Description: Experiments based on PHY110

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

CO1	Perform experiment
CO2	Analyse the results found in the experiment
CO3	Comprehend the error calculation

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√										
CO2		√										
CO3		√										

PME403 Project Management and Entrepreneurship

Credits: 03

Course Rationale: Entrepreneurship is the art of starting a business from scratch. Project Management is the practice that enables businesses to manage their projects in order to achieve their goal. This course aims to teach students about the challenges of entrepreneurship and what can be done in order to be a successful entrepreneur. The course also outlines practices of successful Project Management.

Course Description: Introduction to the conceptual and practical considerations in identifying and developing new products. The theory and practice of project management applied to the creation of new business activities and ventures will be discussed. Topics include project management, innovation and entrepreneurship, business planning, marketing, and mobilizing human and financial resources. These will be applied in the development of a business plan for a business concept. The course includes a number of guest speakers who are leading IT specialists in the country.

Recommended Book(s):

1. Heidi M. Neck, Christopher P. Neck, Emma L. Murray (2020), Entrepreneurship: The Practice and Mindset (2nd Edition), SAGE Publications.

2. Kathy Schwalbe (2021), An Introduction to Project Management: Predictive, Agile, and Hybrid Approaches. (7th Edition), Independent publishing.

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

CO1	Describe a project life cycle and develop a project scope based on requirement(s)
CO2	Design and schedule work plan, and perform estimation while considering factors such as customer requirements and internal/external goals
CO3	Describe the personal attributes and skills, critical risk and success factors that characterize a successful entrepreneur.
CO4	Evaluate new ideas and business start-ups including forms of ownership assessing societal, health, safety, legal and cultural issues
CO5	Explain issues relevant to entrepreneurs such as "green" business practices, environmental sustainability, social entrepreneurship, and intellectual property through individual and team effort

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1											√	
CO2			√									
CO3	√											
CO4		√										
CO5	√											

SOC103 Sociology
Credits: 03

Course Rationale: Studying sociology provides a better understanding of social differences, including differences in social behavior. This course will increase the ability of students to not only better understand the world around them, but also helps to better understand the lives surrounding the technology.

Course Description: Provides students with an understanding of the primary phenomena, concepts, issues and practices associated with sociology. Topics include Scope, Nature, Methods and relation with other branches of Social Science; Stages of Social development (primitive, slavery, feudalism, Capitalism and Socialism); Culture and civilization; Social structure of Bangladesh. Population and world resources. Occidental societies, Industrial revolution. Family - Urbanization and industrialization, Urban Ecology, Cooperative and socialist movements, Rural sociology.

Recommended Book(s):
1. Anthony Giddens (2009), Sociology (6th Edition). Policy Press.

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

CO1	Demonstrate an understanding of the impact of organizations and institutions on the economic environment
CO2	Prepare managerial accounting statements and Design an activity based costing system
CO3	Identify Legal issues concerning financial situations
CO4	Demonstrate decision economic making ability based on trade-off

Mapping of CO vs. PO:

CO(s)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						√						
CO2											√	
CO3											√	
CO4						√						