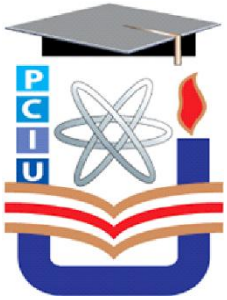
Department of Computer Science & Engineering

Faculty of Science and Engineering



OBE Curriculum
for
B. Sc. in Computer Science and Engineering (CSE)

Version – 3

Port City International University
7-14, Nikunja Housing Society, South Khulshi, Chattogram

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Part A

1. Title of the academic program
Bachelor of Science in Computer Science & Engineering

2. Name of the university
Port City International University

3. Vision of the university
To make Port City International University a leading global university where the students, faculty, and staff will be able to contribute to the development process and will be benefited from the advancement in higher learning and research.

4. Mission of the university
The missions of the university are to provide:

M1	Transformative education that will inspire and nurture creative individuals who are ready to grab opportunities to make a difference.
M2	Advanced research that will enhance the boundary of knowledge and change the quality of life.
M3	Dedicated service as a leading university that will contribute to social, economic and national development.

5. Name of the program offering entity (department/faculty/institute)
Department of Computer Science & Engineering

6. Vision of the program offering entity
The vision of the Computer Science and Engineering Department is to provide its students with the knowledge and skills to solve a variety of Computer Science problems as well as advanced engineering research.

7. Mission of the program offering entity
The missions of the Department of Computer Science & Engineering are:

M1	To provide fundamental software skills and professional IT values.
M2	To equip the graduate to develop software-based solutions to problems in a variety of contexts.
M3	To have curricula those conform to the highest international standards.
M4	To give a grounding in all the core areas of computer science.
M5	To emphasis on the most state-of-the-art ways of software engineering to be used in the IT industry.

8. Objectives of the program offering entity
The objectives of the program offering entity are to:

- Facilitate students to be the best computer engineers and contribute to the development of the nation as well as the whole world with their creativities.
- Prepare students to be well-qualified for academia and the industry.
- Apply engineering principles across a wide range of disciplines.
- Help students build a career easily in a competitive world.

- Help students academically with different activities such as seminars, workshops, programming contests, and training on different related topics.

9. Name of the degree
Bachelor of Science

10. Description of the program
The Department of CSE, PCIU offers an up-to-date and comprehensive streamlined curriculum at the undergraduate level which needs 153 credit hours including 3 credit hours in thesis and project work to be completed for achieving bachelor's degree. The curriculum is designed in such a way that during the first two years, students take compulsory courses in the core areas of computer science and engineering as well as in mathematics and other engineering disciplines. In the third and fourth years, the students concentrate on a number of advanced courses in computer science and engineering providing deeper and applied knowledge and greater ability to take part in the development of different computer system hardware and software.

The offered courses span the various branches of Computer Science and Engineering that include Electronics, Digital Logic Design, Algorithm, Compiler Design, Software Engineering, Computer Networks, Artificial Intelligence, etc. Students are also taught a few courses of basic electrical engineering to groom them in basic engineering. Moreover, some courses on basic sciences, e. g. Physics, Chemistry, Mathematics, and courses on Economics, Bangladesh Studies, English, etc. are also needed to be completed which are offered by the Department of Natural Science, English, and BBA of PCIU.

11. Graduate attributes (based on need assessment)
The following are the graduate attributes of the department of Computer Science and Engineering.

GA1	**Scholar**: Our graduates are expected to be scholars who have a broad knowledge-based realization and corrective expertise.
GA2	**Innovators**: Long-term solutions to every problem will be the main focus of our graduates. They will be analytical, systematic, creative, progressive, and will have the capacity to create feasible and sustainable solutions with critical judgments for real-world problems.
GA3	**Rational**: Our graduates will be better problem solvers with the aid of adequate knowledge-based learning methods and experiencing different problem domains.
GA4	**Professional in computer science:** Our graduates will have the ability to apply the knowledge of mathematics, science, and computer science & engineering to the solution of complex engineering problems with professionalism.
GA5	**Leaders**: They will become better leader who has the capacity to progress in human civilization. They will earn respect through their rightful actions and mass following without any dictatorship. They will take responsibility and seek opportunities to achieve in all spheres of their lives. They are self-confident, inspiring, and leading.
GA6	**Global Citizens**: Our graduates will be able to be a better citizen globally. They will be able to fulfill all the requirements such as morality, sensitivity, and fluency across cultures to be a better human being for the whole global society.

12. Program educational objectives (PEOs)
PEO1: Prepare graduates to have knowledge and competency for careers in Computer Science & Engineering and related domains.
PEO2: Prepare graduates to become leaders in fields related to Computer Science and Information Technology.
PEO3: Prepare graduates to pursue higher education in Engineering or other Professional fields.

13. Mapping Graduate Attributes with PEOs

PEO/GA	GA1	GA2	GA3	GA4	GA5	GA6
PEO1	Yes	Yes	Yes	Yes	No	No
PEO2	No	No	No	No	Yes	Yes
PEO3	Yes	No	No	No	No	No

14. Program learning outcomes (PLOs)

Followings are the PLOs for the department of Computer Science & Engineering, PCIU:

PLO1	Ability to apply knowledge of mathematics, science, and computer science & engineering to the solution of complex engineering problems.
PLO2	Ability to conduct experiments and researches, perform analysis and interpret data for complex engineering problems.
PLO3	Ability to identify, formulate, investigate and synthesis of information to solve complex engineering problems.
PLO4	Ability to use appropriate techniques, skills, and modern engineering tools, instrumentation, software and hardware necessary for complex engineering practice with an understanding of their limitations.
PLO5	Ability to design solutions for complex systems, components, or processes within a defined specification that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
PLO6	Ability to articulate ideas, communicate effectively, in writing and verbally, on complex engineering activities with the engineering community and with society at large.
PLO7	Ability to function effectively as an individual, and as a member or leader in diverse teams.
PLO8	Ability to recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PLO9	Ability to analyze the impact of global and contemporary issues, the role of engineers on society, including, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering.
PLO10	Ability to understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.
PLO11	Ability to execute responsibility professionally and ethically.
PLO12	Ability to demonstrate knowledge and understanding of engineering and management principles to manage projects in multidisciplinary environments.

15. Mapping Graduate Attributes with PLOs

PLO/GA	GA1	GA2	GA3	GA4	GA5	GA6
PLO1	No	No	No	Yes	No	No
PLO2	No	No	No	Yes	No	No
PLO3	Yes	No	No	No	No	Yes
PLO4	Yes	No	No	No	No	No
PLO5	No	No	Yes	No	No	No
PLO6	No	No	No	Yes	No	No

PLO7	No	No	No	No	Yes	No
PLO8	No	Yes	No	No	No	No
PLO9	No	No	No	No	No	Yes
PLO10	No	Yes	No	No	No	No
PLO11	No	No	Yes	No	Yes	No
PLO12	Yes	No	No	No	No	No

16. Mapping mission of the university with PEOs

PEO No.	M1	M2	M3
PEO1	Yes	Yes	No
PEO2	Yes	No	No
PEO3	No	No	Yes

17. Mapping PLOs with the PEOs

PLO/PEO	PEO1	PEO2	PEO3
PLO1	Yes	No	Yes
PLO2	Yes	No	Yes
PLO3	No	No	Yes
PLO4	No	Yes	Yes
PLO5	No	Yes	Yes
PLO6	No	Yes	No
PLO7	No	Yes	No
PLO8	No	Yes	Yes
PLO9	No	Yes	No
PLO10	No	Yes	No
PLO11	No	Yes	No
PLO12	No	Yes	Yes

18. Mapping courses with the PLOs

SL.	Course Code	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
1	PHY 111	√		√		√							
2	PHY 112		√	√	√								
3	CHEM 111	√											
4	HUM 100								√	√		√	
5	HIST 101								√	√		√	
6	HUM 103								√	√			
7	SOC 104								√	√			
8	ACT 110									√		√	
9	ECO 213									√		√	
10	MGT 215							√		√		√	
11	BIO 218	√									√		
12	MKT 324							√		√		√	
13	MIS 435	√								√		√	
14	ENG 101						√						
15	ENG 106						√						
16	MATH 115	√											
17	MATH 125	√											
18	MATH 135	√		√									
19	MATH 215	√											
20	STAT 235	√											
21	MATH 315	√											
22	NATH 325	√											
23	MATH 335	√	√			√							
24	MATH 415	√											
25	CSE 111	√		√									
26	CSE 112		√		√								
27	CSE 121	√		√		√							
28	CSE 122		√		√								
29	CSE 211	√		√		√							
30	CSE 212		√		√					√			
31	CSE 217	√		√		√							

32	**CSE 218**			√	√	√							
33	**CSE 221**	√				√							
34	**CSE 222**		√	√		√				√			
35	**CSE 227**	√		√		√	√						
36	**CSE 228**		√		√								
37	**CSE 231**		√	√		√							
38	**CSE 232**		√		√								
39	**CSE 317**			√									
40	**CSE 321**	√					√					√	
41	**CSE 322**			√		√						√	
42	**CSE 331**		√	√		√							
43	**CSE 332**		√	√		√							
44	**CSE 341**	√				√							
45	**CSE 342**		√		√	√							
46	**CSE 434**			√	√								
47	**CSE 411**	√		√		√							
48	**CSE 412**		√		√								
49	**CSE 421**	√	√	√									
50	**CSE 422**		√	√		√							
51	**CSE 423**		√	√		√							
52	**CSE 424**		√	√	√								
53	**CSE 447**	√		√		√							
54	**CSE 448**			√	√								
55	**CSE 453**		√	√		√							
56	**CSE 454**		√	√			√						
57	**CSE 113**	√		√									
58	**CSE 114**		√		√								
59	**CSE 123**	√		√		√							
60	**CSE 124**		√		√								
61	**CSE 213**	√		√		√							
62	**CSE 214**		√	√									
63	**CSE 233**	√	√	√									
64	**CSE 234**		√		√								
65	**CSE 323**	√		√		√							

66	**CSE 324**		√	√	√								
67	**CSE 333**			√		√							
68	**CSE 334**			√		√							
69	**CSE 413**	√				√							
70	**CSE 414**		√	√									
71	**CSE 315**			√	√	√							
72	**CSE 427**	√	√	√									
73	**CSE 435**	√		√							√		
74	**CSE 441**	√		√									
75	**CSE 443**		√	√									
76	**CSE 449**	√		√									
77	**CSE 400**	√	√	√	√	√	√	√	√	√	√	√	√

Part B

19. Structure of the Curriculum

a) Duration of the program:	12 trimesters (4 years)
b) Admission Requirements:	● Minimum GPA 2.50 in both S.S.C and H.S.C with a science background or equivalent. ● Minimum 5 subjects in O-Level and 2 subjects in A-Level with a minimum grade of B in 4 subjects and C in 3 subjects from science group.
c) Total minimum credit requirement to complete the program:	156 (153+3) Credits
d) Total class weeks in a Year/trimester:	12 class weeks per trimester
e) Minimum CGPA requirements for graduation:	2.50
f) Maximum academic years of completion:	6 years (Regular 4 years with extra 2 years)
g) Category of Courses:	i. General Education Courses ii. Core courses iii. Thesis/Project

20. Term-wise distribution of courses

LEVEL-1/TERM-1

SL. No	Course Code	Course	PoE	Credits	Marks		
					CIE	SEE	Total
1	HIST 101	History of the Emergence of Independent Bangladesh (OPTION I)	CSE	3	30	70	100
2	ENG 101	Composition	CSE	3	30	70	100
3	CSE 111	Computer Fundamental and Programming Techniques	CSE	3	30	70	100
4	CSE 112	Computer Fundamental and Programming Techniques Sessional	CSE	1.5	30	70	100
5	PHY 111	Physics	CSE	3	30	70	100
6	PHY 112	Physics Sessional	CSE	1.5	30	70	100
Total				**15.00**	**180**	**420**	**600**

LEVEL-1/TERM-2

SL. No	Course Code	Course	PoE	Credits	Marks		
					CIE	SEE	Total
1	CSE 113	Electrical Engineering	CSE	3	30	70	100
2	CSE 114	Electrical Engineering Sessional	CSE	1.5	30	70	100
3	CSE 121	Structured Programming Language	CSE	3	30	70	100
4	CSE 122	Structured Programming Language Sessional	CSE	1.5	30	70	100
5	HUM 100	Bangladesh Studies (OPTION I)	CSE	3	30	70	100
6	MATH 115	Differential Calculus & Coordinate Geometry	CSE	3	30	70	100
Total				**15.00**	**180**	**420**	**600**

LEVEL-1/TERM-3

SL. No	Course Code	Course	PoE	Credits	Marks		
					CIE	SEE	Total
1	CSE 123	Electronics	CSE	3	30	70	100
2	CSE 124	Electronics Sessional	CSE	1.5	30	70	100
3	CSE 211	Object Oriented Programming	CSE	3	30	70	100
4	CSE 212	Object Oriented Programming Sessional	CSE	1.5	30	70	100
5	MATH 135	Discrete Mathematics	CSE	3	30	70	100
6	MATH 125	Integral Calculus & Vector Analysis	CSE	3	30	70	100
Total				**15.00**	**180**	**420**	**600**

LEVEL-2/TERM-1

SL. No	Course Code	Course	PoE	Credits	Marks		
					CIE	SEE	Total
1	CHEM 111	Chemistry	CSE	3	30	70	100
2	CSE 213	Digital Logic Design	CSE	3	30	70	100
3	CSE 214	Digital Logic Design Sessional	CSE	1.5	30	70	100
4	MATH 315	Complex Variables & Laplace Transformation	CSE	3	30	70	100
5	CSE 217	Data Structure	CSE	3	30	70	100
6	CSE 218	Data Structure Sessional	CSE	1.5	30	70	100
Total				**15.00**	**180**	**420**	**600**

LEVEL-2/TERM-2

SL. No	Course Code	Course	PoE	Credits	Marks		
					CIE	SEE	Total
1	ECO 213	Economics (OPTION I)	CSE	3	30	70	100
2	CSE 233	Computer Organization & Architecture	CSE	3	30	70	100
3	MATH 215	Linear Algebra	CSE	3	30	70	100
4	MATH 325	Differential Equation and Fourier Analysis	CSE	3	30	70	100
Total				**12.00**	**120**	**280**	**400**

LEVEL-2/TERM-3

SL. No	Course Code	Course	PoE	Credits	Marks		
					CIE	SEE	Total
1	STAT 235	Statistics	CSE	3	30	70	100
2	CSE 227	Algorithms	CSE	3	30	70	100
3	CSE 228	Algorithms Sessional	CSE	1.5	30	70	100
4	CSE 231	Operating Systems Concepts	CSE	3	30	70	100
5	CSE 232	Operating Systems Concepts Sessional	CSE	1.5	30	70	100
6	MATH 415	Numerical Methods	CSE	3	30	70	100
Total				**15.00**	**180**	**420**	**600**

LEVEL-3/TERM-1

SL. No	Course Code	Course	PoE	Credits	Marks		
					CIE	SEE	Total
1	CSE 315	System Analysis and Design (OPTION III)	CSE	3	30	70	100
2	CSE 413	Microprocessor & Assembly Programming	CSE	3	30	70	100
3	CSE 414	Microprocessor & Assembly Programming Sessional	CSE	1.5	30	70	100
4	CSE 221	Database Management Systems	CSE	3	30	70	100
5	CSE 222	Database Management Systems Sessional	CSE	1.5	30	70	100
Total				**12.00**	**150**	**350**	**500**

LEVEL-3/TERM-2

SL. No	Course Code	Course	PoE	Credits	Marks		
					CIE	SEE	Total
1	CSE 333	Computer Peripherals & Interfacing	CSE	3	30	70	100
2	CSE 334	Computer Peripherals & Interfacing Sessional	CSE	1.5	30	70	100
3	CSE 321	Software Engineering	CSE	3	30	70	100
4	CSE 322	Software Engineering Sessional	CSE	1.5	30	70	100
5	CSE 435	Data Communication (OPTION III)	CSE	3	30	70	100
Total				**12.00**	**150**	**350**	**500**

LEVEL-3/TERM-3

SL. No	Course Code	Course	PoE	Credits	Marks		
					CIE	SEE	Total
1	CSE 323	Computer Networks	CSE	3	30	70	100
2	CSE 324	Computer Networks Sessional	CSE	1.5	30	70	100
3	CSE 421	Computer Graphics (OPTION II)	CSE	3	30	70	100
4	CSE 422	Computer Graphics Sessional (OPTION II)	CSE	1.5	30	70	100
5	CSE 317	Theory of Computing	CSE	3	30	70	100
Total				**12.00**	**150**	**350**	**500**

LEVEL-4/TERM-1

SL. No	Course Code	Course	PoE	Credits	Marks		
					CIE	SEE	Total
1	MATH 335	Mathematical and Probabilistic Analysis	CSE	3	30	70	100
2	CSE 331	Pattern Recognition	CSE	3	30	70	100
3	CSE 332	Pattern Recognition Sessional	CSE	1.5	30	70	100
4	CSE 411	Compiler (OPTION II)	CSE	3	30	70	100
5	CSE 412	Compiler Sessional (OPTION II)	CSE	1.5	30	70	100
6	CSE 434	Web Technology Sessional	CSE	1.5	30	70	100
Total				**13.50**	**180**	**420**	**600**

LEVEL-4/TERM-2

SL. No	Course Code	Course	PoE	Credits	Marks		
					CIE	SEE	Total
1	CSE 443	Mobile and Telecommunication (OPTION III)	CSE	3	30	70	100
2	CSE 341	Artificial Intelligence	CSE	3	30	70	100
3	CSE 342	Artificial Intelligence Sessional	CSE	1.5	30	70	100
4	CSE 453	Digital Image Processing (OPTION II)	CSE	3	30	70	100
5	CSE 454	Digital Image Processing Sessional (OPTION II)	CSE	1.5	30	70	100
Total				**12.00**	**150**	**350**	**500**

LEVEL-4/TERM-3

SL. No	Course Code	Course	PoE	Credits	Marks		
					CIE	SEE	Total
1	CSE 423	Simulation & Modeling (OPTION II)	CSE	3	30	70	100
2	CSE 424	Simulation & Modeling Sessional (OPTION II)	CSE	1.5	30	70	100
3	CSE 400	Project & Thesis	CSE	3		100	100
Total				**7.50**	**60**	**240**	**300**

Part C

21. Description of all courses of the program

Course Code: PHY 111, Course Title: Physics

Course Code (BNQF): CSE-0533-111
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** General
Pre-requisites (if any**):** None

Rationale:

Physics is a fundamental science dedicated to explaining all natural phenomena that occur in the universe. Physics helped unlock the mysteries of the universe and laid the foundation for understanding modern Engineering, technology and all other sciences.

Course Objectives:

1. To introduce the systematic and coherent understanding of the fundamental concepts of Physics, its different learning areas and applications in basic Physics.
2. To incorporate economic, environmental, political, ethical, social, safety, and global considerations to generate sustainable solutions in the natural and built environment.
3. To exhibit strong communication, leadership, and teamwork skills.
4. To serve others through professional responsibility and public activities and good citizenship.

Course Content:

Wave and Oscillation: Wave motion and propagation, Simple harmonic motion, Vibration modes, Forced vibrations, Vibration in strings and columns, Sound wave and its velocity, Combination and composition of simple harmonic motions, Lissajous' figures, Doppler effect.
Properties of matter: Stresses and Strains, Elastic limit, Poisson's ratio, Hooke's law, Relation among elastic constants, Bending of beams, Circular motion, Rotation of rigid bodies, Central force, Structure of matter, Mechanical properties of materials.
Modern Physics: Photoelectric effect, Compton effect, De Broglie matter waves and its success in explaining Bohr's theory, Pauli's exclusion principle.

Radioactivity: Nuclear binding energy, different types of radio activity. Radioactive decay law, Nuclear reactions, nuclear fission, nuclear fusion, atomic power plant.

Fluid motion: Equation of continuity, Bernoulli's theorem, Viscosity, Stokes law, Surface tension and Energy, Capillary, Determination of surface tension by different methods.

Interference: Coherent sources and Interference Theories of light, Huygens principle, Interference; Young's Experiment, Interference in Newton ring.

Diffraction: Diffraction by single slit, diffraction from a circular aperture. Resolving power of optical instruments, diffraction at double slit and N slits, diffraction grating.

Polarization: production and analysis of polarized lights, Brewster's law. Malus law, polarization by double refraction, Nicol prism, optical activity, Polari meters.

Heat and Temperature: Gas Thermometer, Platinum resistance thermometer, Various kinds of thermometer and their relation, Kinetic Theory of gases.

Thermodynamics: Work and heat in volume changes; Internal energy; Adiabatic, Isothermal, Isobaric and Isochoric process, The first law of thermodynamics, the Carnot cycle.

Static Electricity: Introduction; Coulomb's law; Electric potential energy, Electrical energy density in terms of electric field, Current, Resistance and Resistivity; Ohm's law; Resistors in series and parallel; Kirchhoff's Rules, Wheatstone Bridge principle.
Magnetism: Magnetic field; Lorentz Force; Motion of a charged particles in magnetic field; Biot-Savart Law; Ampere's law; Magnetic properties of matter; paramagnet; diamagnetic and ferromagnetic.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Identify the basic physics and their influence engineering works.

CLO2 Acquire knowledge of the most important classical mechanics, Waves, Nature of light, Electricity, Magnetism.

CLO3 Interpret fundamental ideas of heat and thermodynamics with an emphasis on making construction decisions.

CLO4 Analyze knowledge about properties of matter, fluid mechanics and their impacts on engineering works.

CLO5 Evaluate knowledge about theorems to construct and solve mechanics and related to the application of Physics in engineering fields.

Mapping Course Learning Outcomes (CLOs) with the PLOs

CLO	PLO											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO1 1	PLO12
CLO1			√									
CLO2	√											
CLO3	√											
CLO4			√									
CLO5					√							

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

CLOs	Topics	Teaching-Learning Strategy	Assessment Strategy
CLO1	Introduction	Lecture, Discussion, Interactive discussions, Questions and answers, Problem Solving	Class Test, Assignment, Exam
CLO2	Waves, Electricity and Magnetism, Nature of Light	Lectures, Questions and answers, Case Study	Presentation, Assignment
CLO3	Heat and Temperature, Thermodynamics	Lecture, Class work, Problem Based Learning	Class Test, Assignment, Exam
CLO4	Properties of matter, Fluid motion	Case study analysis, Problem Based Learning	Written test, Presentation, Exam
CLO5	Mechanics, Modern Physics	Case study analysis, Problem Based Learning	Presentation, Performance, Exam

Books Recommended:

1. *Dr. Gias Uddin Ahmad, "Physics for Engineers Part -1", 1st Ed, Hafiz Book Centre, 2009.*
2. *Dr. Gias Uddin Ahmad "Physics for Engineers Part -2", 1st Ed, Hafiz Book Centre, 2009.*
3. *Concepts of Electricity & Magnetism, By- A.K. Rafiqullah, A.K.Roy, M.S. Huq.*
4. *N. Subrahmaniyanm & Brijlal," A textbook of SOUND" 3rd Ed. Vikas Publishing House Pvt Ltd, 2017.*
5. *N. Subrahmaniyanm & Brijlal, " Heat & Thermodynamics" 3rd Ed., S. Chand & Company, 2017.*

Course Code: PHY 112, Course Title: Physics Sessional

Course Code (BNQF): CSE-0533-112
Credit Hr.: 1.5, **Contact Hr.:** 3.0, **Course Type:** General
Pre-requisites (If any): None

Rationale:

PHY 112 is one of the fundamental courses for the students of department of Computer Science and Engineering. The aim of this course is to provide the abstract idea about Electricity & Magnetism, Modern Physics and Mechanics to the students.

Course Objectives:

1. To learn the basic concepts of physics needed for computer engineering.
2. To apply the physics concepts in solving real time engineering problem.
3. To implement and visualize theoretical aspects in the laboratory
4. To familiarize the students to handle various instruments and equipment.

Course Objectives:

Mechanics:
1. Acceleration due to gravity – Compound pendulum
2. Acceleration due to gravity – Simple pendulum
3. Thickness of a glass plate with a spherometer.
4. Spring Constant of a spiral spring.
5. Volume and density of a cylinder.
8. Potential Energy of a spiral spring.

Properties of matter:
1. Moment of inertia of a fly wheel
2. Moment of inertia - torsional pendulum
3. Rigidity modulus- Static torsion.
4. Rigidity modulus and moment of inertia – Torsion pendulum
5. Young's Modulus- Uniform bending – pin and microscope.

Heat and Thermodynamics:
1. To determine specific heat of liquid by method of mixture.
2. To determine specific heat of liquid by method of cooling.

Electricity:
1. To determine the value of an unknown resistance using Post Office box.
2. To find the resistance of unknown resistance using meter bridge.
3. To find the resistance of the given wire using meter bridge and hence determine the specific Resistance of its material.
4. To verify Ohm's law.

Course Learning Outcomes(CLOs):

After completing the course, students will be able to:

CLO1 Define the basic concepts of physics lab related with Physics (PHY-111) courses and various experimental techniques.

CLO2 Classify the basic laws and theories to determine various properties of the materials given.

CLO3 Characterize fundamental theories, mathematical equations to arrive solution for various problems.

CLO4 Employ experimental procedure available in physics laboratory books.

CLO5 Assess laboratory generated data to reach sound conclusions about physical phenomena.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1		√										
CLO2			√									
CLO3		√										
CLO4		√										
CLO5				√								

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

CLO	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1, CLO2, CLO3, CLO4, CLO5	Mechanics	Lecture, Discussion, Experimental set up, Record data	Performance Test, Lab Report, Viva
CLO1, CLO2, CLO3, CLO4, CLO5	Properties of matter	Lecture, Discussion, Experimental set up, Record data	Performance Test, Lab Report, Viva
CLO1, CLO2, CLO3, CLO4, CLO5	Electricity	Lecture, Discussion, Experimental set up, Record data	Performance Test, Lab Report, viva
CLO1, CLO2, CLO3, CLO4, CLO5	Heat	Lecture, Discussion, Experimental set up, Record data	Performance Test, Lab Report, viva

Books recommended:

1. Practical Physics, (4th Edition) - Dr. Giasuddin Ahmed & Md. Shahabuddin (Hafiz Book Center)

2. Physics Laboratory manual for Engineering Undergraduates, Dr. P.K. Giri, Department Of Physics, Indian Institute of Technology, Guwahati.

Course Code: CHEM 111, Course Title: Chemistry

Course Code (BNQF): CSE-0531-111
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** General
Pre-requisites (if any**):** None

Rationale:

This introductory course in Chemistry is designed to provide students with the basic concepts of Structure of atom, Periodic Table, Chemical Bonding, Chemical thermodynamics, chemical kinetics, and chemical and acid-base equilibrium, mainly discussed in Inorganic Chemistry and Physical Chemistry. This course provides a broad foundation in chemistry that stresses scientific reasoning and analytical problem solving with a molecular perspective.

Course Objectives:

1. To understand the fundamental concepts of chemistry systematically and coherently.
2. To understand atomic theories of matter.
3. To learn the chemical and physical properties of elements of the periodic table.
4. To characterize chemical bonding in compounds.
5. To study the key concept of chemical kinetics, chemical equilibrium and acid-base equilibrium.

Course content:

Structure of atom: Nuclear structure: atomic and mass number, nuclear dimensions, isotopes, mass defect, Radioactivity, half-life of radioactive elements, nuclear binding energy.
Electronic structure: Dalton's theory, Rutherford's atomic model, Bohr theory and their drawbacks.
Pauli exclusion principle, Aufbau principle or $(n + \ell)$ and Hund principle, atomic spectra.
Quantum theory of atom: Historical development of quantum theory: The photoelectric and Compton effects, atomic spectra, dual nature of matter and radiation, quantum theory and orbital concept, the uncertainty principle.
Periodic Table: Periodic law, classification of elements based on electronic configuration, Properties of s-block, p-block, d-block and f-block elements.
Usefulness and limitations of the periodic table: predictions of positions and properties of elements from their electronic configurations.
Chemical Bond: Origin of the chemical bond; development of the electronic theory of valency; Lewis formula, ionic bond, covalent bond and coordination bond.
Modern theories of chemical bond: Valence-bond theory (VBT), VSEPR, Hybridization concepts and MOT. Properties of ionic and covalent compounds; Intermolecular forces, Chelate complexes.
Kinetic theory of gases: van der Waal's forces and equation.
Thermodynamics & Solution: 1st Law and 2nd Law of Thermodynamics, Thermo-chemistry, phase rule, phase diagram of mono-component system, properties of dilute solutions
Acids, Bases and Salts: Properties of water, pH concept, electrical properties of solution. Modern theories of acids and bases, pH, buffer solution, indicators.
Chemical Equilibrium: chemical kinetics, Law of mass action, Thermodynamic derivation of law of mass action.
Application of law of mass of action to chemical reactions. Heterogeneous equilibrium.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Define the fundamental concepts in Physical chemistry, Inorganic Chemistry, Analytical Chemistry and all other related allied chemistry subjects.

CLO2 Classify the concept of atomic phenomena, bonding, kinetics and thermodynamics of chemical reaction.

CLO3 Assign the knowledge of chemistry to explain this material world from atomic and molecular levels.

CLO4 Solve problems related to the application of chemistry in engineering fields.

CLO5 Correlate the various aspects of chemical changes/reactions and determine broad knowledge of chemical concepts.

Mapping Course Learning Outcomes (CLOs) with the PLOs												
CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3	√											
CLO4	√											
CLO5	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLO	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1, CLO2	Structure of atom, electronic structure, Principle for electronic configuration,	Lecture, PPT, Discussion Problem Solving	Class performances, Class Test
CLO1, CLO2, CLO3	Quantum theory of atom, Periodic Table, Usefulness and limitations of the periodic table.	Lecture, PPT, Board work, Documentaries using Visual Tools	Problem Solving, Assignments
CLO2, CLO3, CLO4, CLO5	Chemical Bond. Modern theories of chemical bond Kinetic theory of gases	Lecturing, PPT, Discussion, Classwork	Class performances, Problem Solving, Class Test
CLO3, CLO4, CLO5	Acids, Bases and Salts. Chemical Equilibrium, Application of law of mass of action	Lecture, PPT, Problem Solving Sessions	Presentation, Assignment

Books Recommended:

1. *Darrell D. Ebbing, Steven D. Gammon "General Chemistry", 9th Ed., Houghton Mifflin Company, Boston, 2009.*
2. *Raymond Chang, Jason Over, "General Chemistry: The Essential Concepts", 6th Ed., McGraw-Hill, New York, NY, 2000.*
3. *Martin S. Silberberg, "Chemistry: The Molecular Nature of Matter and Change", 5th Ed., McGraw-Hill, New York, NY, 2009.*
4. *Peter Atkins and Julio de Paula, "Atkins' Physical Chemistry", 8th Ed., W. H. Freeman and Company, NY, 2006.*
5. *P.W. Atkins, T.L. Overton, J.P. Rourke, M.T. Weller, and F.A. Armstrong, "Shriver & Atkins' Inorganic Chemistry", 5th, W. H. Freeman and Company, NY, 2006.*
6. *James E. Huheey, Ellen A. Keiter, Richard L. Keiter, "Inorganic Chemistry: Principles of Structure and Reactivity", 4th, HarperCollins College Publishers, NY, 2006.*

Course Code: HUM 100, Course Title: Bangladesh Studies

Course Code (BNQF): CSE-0222-100
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** General
Pre-requisites (if any**):** None

Rationale:

Bangladesh Studies enables students to acquire a sound knowledge and a balanced understanding of the history and culture of Bangladesh, and of the land, people and economy of the country.

Course Objectives:

1. Understand about Bangladesh's rich heritage and cultural influences and about events which have shaped national identity.
2. Evaluate the structural features of the economy, patterns of agriculture and economic changes, the nature of environmental challenges including ways to address them effectively and pathways to resolve the range of development challenges that the country is currently facing.
3. Apply, organize and present environmental and developmental facts in written and diagrammatic forms.
4. Analyze Environmental and development issues.

Course Content:

History of Bangladesh in brief: Origin of Bengali Ethnic group, terrestrial area, colonial rule, the Pakistan movement and the birth of Pakistan, Language Movement, Election of 1970, the Liberation War of Bangladesh.
Physical features of Bangladesh: Location, Climate and Major physiographic units.
Agriculture and River system: Pattern of Agriculture and types of forest in Bangladesh.
Mineral resources of Bangladesh: Mineral resources and development, industrial set up in Bangladesh and recent infrastructural development.
Human resources and remittance: Human resources and remittance, density and distribution of population, Bangladesh in UN peacekeeping mission.
Political administration: Forms of Government and state mechanisms (executive, legislature, judiciary) of Bangladesh. Review and makeup class
Legal environment of Bangladesh: Constitution of Bangladesh and its Amendments administrative structure of Bangladesh.
Social environment of Bangladesh: Social structure and social stratification in Bangladesh, population migration from rural to urban areas of Bangladesh; ethnic minorities, social problems, festivals, woman in Bangladesh, education and health.
Economic Environment of Bangladesh: Microeconomic trends of Bangladesh economy, GDP, savings, investment and employment, export and import, tourism, recent economic development.
Thrust areas of Bangladesh economy: Poverty alleviation and private sector development.
Foreign policy and relations: Foreign policy of Bangladesh, Relations with neighbors, Bangladesh India relation, Bangladesh Myanmar relation, Bangladesh-Nepal-Bhutan-Sri Lanka and Maldives relation, Bangladesh USA relation, Bangladesh China relation, Bangladesh Middle East relation, Bangladesh EU relation.
Non- conventional security issues and natural disaster, pollution crisis: Environmental security, food security, water security, energy security, climate change, sea level rise, terrorism, water pollution, air pollution, environmental pollution, cyclone, flood, landslide. Review and Makeup class

Course Learning Outcomes (CLO):

CLO1	Identify and explain about the historical, political, social and economic structure of Bangladesh.
CLO2	Characterize Bangladesh Studies and ways of formulating questions through the study of a broad theme like agriculture, mineral resources and recent infrastructural development.
CLO3	Promote and develop locational knowledge and knowledge of broad economic trends in the development of Bangladesh.
CLO4	Demonstrate the development skills in the selection, organization, analysis of information.
CLO5	Define Foreign Policy and relations and give evaluations and express opinions on topics in the syllabus content.

Mapping between Course Learning Outcome (CLO) and Program Learning Outcome (PLO):

CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1									√			
CLO2								√				
CLO3									√			
CLO4											√	
CLO5											√	

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

CLO	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1, CLO2	History of Bangladesh in brief, Physical features of Bangladesh, Agriculture and River system	Lecture, PPT, Discussion Problem Solving	Class performances, class test
CLO2, CLO4	Mineral resources of Bangladesh, Human resources and remittance, Political administration	Lecture, PPT, Board work, Documentaries using Visual Tools	Class performances, Assignments
CLO3	Legal environment of Bangladesh, Social environment of Bangladesh, Economic Environment of Bangladesh	Lecturing, PPT, Discussion, Classwork	Presentation, Class Test
CLO3, CLO5	Thrust areas of Bangladesh economy, Foreign policy and relations, Non -conventional security issues and natural disaster, pollution crisis	Lecture, PPT, Problem Solving Sessions	Problem Solving, Assignment

Books Recommended:

1. *Harun-or-Roshid, the Foreshadowing of Bangladesh: Bengal Muslim League and Muslim Politics.*
2. *History of Bangladesh: Social and cultural history, political history economical history by Sirajul Islam.*
3. *Talukder Maniruzzaman, Radical Politics and the Emergence of Bangladesh.*
4. *Banglapedia: National Encyclopedia of Bangladesh (Asiatic Society).*
5. *Bangladesh Foreign Policy by Harun Ur Rashid.*
6. *Bangladesh Judicial Service by Abdul Halim*

Course Code: HIST 101, Course Title: History of the Emergence of Independent Bangladesh

Course Code (BNQF): CSE-0222-101
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** General
Pre-requisites (if any**):** None

Rationale:

This is an introductory course. The main purpose of this course is to help the student to understand the brief history of Bangladesh and ours greatest event 'Liberation war of Bangladesh'. This course focuses specifically on how Bangladesh appeared as a sovereign country in world map.

Course Objectives:

1 Identify and explain the main events of the history of Bangladesh since the battle of Plessey (1757) to the creation of Bangladesh as a sovereign state in 1971.

2 Analyze and explain the background of the partition of India in 1947.

3 Explain the inevitability of the emergence of Bangladesh as a sovereign state.

4 Identify and explain the early history of Bangladesh for the enlargement of their understanding with patriotism towards the national integration and advancement.

5 Determines the sacrifice of the nation for independence.

Course Objectives:

Description of the country and its people: Geographical features and their influence, Ethnic composition, Language, Cultural syncretism and religious tolerance, Distinctive identity of Bangladesh in the context of undivided Bengal.

Partition of Bengal – 1905: Reasons of partition, impact of partition/ people's reaction, Swadeshi Movement, Significance of the partition.

Proposal for undivided sovereign Bengal and the partition of the Sub Continent, 1947: Rise of communalism under the colonial rule, Lahore Resolution 1940, The proposal of Suhrawardi and Sarat Bose for undivided Bengal: consequences, The creation of Pakistan 1947.

Pakistan: Structure of the state and disparity: Central and provincial structure, Influence of Military and Civil bureaucracy, Economic, social and cultural disparity.

Language Movement and quest for Bengali identity: Misrule by Muslim League and Struggle for democratic politics, The Language Movement: context and phases, United front of Haque – Vasani – Suhrawardi: election of 1954, consequences.

Military rule: the regimes of Ayub Khan and Yahia Khan (1958-1971): Definition of military rules and its characteristics, Ayub Khan's rise to power and characteristics of his rule (Political repression, Basic democracy, Islamisation), Fall of Ayub Khan and Yahia Khan's rule (Abolition of one unit, universal suffrage, the Legal Framework Order).

Rise of nationalism and the Movement for self-determination: Resistance against cultural aggression and resurgence of Bengali culture, Sheikh Mujibur Rahman and the six point movement, Reactions: Importance and significance, The Agortola Case 1968.

The mass- upsurge of 1969 and 11 point movement: background, programme and Significance.

Election of 1970 and the Declaration of Independence by Bangobondhu: Election result and centres refusal to comply, The non-co-operation movement, the 7th March, Operation Searchlight, Declaration of Independence by Bangobondhu and his arrest

The war of Liberation 1971:

a. Genocide, repression of women, refugees

b. Formation of Bangladesh government and proclamation of Independence

c. The spontaneous early resistance and subsequent organized resistance (Mukti Fouz, Mukti Bahini, guerillas and the frontal warfare)

d. Publicity Campaign in the war of Liberation (Shadhin Bangla Betar Kendra, the Campaigns abroad and formation of public opinion)

Contribution of students, women and the masses (Peoples war)

f. The Anti-liberation activities of the occupation army, the Peace Committee, Al-Badar, Al-Shams, Rajakars, pro Pakistan political parties and Pakistani Collaborators, killing of the intellectuals.

g. Trial of Bangabondhu and reaction of the World Community.

i. Formation of joint command and the Victory

j. The overall contribution of Bangabondhu in the Independence struggle.

The role of super powers and the Muslim states in the Liberation war, Unsolved issues between Bangladesh and Pakistan: The contribution of India in the Liberation War, Role of USA, USSR and China in the liberation war of Bangladesh.

The Bangabondhu Regime 1972-1975: Homecoming, Making of the constitution, Reconstruction of the war ravaged country, BAKSAL, The murder of Bangabondhu and his family and the ideological turn-around.

Course Learning Outcomes (CLO):

CLO1	Identify and explain the main events of the history of Bangladesh of this period.
CLO2	Explain the origin and evaluation through different paradigms of Bangla language.
CLO3	Characterize and spot the inevitability of the emergence of Bangladesh as a sovereign state.
CLO4	Identify and explain the early history of Bangladesh for the enlargement of their understanding with patriotism towards the national integration and advancement.
CLO5	Acquire knowledge about economic exploitation and disparity and Construct reports or research related to Bangladesh and its history.

Mapping between Course Learning Outcome (CLO) and Program Learning Outcome (PLO):

CLO	**PLO**											
	PLO 1	PLO 2	PLO3	PLO 4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1									√			
CLO2									√			
CLO3								√				
CLO4											√	
CLO5											√	

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLO	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1, CLO2, CLO3	Geographical features and their influence, Ethnic composition, Bangla Language, Partition of Bangle, Swadeshi Movement. Rise of communalism, Lahore Resolution 1940, The creation of Pakistan 1947.	Lecture, Discussion Problem Solving	Class performances, class test
CLO2, CLO4	Economic, social and cultural disparity between East and West Pakistan, Language Movement, military rule	Lecture, Problem Solving Sessions	Problem Solving, assignment
CLO1, CLO4, CLO5	Six Point Movement, The Agortola Case 1968, The mass- upsurge of 1969, The non-co-operation movement, the 7th March, Operation Searchlight, Declaration of Independence	Lecture, Discussion Problem Solving	Class performances, class test
CLO3, CLO5	Genocide, repression of women, refugees, Mukti Bahini, The Anti-liberation activities, Role of various countries in liberation war, Bangabondhu Regime, BAKSAL.	Lecture, Problem Solving Sessions	Problem Solving, assignment

Books Recommended:

1 *Harun-or-Roshid, The Foreshadowing of Bangladesh: Bengal Muslim League and Muslim Politics,1906-1947,*
2 *Rounaq Jahan, Pakistan: Failure in National Integration,*
3 *Talukder Maniruzzaman, Radical Politics and the Emergence of Bangladesh,*
4 *R. C. Majumdar, History of Bengal, Vol. 1*
5 *Shyamal Ghosh, The Awami League.*

Course Code: HUM 103, Course Title: Introduction to Humanities

Course Code (BNQF): CSE-0223-103
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** General
Pre-requisites (if any**):** None

Rationale:

This course introduces students to a range of ideas and themes in the humanities from a global perspective through an exploration of different aesthetic approaches across a variety of disciplines in the humanities. Students will explore primary source examples from the visual, performing, and literary arts by describing and analyzing the relationship between form and content and by investigating their social, historical, and cultural contexts to determine their meaning and significance. This course is offered for the students of the 1st year.

Course Objectives:

1. To facilitate necessary knowledge about major cultural forms at the introductory level.
2. Help students understand basic humanistic concepts and express knowledge of artistic and musical forms through evaluation of written and oral work appropriate for a university-parallel course.
3. To provide knowledge of cultural diversity in artistic, musical and literary forms.

Course Content:

Literature: Appreciation of literatures: poetry, prose, drama, novel; Contemporary thoughts on literatures;Study. of the contemporary literary work.
History: Introduction; renaissance, reformation, and the beginning of the Modem World; The Scientific Revolution; The industrial Revolution, the age of Democratic Revolution; Nineteenth century Europe; Asia-Pacific region;' Africa; World Wars; South Asia: Colonization, decolonization after; Contemporary world: Cold War and after.
Philosophy: Concept of Philosophy; Science and Philosophy; Science and Philosophy; Science and Philosophy; Region, Literature and Philosophy; Sources of Knowledge; Empiricism, Rationalism Criticism; Concept of value, ethics and Sources of ethical standards.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Identify the importance of literature and its impact on society.

CLO2 Explain beginning of the modern world, revolution on industrial sector, scientific revolution.

CLO3 Describe new world order and define modern age form middle age.

Mapping Course Learning Outcomes (CLOs) with the PLOs

CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1									√			
CLO2								√				
CLO3								√				

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Literature	Lecture, Interactive discussions, Questions and answers	Class Test
CLO2	History	Lecture, Discussion, Problem Solving	Assignment, Written Test
CLO3	Philosophy	Lecturing, Discussion, Classwork	Assignment, Class Test, Written test

Books Recommended:

1. *Sarah Midford, Sara James, "Key concepts in humanities and social sciences", Publisher: La Trobe eBureau, 2018, ISBN:9780995372733.*
2. *Gloria Fiero "Landmarks in Humanities", 4ht Ed, McGraw-Hill Higher Education, 2017.*
3. *Henry M. Sayre," Humanities, The Culture, Continuity, and Change" 4th Ed. Pearson, 2019.*

Course Code: SOC 104, Course Title: Introduction to Social Science

Course Code (BNQF): CSE-0314-104
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** General
Pre-requisites (if any**):** None

Rationale:

The course emphasize continued development of critical thinking skills and the ability to communicate ideas effectively. They foster critical understanding of human action and of interaction with other humans and their environment.

Course Objectives:

1. Compare/evaluate social scientific research and the alternatives
2. Explain the limits/weaknesses of research approaches to knowledge
3. Identify various types of social research and describe their strengths/weaknesses

Course Content:

Introduction: Definition, Nature & Scope of Sociology, development of Sociology: relationship with other social sciences, Contributions of Auguste Comte, Herbert Spencer, Emile Durkheim, Max Weber, Culture, Beliefs and Values: Norms, sanctions, symbols, language, religion, subculture, counter-culture, hegemony and resistance.

Social Interaction, Social Structure and Social Inequality: Socialization - agencies of socialization, socialization and life cycle. Social interaction, exchange, status, role, group, types of group, Definition, nature and role of institutions, family and marriage, economic institution, political institutions, education, bureaucracy, property, Dimensions of social inequality: Class, gender, age, minority group (religious and indigenous), economic vulnerability, Social inequalities in developed & developing countries. Marxist view on classifying societies on the basis of type of control over economic resources and Lenski's view on classifying societies by their main means of Subsistence, Meaning of stratification, slavery, caste, class, role and status, age, gender; theories of stratification-- Marx, Weber, Davis and Moore; social mobility - factors affecting mobility, Gender inequality & women's subjugation in developing societies, Nature & scope of the problem, Urbanizations, acute, chronic & life style diseases, Social, environmental & behavioral factors affecting health, Communicable & behavioral diseases: STD, HIV/AIDS, TB, Hep-B etc,

Environmental Problems, Natural Disasters and Social Crisis, Health, Illness and Society: Environmental Problems, Natural Disasters and Social Crisis: Climate change and its impact on society, Natural disaster, social crisis and vulnerabilities, Climate change, deforestation and mal-development, Poverty, unemployment, prostitution, HIV/AIDS, population problem, corruption, disaster, violence against women, child trafficking and pornography, Factors of social change, theories of social change: functionalism, conflict, modernization, dependency, world system and globalization.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1	Remember the basic concepts and facts of Sociology.
CLO2	Understand the Nature and development scope of sociology, socialization, social stratification, inequalities as well as health and illness of the society.
CLO3	Learn the relationship with other social sciences taking idea from different sociologists, Marxist-lenski's view on classifying societies by their main means of subsistence and theories and make solutions to societal problems at large.

Mapping Course Learning Outcomes(CLOs) with PLOs												
CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1									√			
CLO2									√			
CLO3								√				

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Introduction	Lecture, Discussion, Interactive discussions, Questions and answers, Problem Solving	Assignment, Exam
CLO2	Social Interaction, Social Structure and Social Inequality	Case study analysis, PowerPoint Demonstration, Problem Based Learning	Presentation, Assignment, Performance test
CLO3	Environmental Problems, Natural Disasters and Social Crisis, Health, Illness and Society	Lectures, Online Video, Questions and answers, Case Study, Group Study for Data Analysis	Assignment, Performance test, Exam

Books Recommended:

1. *Martin Marger "Social inequality patterns and processes", 6th Ed., McGRAW-Hill Education, 2002.*
2. *John Scott "Stratification of power", April 3, 2014.*

Course Code: ACT 110, Course Title: Principles of Accounting

Course Code (BNQF): CSE-0411-110
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** General
Pre-requisites (if any**):** None

Rationale:

This course introduces basic concepts of accounting, different types of accounting system and their implication in different organization through theoretical learning and numerical methods. It aims on procedures and practices from the accounting cycle through financial statement presentation with an emphasis on recognizing, valuing, reporting, and disclosing assets, liabilities, and equity, so that the students from engineering major can learn the basics of doing business and contribute to the dynamic environment of an organization with the combined functioning of science and business.

Course Objectives:

1. To acquire conceptual knowledge of financial accounting and to provide knowledge about the technique for preparing accounts in different business organization.
2. To help in applying accounting techniques and methods for the formation, dissolution, partner changes, earnings distribution, and liquidation of partnerships.
3. To assist management in making more effective planning and control decisions through various accounting tools & techniques and to emphasis the changing role of financial accounting.
4. To focus on procedures and practices from the accounting cycle through financial statement presentation.
5. To emphasize on recognizing, valuing, reporting, and disclosing assets, liabilities, and equity through Financial Presentation.

Course Content:

Accounting in action & conceptual framework for financial accounting: Orientation& purpose and nature of accounting, Language of business,Uses of accounting information, Accounting as an information science,Basic objectives and qualitative characteristics of accounting information, Basic elements of financial statements,GAAP- basic assumptions, Principles & constraints.
Accounting Process and cycle: Double entry processing system and accounting equation, Effects of transaction on the accounting equation, Steps in accounting cycle, Identification and recording of transaction, Posting to the ledger, Preparation of the trial balance.
Preparation of worksheet and financial statements for merchandise operation: Unadjusted trial balance and adjustments, A worksheet to prepare financial statements, recording cost of goods purchased, Determining cost of goods on hand, Computing cost of goods sold and gross profit.
Bank Reconciliation statement and plant assets: The necessity of the statement and different methods for preparation of the statement, the concept and reasons of depreciation, Different methods of charging depreciation, Calculating depreciation under different methods.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Explaining the financial resources, obligations, and activities of an economic entity.

CLO2 Identifying the skill of recording financial transactions and preparation of reports in accordance with GAAP.

CLO3 Implementing accounting information as a tool in applying solutions for managerial problems, evaluating the financial performance, and interpreting the financial structure.

CLO4 Summarizing Receipts & Payment Account, Income & Expenditure Account and Balance Sheet for Organizations.

CLO5 Applying practice and theoretical knowledge of financial accounting in real life.

Mapping Course Learning Outcomes (CLOs) with the PLOs

CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PO10	PO11	PO12
CLO1											√	
CLO2									√			
CLO3									√			
CLO4									√			
CLO5											√	

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

CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Accounting in action & conceptual framework for financial accounting	Lecture, Discussion, Interactive discussions, Questions and answers, Group discussion, Problem Solving	Assignment, Exam
CLO2	Accounting Process and cycle	Lectures, Online Video, Questions and answers, Case Study, Powerpoint Demonstration.	Presentation, Assignment, Exam
CLO3	Preparation of worksheet and financial statements for merchandise operation	Lecture, Class work, Group Study, Problem Based Learning, Case Study	Presentation, Assignment
CLO4	Adjusting the Accounts	PowerPoint Demonstration, Case study analysis, Online Video, Problem Based Learning	Class Test, Assignment, Exam
CLO5	Financial Statement Analysis	Lectures, Group Study for Data Analysis, Questions and answers, Case Study, Group discussion	Written test, Presentation, Exam

Books Recommended:

1. *Weygandt, J.J., Kimmel, P.D. & Kieso, D.E. (2015). Accounting Principles(12th ed.). John Wiley & Sons.*
2. *Lerner, J.J. & Cashin, J.A. (2009). Schaum's Outline of Principles of Accounting I(5th ed.). McGraw-Hill Education.*

Course Code: ECO 213, Course Title: Economics

Course Code (BNQF): CSE-0311-213
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** General
Pre-requisites (if any**):** None

Rationale:

This course introduces the basic concepts of economics, various economic factors associated with different economic system and their structure and application. As a student of Computer Engineering program, one must have the knowledge of economy to contribute to the country, as well as to trace the science, information and technological development. Hence. The course is designed to provide the student of B. Sc. (Engg.) program with appropriate knowledge about the nature, strength and weaknesses of the a country's economy.

Course Objectives:

1. To identify and explain economic concepts and theories related to the behavior of economic agents, markets, industry and firm structures, legal institutions, social norms, and government policies.
2. To integrate theoretical knowledge with quantitative and qualitative evidence in order to explain past economic events and to formulate predictions on future ones.
3. To learn about the consequences of economic activities and institutions for individual and social welfare.
4. To introduce the basic features of alternative representations of human behavior in economics.
5. To identify the market situation and take necessary steps applying theoretical knowledge to survive in the market.

Course Content:

Definition and Subject matter of Economics: Distinction between micro & macroeconomics-some basic economic concepts- Alternative economics systems- Capitalism, Socialism and Islamic economics.
The Theory of demand and supply and their uses: Elasticity of demand and supply & their measurement. Difference between demand and supply of agricultural and industrial products. The Law of diminishing marginal utility & the law of equimarginal utility consumer's surplus.

The Indifference Curve analysis: Properties of Indifference Curve. Consumer's equilibrium-Income, substitution & price effects.
The Theory of Production: factors of production, returns to scale—production functions- ISO-product and Iso-cost curves- producer's equilibrium.
Market structure: Perfect, imperfect and monopoly-concepts of cost & revenue. short run and long run, cost curves-producer's equilibrium.
The Pricing of the factors of Production: The marginal productivity of distribution-determination of rent, wages, interest and profit.
National Income & its different concepts: methods of computing National Income-problems of computing National Income-Uses of National Income.
The Theory of income determination: Keynesian approach-consumption function, Investment function- Multiplier.
Banking: The commercial banks-functions of commercial banks. Principles of commercial banks and balance sheet-Multiple credit and credit creation-Specialized financial institutions. The Central Bank-functions of Central Bank, various instruments of credit control & their limitations- Monetary policy. Islamic banking systems.
Public Finance: Private Vs. public finance-Sources of revenue & heads of expenditure of the governments. Public expenditure & Public borrowing budgets-capital & revenue. Taxation-Principles of taxation-type of taxation-Incidence of taxation-zaket public debt: Internal vs. external debt- Burden of public debt- fiscal policy.
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Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Explaining the basic theories of economics in critical thinking and problem solving.

CLO2	Identifying how households (demand) and businesses (supply) interact in various market structures to determine price and quantity of a good produced.
CLO3	Checking the links between household behavior, production costs and the economic models of demand and supply.
CLO4	Differentiating operations of markets under varying competitive conditions and the concept of opportunity cost.
CLO5	Executing economic models to examine current economic issues and evaluate policy options for addressing these issues.

Mapping Course Learning Outcomes (CLOs) with the PLOs

CLO	PLO											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1											√	
CLO2									√			
CLO3											√	
CLO4									√			
CLO5									√			

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

CLOs	Topics	Teaching-Learning Strategy	Assessment Strategy
CLO1	Definition and Subject matter of Economics, The Theory of demand and supply and their uses	Lecture, Discussion, Interactive discussions, Questions and answers, Group discussion, Problem Solving	Assignment, Exam
CLO2	The Indifference Curve analysis, The Theory of Production, Market structure	Lectures, Online Video, Questions and answers, Case Study, Powerpoint Demonstration.	Presentation, Assignment, Exam
CLO3	The Pricing of the factors of Production	Lecture, Class work, Group Study, Problem Based Learning, Case Study	Presentation, Assignment
CLO4	National Income & it's different concepts, The Theory of income determination	PowerPoint Demonstration, Case study analysis, Online Video, Problem Based Learning	Class Test, Assignment, Exam
CLO5	The Theory of income determination, Banking, Public Finance	Lectures, Group Study for Data Analysis, Questions and answers, Case Study, Group discussion	Written test, Presentation, Exam

Books Recommended:

1. *Samuelson, P.A. & Nordhaus, W.D.(2009). Economics(19th ed.). Irwin/Mc-Graw-Hill.*
2. *Gwartney, J. D., Stroup, R. L. & Sobel, R. S. (2000). Economics: Private & Public Choice (9th ed.). Dryden Press.*

Course Code: MGT 215, Course Title: Introduction to Management

Course Code (BNQF): CSE-0413-215
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** General
Pre-requisites (if any**):** None

Rationale:

This course is designed to teach the fundamentals of management and how management evolves with the expansion of an organization. As a student of Computer Engineering program, one must have the knowledge of management functions and managerial roles to work as effective team leader and design proper planning for the scientific development.

Course Objectives:

1. To explain traditional and modern techniques of management.
2. To prepare students for General management and supervisory positions.
3. To foster management qualities, like: leadership, motivating people etc.
4. To provide background for the further study in the advance management courses.
5. To deliver the knowledge of working in teams and groups.

Course Content:

Meaning and Evolution of Management Thought: Meaning, Nature, Purpose and Principles, Functions of management, Managerial functions at different organizational management roles, concepts of productivity, effectiveness and efficiency, Concept of management and administration: Evolution of Management Thought; Scientific management, administrative management, Bureaucratic management approach. Hawthorn experiment, Theory "X" and theory "Y",System theory**.**

Environment, Planning and decision making process in Management: Internal and External Environment, Components of Internal and external environment: Planning; Meaning, nature of planning, types of planning, steps of planning, tools and techniques in planning, the planning process, Management by Objectives(MBO), Strategic Management, Strategic Planning Process; Decision Making; Meaning of Decision Making, types of decision making, Decision making conditions, Decision Making Process, Problems and Opportunities of decision making. Nature of managerial decision making, decision support system.

Organizing and Managing Human Resources: Meaning, Organizational structure, Division of work, Span of management, Departmentalization, delegation of authority, centralization and decentralization, co-ordination, Line and staff function: Managing Human Resources; Concepts of HRM, functions, roles, importance, model.

Leading: Motivation-meaning, motivation framework, motivation and satisfaction, motivation theories: Leadership-Meaning, Types of power, Leadership behaviors. Leadership Theories, types of Leadership:.

Controlling: Controlling; Meaning and importance of controlling, Types of control, Controlling process, Requirements of effective control, Methods of controlling

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Understand the role of a manager and how it relates to the organization's mission

CLO2 Define management, its basic functions and skills.

CLO3 Recognize the concept of social responsiveness and its benefits.

CLO4 Explain the relationship between strategic, tactical, and operational plans

CLO5 Identify the stages of team development and the skills a team must acquire to become effective.

Mapping Course Learning Outcomes (CLOs) with the PLOs												
CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1							√					
CLO2									√			
CLO3											√	
CLO4									√			
CLO5							√					

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Meaning and Evolution of Management Thought	Lecture, Discussion, Interactive discussions, Questions and answers, Group discussion, Problem Solving	Assignment, Exam
CLO2	Environment, Planning and decision making process in Management	Lectures, Online Video, Questions and answers, Case Study, PowerPoint Demonstration.	Presentation, Assignment, Exam
CLO3	Organizing and Managing Human Resources	Lecture, Class work, Group Study, Problem Based Learning, Case Study	Presentation, Assignment
CLO4	Leading	PowerPoint Demonstration, Case study analysis, Online Video, Problem Based Learning	Class Test, Assignment, Exam
CLO5	Controlling	Lectures, Group Study for Data Analysis, Questions and answers, Case Study, Group discussion	Written test, Presentation, Exam

Books Recommended:

1. *Griffin, R. W. (2012). Fundamentals of management. Mason, OH: South-Western Cengage Learning.*
2. *Robbins, S. P., Stuart-Kotze, R., & Coulter, M. (2000). Management. Scarborough, Ont: Prentice Hall.*

Course Code: BIO 218, Course Title: Introduction to Biological Science

Course Code (BNQF): CSE-0511-218

Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** General

Pre-requisites (if any**):** None

Rationale:

This course is a general introductory science course, emphasizing principles with wide applications to all living organisms, including cell structure and function, mechanisms of inheritance, the diversity of life, evolution and adaptations to the environment. This course is offered to the 1st year students to get them familiar with the basic biological concepts.

Course Objectives:

1. To facilitate necessary knowledge about basic biological process in common life.
2. To provide the knowledge of genetics, heredity and evolution – thus explaining how present-day organisms may have arisen.
3. To help students conceptualize basic theories in ecology, how different life forms, including humans, interact with each other and with the physical, chemical and biological world around them.

Course Content:

Introduction to Biology: Overview and introduction to biological science -scientific method.

Ecology: Diversity of life in the biosphere -Population Ecology - Community Ecology.

Evolution and Speciation: Evidence of evolution, history, classification, -Natural selection –speciation.

Diversity: The Kingdoms of Life –taxonomy, Prokaryotes -Protists –Fungi.

Cell Theory, Metabolism: basic chemistry of life -enzymes - membrane function, organelles - energy flow, Respiration & Photosynthesis – glycolysis, aerobic respiration - glucose production.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Know the basic concepts of biological science.

CLO2 Recognize the factors that determine and influence distribution of life on Earth based on climate.

CLO3 Memorize the structure and dynamics of communities, including types of interactions, and how they influence growth models and diverse adaptations that exist as a result of community dynamics, trophic structures, concepts of species diversity, keystone species, disturbance and primary or secondary succession, invasive species.

CLO4 Recall the ecosystem structure and dynamics, including primary production and nutrient cycling.

Mapping Course Learning Outcomes (CLOs) with the PLOs												
CLO	**PLO**											
	PLO1	POL2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3										√		
CLO4										√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Introduction to Biology	Lecture, Interactive discussions, Questions and answers	Class Test
CLO2	Ecology	Lecture, Discussion, Problem Solving	Assignment, Written Test
CLO3	Evolution and Speciation, Diversity	Lecturing, Discussion, Classwork	Assignment
CLO4	Cell Theory, Metabolism	Lecture, Problem Solving	Class Test, Written test

Books Recommended:

1. *Campbell Biology, 2nd Canadian Edition (2017) Authors: Reece, J. B., L. A. Urry, M. L. Cain, S. A. Wasserman, P. V. Minorsky, R. B. Jackson, F. E. Rawle, D. G. Durnford, C. D. Moyes, K. Scott, and S. J. Walde. Pearson, Benjamin Cummings ISBN-10: 0134589947 ISBN-13: 978-0134189116*

Course Code: MKT 324, Course Titles: Principles of Marketing

Course Code (BNQF): CSE-0414-324
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** General
Pre-requisites (if any**):** None

Rationale:

This course introduces the basic principles of marketing and the application of these practices. An engineering student should know the marketing skills and concepts to promote and showcase the ideas, invention and innovation. The course aims at delivering knowledge of identifying target market and goal setting, product and service branding and dealing the consumers.

Course Objectives:

1. To provide the idea of the role of marketing within society and within an economic system.
2. To familiarize the students the knowledge of the vital role of marketing within a firm and the necessary relationships between marketing and the other functional areas of business.
3. To acquire the knowledge of the various decision areas within marketing and the tools and methods used by marketing managers for making decisions.
4. To accumulate key marketing principles and terminology. Because this is a survey course, there is an emphasis on basic terminology and concepts.
5. To furnish the student the idea of the how a marketing perspective is important in personal and professional development.

Course Content:

Core concept of Marketing and Holistic marketing: Definition of Marketing, Needs, wants, demands, five core customer and market place concept, marketing management orientations, Holistic marketing concept, value, satisfaction, partner Relationship management, marketing process.

Company and Marketing Strategy, Marketing Environment, Marketing Information System: Definition of strategic planning, mission statement, business portfolio, portfolio analysis, The BGC growth-share matrix, Micro Environment Macro Environment, Definition of Marketing Information System, definition of Marketing Research, primary data, secondary data, and marketing research process.
Consumer Markets and Consumer Buying Behavior, Business Markets, Business Buying Behavior: Definition of consumer buyer behavior, consumer market, Model of consumer buyer behavior**,** Factors influencing consumer behavior, Buyer decision process, Definition of business buyer behavior, characteristics of business market, Definition of business buying process participants in the business buying process, Factors influences on Business buying process.

Designing a Customer-Driven Marketing Strategy, Product and Services: Concept of Market segmentation, Target Market, Market positioning**,** Variables used in segmenting consumer market, Target Marketing Strategy, Product, product levels, Types of consumer product, Define Brand, Brand Equity, services, characteristics of service, three types of marketing in service industry.
New product Development and Branding strategy: Definition of new product development, Major stages of new product development, Product life cycle.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Explaining what marketing is and how it's used. Identify the primary marketing activities of an organization.

CLO2 Recognizing market segments and target customers. Developing a marketing plan.

CLO3	Executing principles of ethics and social responsibility in marketing.
CLO4	Implementing marketing information and research to develop marketing strategies for organizations.
CLO5	Generating product marketing decisions based on product life cycle, use pricing, distributing, promoting and branding strategies to enhance marketing of products and services.

Mapping Course Learning Outcomes (CLOs) with the PLOs												
CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1									√			
CLO2							√					
CLO3											√	
CLO4									√			
CLO5							√					

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Core concept of Marketing and Holistic marketing	Lecture, Discussion, Interactive discussions, Questions and answers, Group discussion, Problem Solving	Assignment, Exam
CLO2	Company and Marketing Strategy, Marketing Environment, Marketing Information System	Lectures, Online Video, Questions and answers, Case Study, PowerPoint Demonstration.	Presentation, Assignment, Exam
CLO3	Consumer Markets and Consumer Buying Behavior, Business Markets, Business Buying Behavior	Lecture, Class work, Group Study, Problem Based Learning, Case Study	Presentation, Assignment
CLO4	Designing a Customer-Driven Marketing Strategy, Product and Services	PowerPoint Demonstration, Case study analysis, Online Video, Problem Based Learning	Class Test, Assignment, Exam
CLO5	New product Development and Branding strategy	Lectures, Group Study for Data Analysis, Questions and answers, Case Study, Group discussion	Written test, Presentation, Exam

Books Recommended:

1. *Kotler, Philip. (1991). Principles of marketing. Englewood Cliffs, N.J. :Prentice Hall,*
2. *Kotler, Philip, Armstrong, Gary, Opresnik, Marc Oliver. (2018). Principles of marketing 17th ed. (17th ed., Global Ed.). Harlow: Pearson.*

Course Code: MIS 435, Course Title: Management Information Systems

Course Code (BNQF): CSE-0611-435

Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** General

Pre-requisites (if any**):** None

Rationale:

This course provides the background necessary for understanding the role of information systems in organizations and for using computer tools and technology in solving business problems. This course is offered to the student students of the 1st year to get them familiar with the basic concepts of management information system.

Course Objectives:

1. To provide necessary knowledge about managerial perspective of information systems and what role they play in an organization.
2. To develop skills on modern technologies and how organizations can use these technologies for their growth.

Course Content:

Introduction: IS and IT

Complimentary Assets: Organizational Capital and The Right Business Mode, Contemporary Approaches to Information Systems, Contemporary Approaches to Information Systems

IT is Business and Management: Business Processes and Information Systems, Customer Relationship Management (CRM), Supply Chain Management (SCM); Enterprise Systems

IT and IS in organizations: Evolving role of IS in organization

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Recognize the roles of Information Systems.

CLO2 Recall various types of information systems at various levels of the organizations.

CLO3 Memorize how to build an information system based on user requirements.

CLO4 Estimate the strategic role of information systems and information technology in organizations.

Mapping Course Learning Outcomes (CLOs) with the PLOs

CLO	**PLO**											
	PLO1	POL2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3											√	
CLO4									√			

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Introduction	Lecture, Interactive discussions, Questions and answers	Class Test
CLO2	Complimentary Assets	Lecture, Discussion, Problem Solving	Assignment, Written Test
CLO3	IT is Business and Management	Lecturing, Discussion, Classwork	Assignment
CLO4	IT and IS in organizations	Lecture, Problem Solving	Class Test, Written test

Books Recommended:

1. *Management Information Systems by James O'Brien.*
2. *Strategic Management of Information Systems by Keri E. Pearlson, Carol S. Saunders.*
3. *Strategic Planning for Information Systems, by John Ward, Joe Peppard.*

Course Code: ENG 101, Course Title: Composition

Course Code (BNQF): CSE-0231-101
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** General
Pre-requisites (if any**):** None

Rationale:

This course provides students with the theoretical foundations that prepare them for the demands of academic and professional English writing. By learning and practicing the strategies and processes for a student, this course will help him/her to be a successful writer to accomplish his/her purpose of life. The content is designed to prepare B.Sc. (Engg.) students not only for academic communication but also realize professional and personal goals. This is one of the core-curriculum course prepared for the students to help them to increase their efficacy in communicative acts and writing skills.

Course Objectives:

1. To facilitate the necessary knowledge of image various methods for critical thought, for the development of ideas, for the arrangement of those ideas to achieve a specific rhetorical goal, for the application of an appropriate style, and for revision and editing.
2. To Distinguish the ways of language and communication shape experience; construct meaning, and foster community.
3. To Differentiate rhetorical contexts and use such descriptions to increase the efficacy of communicative acts.
4. To Correlate the forms and conventions of academic writing, particularly the forms and conventions of argumentative and analytical writing.
5. To Generalize texts that demonstrate an understanding of how purpose, process, subject matter, form, style, tone, and diction are shaped by particular audiences and by specific communicative constraints and opportunities.

Course Content:

Introduction to parts of speech, tense and conditional sentences: Parts of Speech along with its classifications, Article and Tense, Conditional and Completing Sentence.
Voice: Analyze articles, punctuation marks, sentence structure and both active and passive voices in sentences.
Completing Sentences, Suffix-Prefix and Preposition: Confusing Words, Misspelling and Paragraph Writing, Suffix, Prefix, Preposition.
Transformation of Sentences, Change of Degree: Sentence, Transformation of Sentence and Change of Degree.
Linkers, Punctuation: Linkers, Punctuation and Capitalization and Composition Development.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Learn proper uses of all kinds of parts of speech, tense and conditional sentences.

CLO2 Analyze articles, punctuation marks, sentence structure and both active and passive voices in sentences.

CLO3 Solve completing sentence, homophones, misspelling and common mistakes in English.

CLO4 Apply word formation, transformation of sentence and change of degree in sentences.

CLO5 Identify linkers, punctuation, capitalization and paragraph- composition development.

Mapping Course Learning Outcomes(CLOs) with PLOs												
CLO	**PLO**											
	PLO 1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO1 0	PLO1 1	PLO1 2
CLO1						√						
CLO2						√						
CLO3						√						
CLO4						√						
CLO5						√						

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Introduction to parts of speech, tense and conditional sentences	Lecture, Discussion, Interactive discussions, Questions and answers, Group discussion, Problem Solving	Assignment, Exam
CLO2	Voice	Lectures, Online Video, Questions and answers, Case Study, Powerpoint Demonstration.	Presentation, Assignment, Exam
CLO3	Completing Sentences, Suffix-Prefix and Preposition	Lecture, Class work, Group Study, Problem Based Learning, Case Study	Presentation, Assignment
CLO4	Transformation of Sentences, Change of Degree	PowerPoint Demonstration, Case study analysis, Online Video, Problem Based Learning	Class Test, Assignment, Exam
CLO5	Linkers, Punctuation	Lectures, Group Study for Data Analysis, Questions and answers, Case Study, Group discussion	Written test, Presentation, Exam

Books Recommended:

1. *Wren and Martin., "High School English Grammar", 1st Ed. 2019, S Chand & Co Ltd., 2013.*
2. *Raymond Murphy "Intermediate English Grammar", 75th Reprint, Cambridge University Press, 2014.*

Course Code: ENG 106, Course Title: Freshman English – II

Course Code (BNQF): CSE-0231-106
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** General
Pre-requisites (if any**):** None

Rationale:

This course is the second course in a two-semester sequence of Composition courses. It is an advanced writing and reading course dealing with logic in thought and communication. Because skills in the areas of reading comprehension, writing, listening, thinking, grammar (usage, mechanics), and appreciation of literature through the theme identity is essential for the students. The student of B. Sc. (Engg.) program will learn this course that emphasize on reasoning and argument, research skills, and sophistication of style in writing. This course satisfies a general education requirement in the Communications Area.

Course Objectives:

1. To develop research and writing that aims to expose students to writing and research methods and across the disciplines from psychology to social history to English literature.
2. To integrate academic and interdisciplinary reading, writing, and thinking into your own research so that, as you continue your studies, you can write more skillfully and critically about the various subject matters that impact your life and learning
3. To analyze and describe rhetorical contexts and use such descriptions to increase the efficacy of communicative acts.

Course Content:

Reading Techniques: scanning, skimming, detailed reading, active reading, reading comprehension, vocabulary, question answer, summary writing, flow chart, rearranging.
Writing techniques: expository writing, descriptive writing, narrative writing, writing paragraph, amplification writing, critical writing, letter writing, application writing.
Writing skills: Essay writing, Job application writing, Cover letter, Report writing, thesis writing.
Grammar: tenses, use of idioms, prepositions, modals, conditional sentence, use of linking words, use of suffixes and prefixes, synonyms and antonyms.

Listening: watching videos, speeches, movies, pair work, group work, presentation, error finding, and correction.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1	Interpret appropriate study skills for annotation, note taking, completion of assignments, and reflective journal writing.
CLO2	Analyze variety of reading strategies to foster comprehension and to construct personally meaningful and culturally relevant connections to the text.
CLO3	Generalize writing process and demonstrate the ability to write clear sentences and construct paragraphs and essays that effectively make use of supporting details, examples, and evidence.
CLO4	Apply listening ability to revise in stages and to discover errors and correct them.
CLO5	Construct individual perspectives in essays that demonstrate critical thinking skills, logical organization, and command of standard grammar.

Mapping Course Learning Outcomes(CLOs) with PLOs												
CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1						√						
CLO2						√						
CLO3						√						
CLO4						√						
CLO5						√						

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Reading Techniques	Lecture, Discussion, Interactive discussions, Questions and answers, Group discussion, Problem Solving	Assignment, Exam
CLO2	Writing techniques	Lectures, Online Video, Questions and answers, Case Study, PowerPoint Demonstration.	Presentation, Assignment, Exam
CLO3	Writing skills	Lecture, Class work, Group Study, Problem Based Learning, Case Study	Presentation, Assignment
CLO4	Grammar	PowerPoint Demonstration, Case study analysis, Online Video, Problem Based Learning	Class Test, Assignment, Exam
CLO5	Listening	Lectures, Group Study for Data Analysis, Questions and answers, Case Study, Group discussion	Written test, Presentation, Exam

Books Recommended:

1. *Simon Greenall, Michael Sawn "Effective Reading Student's Book", Illustrated,reprint, Cambridge University Press 1986.*
2. *L. G. Alexander "Fluency in English", 5th Ed., Longman, 1975.*

Course Code: MATH 115, Course Title: Differential Calculus & Co-ordinate Geometry

Course Code (BNQF): CSE-0541-115
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** General
Pre-requisites (if any**):** None

Rationale:

The course will provide an understanding of the basic concepts of differential calculus and coordinate geometry. So that students can apply the knowledge of calculus and geometry to translate a practical problem involving some real-life applications into mathematical problem and solve it by mean of calculus and geometry. Emphasize has been given on problems involving areas, volumes, sequences, series and power series.

Course Objectives:

1. To learn the concepts of the derivative and its underlying concepts such as limits and continuity.
2. To learn to calculate derivative for various type of functions using definition and rules.
3. To solve the problems related to the pair of straight lines, circles, system of circles, parabola, ellipse etc.

Course Content:

Course Contents:
Differential Calculus: Limit, Continuity and differentiability, Successive Differentiation of various types of function, Liebnitz's theorem, Roile's theorem, Mean value theorem, Taylor's theorem in finite and infinite form, Mac laurine's theorem's in finite and infinite form, Lagrange's form of remainders, Cauchy's form's of remainder's, Expansion of function, Evaluation of function - of Hospitals rule, Partial- Differentiation, Euler's theorem, Tangent and Normal, Suhtangent and abnormal in Cartesian and polar co-ordinates, Determination of minimum and maximum values of 'unction and point of inflexion, Applications, Curvature, Radius of Curvature, Center of curvature.
Coordinate Geometry: Changes of axes, Pair of straight line, System of circle, Ellipse Parabola.

Course Outcomes (CLO):

CLO1	Define the basic concepts of differential calculus and geometry.
CLO2	Describe what happens to objects when a dimensional shipment occurs.
CLO3	Determine the trend of change of a function with respect to different independent variables.
CLO4	Characterize and calculate the extreme values of functions.
CLO5	Conclude the rate of change of shape of different standard particles and draw the geometrical figure through their equations.

Mapping between Course Learning Outcomes and Program Learning Outcomes:												
CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3	√											
CLO4	√											
CLO5	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLO	**Contents**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1, CLO2, CLO3	Differential Calculus	Lecture, Discussion	Class performances, class test, assignment
CLO4, CLO5	Coordinate Geometry	Lecture, Discussion	Class performances, class test, assignment

Books Recommended:

1. Stewart, J., Clegg, D.K. and Watson, S., 2020. *Calculus: early transcendentals*. Cengage Learning.
2. Bird, J., 2014. *Engineering mathematics*. Routledge.
3. Dass, H.K., 2008. *Advanced engineering mathematics*. S. Chand Publishing.
4. Eisenhart, L.P., 2005. *Coordinate geometry*. Courier Corporation.

Course Code: MATH 125, Course Title: Integral Calculus and Vector Analysis

Course Code (BNQF): CSE-0541-125
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** General
Pre-requisites (if any**):** None

Rationale:

The course helps the students to understand the concept of integration and its application to physical problems such as evaluation of areas, volume of revolution, force and work. The purpose of the course is to provide an understanding of the basic relations of vector analysis, to demonstrate practical applications of vector analysis and to train the student in problem formalization and in methods of solution

Course Objectives:

1. Identify integration through the use of the fundamental formulas and for the various techniques of integration for both single and multiple integrals.
2. Evaluate the divergence and the curl physically and apply these operators to carry out surface and line integration.
3. Create and analyze mathematical models of integration in solving problems involving evaluation of arc lengths, areas, volumes, work and force.
4. Apply the three fundamental theorems of the vector analysis, viz. Gauss', Green's and Stokes' theorems.

Course Content:

Integral Calculus: Definitions of integration, integration of method of substitution, integration by parts, Standard integrals, Integration by the method of successive reduction, Definite integrals, its properties and use in summing series, Walli's formula, Improper integrals, Beta function and Gamma function, Area under a plane curve in Cartesian and polar co-ordinates, Trapezoidal rule, Simpson's rule, arc lengths of curves in Cartesian and polar co-ordinates, parametric and pedal equation, Intrinsic equation, Volumes. of solids of revolutions by shell method, Area of surface revolution.

Vectors Analysis: Scalars and vectors, equality of vectors, Addition and subtraction of vectors, Multiplication of vectors by scalars, Scalar and vectors product of two vectors and their geometrical interpretation, Triple products and multiple products, Linear dependence and independence of vectors together with elementary application, definition of line, surface and volume integrals, Gradient, divergence and curl of point function, -Various formulae, Gauss's theorem, Stroke's , theorem, Green's theorem.

Course Learning Outcomes (CLO):

CLO1	Define the definition of indefinite and definite integrals, recall integration by substitution, Define the natural logarithmic, natural exponential, general exponential, general logarithmic functions and their integrals.
CLO2	Study the definition of improper integrals, Define the polar system of coordinates, Outline the method of finding area of plane regions using polar coordinates.
CLO3	Examine improper integrals for convergence, calculate volume by both washers and cylindrical shells methods, calculate areas of plane regions and arc length using polar coordinates
CLO4	Conclude the divergence and the curl physically and apply these operators to carry out surface and line integration by means of Gauss and Stokes's theorems, Identify the most appropriate coordinate system for a given problem and apply the gradient, the divergence and the curl in the selected coordinate system.
CLO5	Acquire vector algebra and use the gradient of scalar field to solve elementary problems in physics, carry out line, surface and volume integration as well as differentiation of scalar and vector fields.

Mapping between Course Objectives and Program Objectives:												
CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PO12
CLO1	√											
CLO2	√											
CLO3	√											
CLO4	√											
CLO5	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLO	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1, CLO2, CLO3	Integral Calculus	Lecture, PPT Demonstration, Group discussion	Class performances, class test, assignment
CLO4, CLO5	Vectors Analysis	Lecture, PPT Demonstration, Group discussion	Class performances, class test, Assignments

Books Recommended:

1. Anton, H., Calculus Early Transcendentals Combined 9e Anton Bivens Davis Solutions Manual And Test Bank PDF.
2. Spiegel, M.R., 1974. *Vector Analysis and an Introduction to Tensor Analysis SI (metric) Edition*. Schaum Publishing Company.
3. Das, B.C. and Mukherjee, B.N., 1996. Integral calculus—differential equations. *UN Dhur & Sons Pvt. Ltd, Kolkata*.

Course Code: MATH 135, Course Title: Discrete Mathematics

Course Code (BNQF): CSE-0613-135
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any): None

Rationale:

This course enables students to strengthen and increase the understanding of discrete mathematics with special emphasis on computer science applications. It is offered to the 1st year students to escalate their knowledge on discrete mathematics.

Course Objectives:

1. To provide basic knowledge of mathematical logic for analyzing propositions and proving theorems.
2. To develop skills to use sets for solving applied problems, and use the properties of set operations algebraically.
3. To work with relations and investigate their properties.
4. To investigate functions as relations and their properties.
5. Getting idea about concepts of graph, digraphs and trees.

Course Content:

Set, Functions, Relations: Set, Set Operation, Functions, Relations and Their Properties, n-ary Relations and Their Applications, Representing Relations, Closures of Relations, Equivalence Relations, Partial Orderings.
Propositional Calculus: Propositions, Predicate and Quantifier.
Algorithms: Complexity, Divisions, Algorithm, Application of Number Theory.
Recursion: Sequences and summations, Recursive Definition and algorithm.
Combinatorial Analysis: Permutation and Combination, Divide and Conquer Algorithms, Generating Functions, Inclusion-Exclusion.
Graphs: Representation, Isomorphism, Connectivity, Euler and Hamilton path, shortest path, Planarity, Coloring.
Trees: Introduction to Trees, Application of Trees, Tree Traversal, Spanning Trees, Minimum Spanning Trees
Mathematical Induction: Mathematical Induction, Recursive Definitions and structural Induction, Strong Induction.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Demonstrate the use of propositional logics and predicate logics.

CLO2 Determine the concepts of Set, Functions and Number Theory.

CLO3 Understand Graph and Tree related problems and apply algorithms to solve various problems (shortest path, graph coloring, spanning trees etc.)

CLO4 Apply basic definitions, facts, and notation for commonly used discrete math

Mapping Course Learning Outcomes(CLOs) with PLOs												
CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3			√									
CLO4			√									

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Propositional Calculus	Lecture, Interactive discussions, Questions and answers	Class Test, Assignment, Exam
CLO2	Set, Functions, Relations, Number Theory,	Lecture, Discussion, Problem Solving	Class Test, Assignment, Exam
CLO3	Graphs, Trees, Algorithms, Recursion, Combinatorial Analysis	Lecture, Problem Solving	Written test, Exam
CLO4	Mathematical Induction	Lecture, Discussion, Problem Solving	Class Test, Assignment, Exam

Books Recommended:

1. *Kenneth H. Rosen, "Discrete Mathematics and its Applications", 7th Edition, McGraw Hill, 2012.*
2. *R. Johnsonbaugh, "Discrete Mathematics", 5th edition, Prentice Hall.*
3. *Seymour Lipschutz and Marc Lipson, "Schaum's Outline of Discrete Mathematics", 3rd edition, McGraw-Hill.*

Course Code: MATH 215 Course Titles: Linear Algebra

Course Code (BNQF): CSE-0541-215
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** General
Pre-requisites (if any): None

Rationale:

This course covers matrix theory and linear algebra, emphasizing topics useful in other disciplines. The concepts of linear algebra are useful in physics, economics and social sciences, natural sciences, and engineering. The aim of the linear algebra is that learners should be provided with a conceptual background which empowers them to make rational sense of elementary linear algebra.

Course Objectives:

1. To explain the characteristics of matrix theory and linear algebra.
2. To provide a physical interpretation of the matrices and system of linear equations.
3. To apply matrices in solving engineering problems.

Course Content:

Systems of Linear Equations: Introduction to systems of linear equations, Gaussian elimination

Vector Spaces: Introduction, Vector Spaces, Examples of Vector Spaces, Linear Combinations, Spanning Sets, Subspaces, Linear Spans, Row Space of a Matrix, Linear Dependence and Independence, Basis and Dimension, Application to matrices, Rank of a matrix, Sums and direct sums, coordinates.

Linear Mappings and Matrices: Introduction, Matrix Representation of a Linear Operator, Change of Basis, Similarity, Matrices and General Linear Mappings.

Diagonalization: Eigenvalues and Eigenvectors: Introduction, Polynomials of Matrices, Eigenvalues and Eigenvectors, Computing Eigenvalues and Eigenvectors.

Course Learning Outcomes (CLO):

CLO1 Define the basic concepts of matrices.

CLO2 Illustrate the use of determinants

CLO3 Develop techniques to classify and solve linear systems of equations

CLO4 Explore the concept of orthogonality in vector spaces

CLO5 Compute eigen values and eigenvectors of matrices

Mapping between Course Learning Outcomes (CLO)and Program Learning Outcomes (PLO):												
CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO 2	√											
CLO 3	√											
CLO 4	√											
CLO 5	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLO	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1, CLO2, CLO3, CLO4	Systems of Linear Equations, Vector Spaces	Lecture, PPT, Discussion	Class performances, Assignments, Class Test
CLO1, CLO2, CLO3, CLO5	Linear Mappings and Matrices, Diagonalization: Eigenvalues and Eigenvectors	Lecture, PPT, Discussion	Class performances, Assignments, Class Test

Books Recommended:

1. Strang, G., Strang, G., Strang, G. and Strang, G., 1993. *Introduction to linear algebra* (Vol. 3). Wellesley, MA: Wellesley-Cambridge Press.

2. Lipschutz, S. and Lipson, M.L., 2013. *Schaum's Outline of Linear Algebra*. McGraw-Hill Education.

3. Lay, D.C., 2003. *Linear algebra and its applications*. Pearson Education India.

4. Dass, H.K., 2008. *Advanced engineering mathematics*. S. Chand Publishing.

Course Code: STAT 235, Course Title: Statistics

Course Code (BNQF): CSE-0542-235
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** General
Pre-requisites (if any): None

Rationale:

This is an introductory course in statistics designed to provide students with the basic concepts of data analysis and statistical computing. The main objective is to provide students with pragmatic tools for assessing statistical claims and conducting their statistical analyses. Statistical knowledge helps the engineering students to use the proper methods to collect the data, employ the correct analyses, and effectively present the results for future decision-making.

Course Objectives:

1. To understand the basic concepts of statistics and apply them in the practical field of Engineering.
2. To Apply statistical techniques using descriptive and inferential statistics for analysis of data.
3. To draw a better conclusion on hypothesis testing.
4. To study the key concept of probability and probability distribution.
5. To apply different sampling methods for identifying a valid estimate.

Course Contents:

Basic Statistics: Introduction to Statistics, Important concepts, Role of Statistics in computer science engineering, etc. Frequency distribution: Frequency distribution for qualitative and quantitative data, Representation: Graphical representation for qualitative and quantitative data, Explanation of various charts and graphs. Measures of central tendency: Introduction of central tendency, characteristics of a good measure of central tendency, Mean, median mode calculation of discrete and continuous variables with their merits and demerits. States different types of quantiles. Measures of dispersion: absolute and relative measures, characteristics of good measures, range, mean deviation, Variance and standard deviation, Quartile deviation, Coefficient of variation, Mathematical calculation of different measures and their applications.
Correlation and Regression analysis: Correlations, Simple correlation, Scatter Diagram, Karl-Pearson correlation coefficient, rank correlation: Rank correlation, the Rank correlation for tied observations. Regression analysis: Simple linear regression model, Estimation of the regression parameters, Method of least squares, Error of random variable, Coefficient of determination.
Introduction to probability: Sets and probability, Random variable: Random variable and its probability distribution binomial Distribution, Poisson distribution, Continuous probability distribution: Normal distribution, Standard normal distribution.
Test of hypothesis: Concepts of Hypothesis Testing, Test concerning the mean of a normal population, testing equality of means of two normal populations, Test concerning the variance of normal distribution, Statistical significance, t-test, Chi-square test, Test of goodness of fit. Sampling methods: Types of probability and non-probability sampling methods. Parameter estimation: Parameter estimation, Point estimation, interval estimation, Sample size determination, Confidence Interval. Analysis of variance: One-way analysis of variance, Two-factor analysis of variance.

Course Learning Outcomes (CLO):

CLO1 Explain the basic concepts of statistics in different areas of computer science and engineering.

CLO2 Describe the data using descriptive and inferential statistics.

CLO3 Explain the basic laws of probabilities, random variable, and their probability distributions.

CLO4 Discuss different types of sampling techniques and their estimation.

CLO5 Interpret various hypotheses to conclude about the population.

Mapping between Course Learning Outcomes (CLOs) and Program Learning Outcomes (PLOs):												
CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PO12
CLO1	√											
CLO2	√											
CLO3	√											
CLO4	√											
CLO5	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topic**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Introduction to Statistics & Frequency distribution	Lecture, Discussion	Interactive Discussion Class performances, Assignments
CLO1 CLO2	Measures of central tendency& Measures of dispersion	Lecture, Discussion Problem Solving	Problem Solving & Class Test
CLO2	Correlation analysis & Regression analysis	Lecture, Discussion, Problem Solving	Performances, Quizzes And Assignment
CLO3	Introduction to probability, Random variable, Discrete and Continuous probability distribution	Lecture, Discussion Problem Solving	Class performances,
CLO4 CLO5	Test of hypothesis, Test of goodness of fit	Lecture, Discussion Problem Solving	Presentation, Class Test & Assignments
CLO5	Sampling methods, Parameter estimation Interval and Analysis of variance	Lecture, Discussion	Performances, Quizzes

Books Recommended:

1 *Business Statistics by Roy, M.K., Paul, J.C. and Roy, D.C. 2nd edition, 2017.*

2 *Fundamentals of Mathematical Statistics (A Modern Approach) by Gupta, S.C. and Kapoor, V.K. 10th edition 81-7014-791-3, Sultan Chand & Sons. New Delhi, 2000.*

3 *Introduction to Probability and Statistics by Mendenhall, W., Beaver, R.J. and Beaver, B.M, 97-8133-75582-80,Cengage Learning, 15th edition 2012.*

4 *Statistical techniques in business & economics by Lind, D.A., Marchal, W.G. and Wathen, S.A, 978-0-07-340180-5, New York, NY: McGraw-Hill/Irwin, 15th edition 2012.*

5 *Fundamental of probability and probability distribution, by Roy, M.K., Paul, J.C. and Roy, D.C. 4th edition, 2017.*

Course Code: MATH 315, Course Title: Complex Variable and Laplace Transform

Course Code (BNQF): CSE-0541-315
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** General
Pre-requisites (if any): None

Rationale:

This course is intended to prepare the students with mathematical tools and techniques that are required in advanced courses offered in the engineering programs. In particular, students will acquire the skill of contour integration to evaluate complicated real integrals via residual calculus and able to apply transforms to solve differential equations.

Course Objectives:

1. To understand the functions of complex variables, continuity, differentiability and elementary transformation concepts in complex variable
2. Evaluate complex contour integrals directly and by the fundamental theorem, apply the Cauchy integral theorem in its various versions, and the Cauchy integral formula, and Represent functions as Taylor, power and Laurent series, classify singularities and poles, find residues and evaluate complex integrals using the residue theorem.
3. Understand Laplace transform and Inverse transforms of elementary functions and prove their properties, find differentiation and integration of Laplace transform and converse, prove Shifting Property for inverse Laplace transforms and evaluate integral by convolution theorem.
4. To equip students with the concepts of differential equations and how to solve with Laplace.

Course Content:

Complex Variable: Complex number system, General functions of a complex variable, Limit and continuity of a function of complex variable and related theorems, Complex differentiation and the Cauchy-Rieman equations, Mapping by elementary functions, Line integral of a complex function, Cauchy's integral theorem, Tailor's and Laurrent's theorems, Singular points, Residue, Cauchy"s residue theorem, Evaluation of residue, Contour integration, Conformal mapping.

Laplace transform: Definition, Laplace of some elementary functions, Sufficient conditions for instance of laplace transforms, Inverse laplace transforms, laplace transforms of derivatives, the nth step function, Periodic function, some special theorems of laplace transforms, Partial fraction, isolation of differential equation by laplace transform, Evaluation of improper integral.

Course Learning Outcomes (CLO):

CLO1	State complex numbers algebraically and geometrically and compute limit, variable, and continuity for complex functions as well as consequences of continuity
CLO2	Illustrate the concept and consequences of analyticity and the Cauchy-Riemann equations and of results on harmonic and entire functions including the fundamental theorem of algebra
CLO3	Determine complex contour integrals directly and by the fundamental theorem, apply the Cauchy integral theorem in its various versions, and the Cauchy integral formula, and Represent functions as Taylor, power and Laurent series, classify singularities and poles, find residues and evaluate complex integrals using the residue theorem.
CLO4	Determine Laplace transforms and inverses
CLO5	Employ the Laplace transforms to solve differential and integral equations.

Mapping between Course Objectives and Program Objectives:													
CLO	**PLO**												
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PO12	PLO13
CLO1	√												
CLO2	√												
CLO3	√												
CLO4	√												
CLO5	√												

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLO	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1, CLO2, CLO3	Complex Variable	Lecture, PPT, Group Discussion	Class performances, Class Test, Assignments
CLO4, CLO5	Laplace transform	Lecture, Discussion, Group study for problem analysis	Class performances, Class Test, Assignments

Book Recommend:

1. Jeffrey, A., 2005. *Complex analysis and applications*. Chapman and Hall/CRC.
2. Spiegel, M.R., 1965. *Laplace transforms*. New York: McGraw-Hill.
3. Dass, H.K., 2008. *Advanced engineering mathematics*. S. Chand Publishing.

Course Code: MATH 325, Course Title: Differential Equations and Fourier Analysis

Course Code (BNQF): CSE-0541-325
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** General
Pre-requisites (if any): None

Rationale:

The course will demonstrate the usefulness of ordinary and partial differential equations for modeling physical and other phenomena. Finally, the Fourier analysis including the Fourier transform, the Fourier series, and the discrete Fourier transform will be covered along with applications in signal processing, data communication, control engineering etc.

Course Objectives:

1. Identify the type of a given differential equation and select and apply the appropriate analytical technique for finding the solution of first order and selected higher order ordinary differential equations
2. Evaluate first order differential equations including separable, homogeneous, exact, and linear
3. Create and analyze mathematical models using first order differential equations to solve application problems such as circuits, mixture problems, population modeling, orthogonal trajectories, and slope fields.
4. To equip students with the concepts of partial differential equations and how to solve linear Partial Differential with different methods. Students also will be introduced to some physical problems in Engineering models that results in partial differential equations.

Course Content:

Differential Equations: Degree and order of ordinary differential equation, Formation of differential equation, Solution of first order differential equation by various methods, Solution of general linear equations of second and higher order with constant co-efficient, Solution of homogenous linear equations. Solution of differential' equations of the higher order when the dependent and independent variables are absent. Solution of differential equation by the method based on the factorization of the operations.

Fourier Analysis: Fourier series and co-efficient, Convergence of Fourier series, Real and complex form, Finite transform, Fourier integral, Fourier transform and their uses in solving boundary value problems.

Course Learning Outcomes (CLO):

CLO1	Study first order differential equations including separable, homogeneous, exact, and linear.
CLO2	Discuss existence and uniqueness of solutions and solve second order and higher order linear differential equations with constant coefficients.
CLO3	Characterize mathematical models using higher order differential equations to solve application problems and determine solutions to second order linear homogeneous differential equations
CLO4	Assess differential equations of the higher order, differential equation by the method based on the factorization of the operations and Frobenius method.
CLO5	Analysis both real and complex forms of the Fourier series for standard periodic waveforms and the Fourier transform of elementary functions from the definition. Derive the solution of boundary value problems using the Fourier transforms.

Mapping between Course Learning Outcome (CLO) and Program Learning Outcome (PLO):												
CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PO12
CLO1	√											
CLO2	√											
CLO3	√											
CLO4	√											
CLO5	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLO	**Contents**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1, CLO2, CLO3, CLO4	Differential Equations	Lecture, Discussion	Class performances, Class Test, Assignments
CLO5	Fourier Analysis	Lecture, Discussion	Oral and Presentation, Class Test

Books Recommended:

1 Bronson, R., 2003. *Differential Equations [: Based on Schaum's Outline of Theory and Problems of Differential Equations, by Richard Bronson*. Tata McGraw-Hill Education.

2 Zill, D.G., 2012. *A first course in differential equations with modeling applications*. Cengage Learning.

3 Bali, N.P., 2006. *Golden Differential Equations*. Firewall Media.

4 Spiegel, M.R., 1974. Schaum's Outline of theory and problems of Fourier analysis. *Schaums's outline series*, *22*.

5 Dass, H.K., 2008. *Advanced engineering mathematics*. S. Chand Publishing.

Course Code: MATH 335, Course Title: Mathematical and Probabilistic Analysis

Course Code (BNQF): CSE-0613-335
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any**):** None

Rationale:

The main focus of this course is to introduce the relation between probability and statistics in a curriculum, conceptual difficulties with learning probability, statistical data analysis through stochastic analysis. This course will also provide an insight about different mathematical notations, number series, mathematical problems such as divisibility, prime, relative primality as well as sums and recurrences etc. This course will also provide a depth knowledge of stochastic process through the study of random variables, discrete and continuous probability with probability distribution functions(PDFs) and their real applications. Alongside, this course will provide an introductory basis for describing the evolution of observable events using hiddem markov models. This comprehensive course is designed for undergraduate students to address the future research challenges that have been faced through the proper study of statistical and mathematical analysis as well as the stochastic processes. This course will satisfy a 100-level requirement for courses in computer science and engineering for undergraduate majors.

Course Objectives:

1. To facilitate necessary knowledge about the basic mathematical notations, different generating functions, and mathematical induction.
2. Helping the students to develop ability in statistical and mathematical analysis of a problem such as the study of discrete and continuous probability.

Course Content:

The Tower of Hanoi, Lines in the Plane, The Josephus Problem,
Notation, Sums and Recurrences, Manipulation of Sums, Multiple Sums,
General Methods, Finite and Infinite Calculus, Infinite Sums,
Divisibility, Primes, Prime Examples, Factorial Factors,
Relative Primality, ‘mod': The Congruence Relation,
Independent Residues, Additional Applications, Phi and Mu,
Basic Identities, Basic Practice, Tricks of the Trade, Generating Functions,
Hypergeometric Functions, Hypergeometric Transformations, Partial Hypergeometric Sums, Mechanical Summation,
Stirling Numbers, Eulerian Numbers, Harmonic Numbers,
Harmonic Summation, Bernoulli Numbers, Fibonacci Numbers,Continuants,
Domino Theory and Change, Basic Maneuvers, Solving Recurrences,
Special Generating Functions, Convolutions, Exponential Generating Functions, Dirichlet Generating Functions,
Discrete Random Variables, Continuous Random Variables, Expectation of a Random Variable, Jointly Distributed Random Variables, Moment Generating Functions,
Introduction, Chapman–Kolmogorov Equations,Classification of States,
Reversible Markov Chains, Markov Chain Monte Carlo Methods,
Limiting Probabilities,Mean Time Spent in Transient States, Branching Processes,
Markov Decision Processes, Hidden Markov Chains,
Queuing models, open and closed Queuing network,
Application of Queuing model.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1	Recall the mathematical technique used for the algorithm, the usage and meaning of basic formulas in discrete mathematics.
CLO2	Analyze specific problems by utilizing learned knowledge.
CLO3	Apply experience in using various techniques of mathematical induction (weak, strong, and structural induction) to prove simple mathematical properties of a variety of discrete structures
CLO4	Apply key concepts of probability, including discrete and continuous random variables, probability distributions, conditioning, independence, expectations, and variances
CLO5	Evaluate the different statistical distributions (e.g., Reversible Markov Chains, Markov Decision Processes, Hidden Markov Chains) and the typical phenomena that each distribution often describes.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

CLO	PLO											
	PLO1	PLO2	PLO3	PLO 4	PLO5	PLO6	PLO7	PLO 8	PLO9	PLO1 0	PLO1 1	PLO1 2
CLO1	√											
CLO2		√										
CLO3					√							
CLO4					√							

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

CLOs	Topics	Teaching-Learning Strategy	Assessment Strategy
CLO1	The Tower of Hanoi, Lines in the Plane, The Josephus Problem, Notation, Sums and Recurrences, Manipulation of Sums, Multiple Sums, General Methods, Finite and Infinite Calculus, Infinite Sums, Divisibility, Primes, Prime Examples, Factorial Factors, Relative Primality, 'mod': The Congruence Relation,	Lecture, Discussion, Interactive discussions, Questions and answers, Problem Solving	Class Test, Assignment, Exam
CLO2	Independent Residues, Additional Applications, Phi and Mu, Basic Identities, Basic Practice, Tricks of the Trade, Generating Functions, Hypergeometric Functions, Hypergeometric Transformations, Partial Hypergeometric Sums, Mechanical Summation,	Lecture, Discussion, Interactive discussions, Questions and answers, Problem Solving	Presentation, Assignment
CLO3	Domino Theory and Change, Basic Maneuvers, Solving Recurrences, Special Generating Functions, Convolutions, Exponential Generating Functions, Dirichlet Generating Functions,	Lecture, Group work, Problem Solving,	Class Test, Assignment, Exam
CLO4	Discrete Random Variables, Continuous Random Variables, Expectation of a Random Variable, Jointly Distributed Random Variables, Moment Generating Functions, Introduction, Chapman–Kolmogorov,	Case study analysis, Problem Based Learning, Tutorials	Written test, Presentation, Exam

	Equations,Classification of States,		
CLO5	Reversible Markov Chains, Markov Chain Monte Carlo Methods,Limiting Probabilities,Mean Time Spent in Transient States, Branching Processes, Markov Decision Processes, Hidden Markov Chains, Queuing models, open and closed Queuing network, Application of Queuing model.	Problem Based Learning, Problem Based Sessions, Case study analysis	Written test, Presentation, Exam

Books Recommended:

1. *Ronald L. Graham, Donald E. Knuth and Oren Patashnik, Concrete Mathematics, Published by Addison-Wesley, 2nd Edition.*
2. *Sheldon M. Ross, Introduction to Probability Models, Published by Elsevier, 9th Edition, 2007*
3. *Donald Knuth, The Art of Computer Programming (Volume 1), Published by Addison-Wesley-1997*

Course Code: MATH 415, Course Title: Numerical Methods

Course Code (BNQF): CSE-0541-415
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** General
Pre-requisites (if any**):** MATH 215

Rationale:

This course is an introduction to a broad range of numerical methods for solving mathematical problems that arise in Science and Engineering. The goal is to provide a basic understanding of the derivation, analysis, and use of these numerical methods, along with a rudimentary understanding of finite precision arithmetic and the conditioning and stability of the various problems and methods.

Course Objectives:

1. To introduce and develop the different mathematical methods
2. To develop and apply the appropriate numerical techniques for certain problem, interpret the results, and assess accuracy.

Course Content:

Finite Difference: Finite difference, Forward difference, backward difference, Central difference, Difference of polynomial, Factorial Notation
Solution of Algebraic and Transcendental Equations: Bisection Methods, Method of Successive Approximation, Methods of False Position, Newton Raphson Method, Descarde's Rule of sign.
Simultaneous Linear Algebraic Equations: Gauss Elimination Method, Gauss Jordan Method, Method of Factorizations, Crout's Methods, Iterative Methods, Gauss Seidel Iteration Methods, Jacobi Method of Iteration.
Interpolation : Gregory Newton's forward interpolation formula, Gregory Newton's backward interpolation formula ,Equidistance Term with one or more missing values, Gauss's forward interpolation formula, Gauss's backward interpolation formula, Sterling's formula, Bessel's formula, Properties of Divided difference formula, Newton's Divided difference formula, Lagrange's formula.
Numerical Differentiation: Derivatives using Gregory Newton's forward interpolation formula, Derivatives using Gregory Newton's backward interpolation formula, Derivatives using Newton's Divided difference formula, Lagrange's formula, Derivatives using Sterling's formula.
Numerical Integration: Numerical Integration, General Quadrature formula, Trapezodial rule, Simpsons one-three rule, Simpsons one-eight rule, Weddle's rule,Error's in Quadrature formula, Romber's formula.
Numerical Solution to Ordinary Differential Equations: Power series solution/ Pointwise Methods, Solution by Taylor's series, Taylor's series method for Simultaneous first order differential equations, Taylor's series method for Simultaneous higher order differential equations, Picard's method of successive approximation, Picard's method for Simultaneous first order differential equations, Picard's method for Simultaneous second order differential equations, Euler's methods, Runge-Kutta methods, Higher order Runge-Kutta methods, Runge-Kutta methods for Simultaneous first order differential equations, Runge-Kutta methods for Simultaneous second order differential equations, Milne's methods.
Numerical Solution to Partial Differential Equations: Difference quotients, Geometrical representation of partial difference quotients, Classification of partial differential equations, Elliptic equations, Solution to Laplace's equation by Liemann's iteration process, Poisson's Equation and its solution.

Empirical Laws and Curve Fitting: The linear law, Laws reducible to linear law, Method of group of averages, Equations involving three constants, Principles of Least Squares, Fitting a straight Line, Fitting a parabola, Fitting an Exponential Curve, Sum of Squares of Residuals, Method of moments.

Course Learning Outcomes (CLO):

CLO1 Define the finite differences

CLO2 Compute the analysis solution of algebraic equations. .

CLO3 Determine the Interpolation and numerical differentiation.

CLO4 Demonstrate report or research work to be used in different software tools and application.

CLO5 Assess the Numerical Integration and Solution of some algebraic equation with some methods and Employ the first orders differential equations and first orders partial differential equations.

Mapping between Course Learning Objectives and Program Learning Objectives:

CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3	√											
CLO4	√											
CLO5	√											

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

CLO	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1, CLO2, CLO3	Finite Difference, Solution of Algebraic and Transcendental Equations, Simultaneous Linear Algebraic Equations, Interpolation	Lecture, PPT, Discussion	Interactive Discussion, Class performances, Assignments, Class Test
CLO4 ,CLO5	Numerical Differentiation and Integration, Numerical solution of ordinary differential equations, Empirical Laws and Curve Fitting	Lecture, PPT, Discussion, Problem Solving	Interactive Discussion, Class performances, Assignments, Class Test

Books Recommended:

1. A.R.Vasishtha and Vipin Vasishtha. A text book on Numerical Analysis.

2. Dr.V N Vdamurthy and Dr N Ch S N Iyengar, A book on Numerical methods

Course Code: CSE 111, Course Title: Computer Fundamental and Programming Techniques

Course Code (BNQF): CSE-0611-111
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any**):** None

Rationale:

This course covers the fundamentals of computer programming terminology, computer components, hardware, operating systems, number systems, system software, and popular application software are all covered in this course. The course links technology with communication to provide consumers with access to a wealth of data and information, both locally and globally. The student of B. Sc. (Engg.) program will exhibit proficiency with software applications and demonstrate knowledge of computer technology and components to aide in their understanding of data and information.

Course Objectives:

1. To facilitate necessary knowledge about fundamentals of computing devices and reinforce computer vocabulary.
2. Make the students understand the computer network organization.
3. To develop skills on basic terminology used in computer programming involving decision structures, loops and functions.

Course Content:

Introduction and Basic Organization of Computers: Types of computer, history and generations of computers, number systems and its conversions, logic gates. Memory Organizations, Storage, processor, operating system basics.
Basics of Networking: LAN, MAN, WAN, Topology, Switch, Router.

Programming Language Basics: general form of a simple program, variable, identifiers, operators, decision making, arrays.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Analyze the basic parts of computer system, types of computer, history and generations of computers, number system and basic digital circuits.
CLO2 Classify the Computer networks.
CLO3 Formulate the simple computer programs using decision structures, loops and functions.

Mapping Course Learning Outcomes(CLOs) with PLOs

CLO	PLO											
	PLO 1	PLO 2	PLO3	PLO 4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO1 0	PLO1 1	PLO1 2
CLO1	√		√									
CLO2			√									
CLO3			√									

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Introduction and basic organization of computers	Lecture, Discussion, Interactive discussions, Questions and answers, Problem Solving	Class Test, Assignment, Exam
CLO2	Basics of networking	Lectures, Questions and answers, Case Study	Presentation, Assignment
CLO3	Programming language basics	Lecture, Class work, Problem Based Learning	Written Test, Assignment, Exam

Books Recommended:

1. *Dr. M. Lutfur Rahman and Dr. M. Alamgir Hossain, "Computer Fundamentals", 1st Ed., Systech Publications Ltd., 2013.*
2. *E.Balagurusamy, "Programming in ANSIC", 6th Ed., Tata McGraw-Hill Publishing Company, 2016.*
3. *Pradeep K. Sinha, "Computer Fundamentals", 6th Ed., BPB publications, 2004.*

Course Code: CSE 112, Course Title: Computer Fundamental and Programming Techniques Sessional

Course Code (BNQF): CSE-0611-112
Credit Hr.: 1.50, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any): None

Rationale:

This course introduces basic Web page development techniques and computer programming terminology. Topics include HTML, CSS used in the development of Web pages and programming essentials including data types, elementary control structures and functions used within the framework of imperative programming paradigms. The student of B. Sc. (Engg.) program will learn this course to improve the knowledge about markup languages to develop basic Web pages and understanding of programming essentials.

Course Objectives:

1. To familiarize students with the basics of web design
2. Helping the students to ability in design simple programs.
3. To develop skills on create programs involving decision structures, loops and functions.

Course Content:

Web Design Basics: HTML, CSS etc.
Introduction to Programming Language: Identifiers, different data types, writing and running programs.
Conditional Statements: Conditional statements (If-else, Nested-if, Switch Statements), basic learning of looping, functions.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Apply different methods in web design.

CLO2 Create the simple computer programs.

CLO3 Analyze the concepts about control statements in programming language.

Mapping Course Learning Outcomes (CLOs) with the PLOs

CLO	PLO											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1				√								
CLO2				√								
CLO3		√										

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Introduction and basic organization of computers	Lecture, Discussion, Interactive discussions, Questions and answers, Problem Solving	Class Test, Assignment, Exam
CLO2	Basics of networking	Lectures, Questions and answers, Case Study	Presentation, Performance
CLO3	Programming language basics	Lecture, Class work, Problem Based Learning	Written Test, Assignment, Exam

Books Recommended:

1. *Byron S. Gottfried, "Programming with C", 2nd Ed., Tata McGraw-Hill Publishing Company, 2005.*
2. *E.Balagurusamy, "Programming in ANSIC", 6th Ed., Tata McGraw-Hill Publishing Company, 2016.*
3. *H. Schildt, "Teach yourself C", 3rd Ed., McGraw-Hill Osborne, 2009-2010.*

Course Code: CSE 121, Course Title: Structured Programming Language

Course Code (BNQF): CSE-0613-121
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any**):** CSE 111

Rationale:

This course introduces structure programming concepts for undergraduate Computer Science students. This course covers the functional programming style, which uses structured control flow elements such as selection and repetition, block structures, and subroutines to improve the clarity, quality, and development time of a computer program which students will encounter in many computer science courses.

Course Objectives:

1. To facilitate necessary knowledge about functional programming style.
2. Helping the students to develop ability in design, implement, debug and test small programs.
3. To develop skills on simple algorithms to solve a wide range of common programming problems.

Course Content:

Introduction: Structure of programming language, Functions and uses of different parts of programming languages.

Variables and Operators: Automatic, Static, Register, Extern. Library functions and their uses, Unary Operator and Conditional Operator, bit-wise Operators. Precedence and Associatively.

Branching, Looping, Array and Pointer:
Branching: Details about conditional expressions in programming, Use of If-else statements, Switch statements.
Loops: Loops Syntax and uses, Introducing nested loops and their uses.
Function: User-defined-function: Definition, prototype, creating and calling functions. Recursive function: Create and use.
Arrays: Initialization, Access, Passing and Receiving. String, 2D Array handling, Sorting and Searching in array.
Pointers: Concept, Passing and Receiving Pointers, Dynamic Memory Allocations.
Structures, Data Files:
Structure: Initialization, Access, Passing and Receiving Structure.
Unions: Initialization, Access, Passing and Receiving Unions
Data Files: Types of File, text File Handling, Binary File Handling.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Identify the different methods in computer programming.

CLO2 Analyze the basic programming concepts: constants, variables, expressions, data types and operators.

CLO3 Design programs involving decision structures, loops and functions, array, string, and pointers.

CLO4 Assemble the design of the program with union, structures and manipulate basic data files.

Mapping between Course Objectives and Program Objectives:												
CLO	**PLO**											
	PLO 1	PLO 2	PLO3	PLO 4	PL O5	PLO6	PLO7	PLO8	PLO9	PLO1 0	PLO1 1	PLO1 2
CLO1			√									
CLO2	√											
CLO3					√							
CLO4					√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Introduction Variables and operators	Lecture, Discussion, Interactive discussions, Questions and answers, Problem Solving	Class Test, Assignment, Exam
CLO2	Branching, Looping,	Lectures, Questions and answers, Case Study	Presentation, Assignment
CLO3	Array,Pointer and Structures	Lecture, Class work, Problem Based Learning	Written Test, Assignment, Exam
CLO3	Data Files	Lecture, Class work, Case Study	Presentation, Assignment, Exam

Books Recommended:

1. *Byron S. Gottfried, "Programming with C", 2nd Ed., Tata McGraw-Hill Publishing Company, 2005.*
2. *E.Balagurusamy, "Programming in ANSIC", 6th Ed., Tata McGraw-Hill Publishing Company, 2016.*
3. *H. Schildt, "Teach yourself C", 3rd Ed., McGraw-Hill Osborne, 2009-2010.*

Course Code: CSE 122, Course Title: Structured Programming Language Sessional

Course Code (BNQF): CSE-0613-122
Credit Hr.: 1.50, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites: CSE-0611-111

Rationale:

This course covers functional programming, programming mechanisms, and developing basic programming abilities for program design and development. The course is intended to prepare students for a gain basic knowledge about some advanced topics of C like structure, pointer, file implement algorithms in C, debug and run programs. This course assist student to implement various concepts and structures of C programming language.

Course Objectives:

1. To provide knowledge about basic programming skills with respect to program design and development.
2. Helping the students to develop ability in program design, implement, debug and test.
3. Apply the knowledge of simple algorithms to solve a wide range of common programming problems.

Course Content:

Branching and Looping: Design program using conditional expressions, Use of If-else statements, Switch statements, Loops Syntax, Nested loops.
Array and Function: Design program User-defined-function, prototype, creating and calling functions. Recursive function: Create and use. Initialization, Access, Passing and Receiving. String, 2D Array handling, Sorting and Searching in array.
Pointers, Structures, Unions: Concept, Passing and Receiving Pointers, Dynamic Memory Allocations.
Initialization, Access, Passing and Receiving Structure. Initialization, Access, Passing and Receiving Unions.
Data Files: Types of File, text File Handling, Binary File Handling.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Demonstrate problem solving skills by developing and implementing algorithms to solve problems related to branching and looping.

CLO2 Adapt the creativity skills through analyzing problem specification, design methodology and implementation of functions

CLO3 Evaluate the usefulness of various fundamental principles, typical characteristics and mechanisms of a structured programming language.

CLO4 Apply structured for develop basic programming skills with respect to program design and development.

Mapping Course Learning Outcomes (CLOs) with the PLOs

CLO	PLO											
	PLO1	PLO 2	PLO 3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1		√										
CLO2				√								
CLO3		√										
CLO4				√								

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Introduction Branching and Looping	Lecture, Discussion, Interactive discussions, Questions and answers, Problem Solving	Class Test, Assignment, Exam
CLO2	Array and Function	Lectures, Questions and answers, Case Study	Oral Presentation, Assignment
CLO3	Pointers, Structures, Unions	Lecture, Class work, Problem Based Learning	Written Test, Assignment, Exam
CLO4	Data Files	Lecture, Class work, Case Study	Presentation, Assignment, Exam

Books Recommended:

1. *Byron S. Gottfried, "Programming with C", 2nd Ed., Tata McGraw-Hill Publishing Company, 2005.*
2. *E.Balagurusamy, "Programming in ANSIC", 6th Ed., Tata McGraw-Hill Publishing Company, 2016.*
3. *H. Schildt, "Teach yourself C", 3rd Ed., McGraw-Hill Osborne, 2009-2010.*

Course Code: CSE 211, Course Title: Object Oriented Programming

Course Code (BNQF): CSE-0613-211
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any**):** None

Rationale:

This course introduces Java object-oriented programming, which uses real-world concepts like inheritance, hiding, and polymorphism to implement real-world concepts in programming. The course focuses on the understanding of object-oriented concepts such as classes, objects, data abstraction, methods, method overloading, inheritance and polymorphism. Students will understand the basic object oriented programming concepts and apply them in problem solving.

Course Objectives:

1. To facilitate necessary knowledge about object-oriented programming with Java, covering topics such as class design, inheritance, dynamic binding and static binding.
2. Accumulate basic idea about core data structures such as lists, trees and hash tables of the sections.
3. Getting idea about how to design, use classes correctly and relationships among classes.

Course Content:

Overview: Object Oriented Programming, Introduction to a Simple Java Program. Loop Basics, Array Basics

Introducing Classes: Closer look at Classes, Method in Java, Method Overloading, and Recursion.

Inheritance, Interfaces and Abstraction: Polymorphism, Class access control, Multiple inheritance

Introduction to Polymorphism, Abstract Class, Interfaces, Constructor and Destructor, Data Abstraction & Information Hiding Exception Handling, Different binding style
Files and Stream, Swing Basics

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Distinguish between Structured and Object-Oriented problem-solving approaches.

CLO2 Identify classes and objects from the given problem description.

CLO3 Analyze the secured data processing by applying Abstraction, Encapsulation and Information hiding.

CLO4 Formulate the code reusability and extensibility by means of Inheritance and Polymorphism.

Mapping Course Learning Outcomes (CLOs) with the PLOs												
CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2			√									
CLO3			√									
CLO4					√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Introduction Overview	Lecture, Discussion, Interactive discussions, Questions and answers, Problem Solving	Class Test, Assignment, Exam
CLO2	Inheritance	Lectures, Questions and answers, Case Study	Presentation, Assignment
CLO3	Interfaces, Abstraction	Lecture, Class work, Problem Based Learning	Written Test, Assignment, Exam
CLO4	Polymorphism	Lecture, Class work, Case Study	Presentation, Assignment, Exam

Books Recommended:

1. *Herbert Schildt, "Java: The Complete Reference", 11th Ed., McGraw-Hill Education, 2018.*
2. *E. Balagurusamy, "Programming with Java" 6th Ed., McGraw-Hill Education, 2019.*
3. *Paul Deitel, Harvey Deitel, "Java: How to Program", 11th Ed., Pearson, 2017.*

Course Code: CSE 212, Course Title: Object Oriented Programming Sessional

Course Code (BNQF): CSE-0613-212
Credit Hr.: 1.50, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any): None

Rationale:

This course uses the Java programming language to teach Object-Oriented programming concepts, techniques, and applications. To understand inheritance, polymorphism, and encapsulation in order to program effectively and solve real-world problems by creating real-time projects. The primary aim of the module is to enable the students to tackle complex programming problems, making good use of the object-oriented programming paradigm to simplify the design and implementation process.

Course Objectives:

1. To facilitate necessary knowledge about concept of OOP with a pure object oriented programming language (Java).
2. Helping the students to develop ability in how to use advance programming features such as GUI design, exception handling and multithreading.
3. To develop skills on how to use various object oriented concepts to solve different problems.

Course Content:

Methods, Operators and Types: fundamentals of object oriented programming, Java primitive types, variable declaration, operators and method calls.

Control Structures: Explore the control structures found in Java.

Arrays, References and Classes: Arrays and references in Java, and how to define and instantiate their own class.

Input/Output and Exceptions: Streams and Exceptions, Read and write data to and from the file system and network, handle errors using Java Exceptions.

Inheritance and Interfaces: Object-oriented programming as expressed in Java, how to extend classes, as well as specify and provide implementations for Java interfaces.

Abstraction and Graphical Interfaces. Code-reuse through inheritance and the use of inner classes for encapsulation, construct a graphical interface using Swing.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Practice object oriented Programming for small systems/ problems, involving multiple objects.

CLO2 Create classes and objects using Java.

CLO3 Analyze the secured data processing by applying Abstraction, Encapsulation and Information hiding.

CLO4 Write code, test, and document and prepare a professional looking package for specified systems / problems.

Mapping Course Learning Outcomes (CLOs) with the PLOs												
CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1		√										
CLO2				√								
CLO3		√										
CLO4									√			

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Introduction and Methods, operators	Lecture, Discussion, Interactive discussions, Questions and answers, Problem Solving	Class Test, Assignment, Exam
CLO2	Arrays, references and classes Input/output and	Lectures, Questions and answers, Case Study	Presentation, Assignment
CLO3	Exceptions: Inheritance and interfaces	Lecture, Class work, Problem Based Learning	Written Test, Assignment, Exam
CLO4	Abstraction and graphical interfaces	Lecture, Class work, Case Study, Team Work	Presentation, Assignment, Exam

Books Recommended:

1. *Herbert Schildt, "Java: The Complete Reference", 11th Ed., McGraw-Hill Education, 2018.*
2. *E. Balagurusamy, "Programming with Java" 6th Ed., McGraw-Hill Education, 2019.*
3. *Paul Deitel, Harvey Deitel, "Java: How to Program", 11th Ed., Pearson, 2017.*

Course Code: CSE 217, Course Title: Data Structure

Course Code (BNQF): CSE-06217
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any**):** CSE 121

Rationale:

Data Structures are specific method of arranging and storing data in computers so that we may execute more efficient operations on the data. The data structure course is offered to the students of 2nd year for learning different types of data structures and their uses. This course will give students the knowledge on how data structure plays a significant role in improving a programs performance.

Course Objectives:

1. Helping students to develop knowledge about different data structures.
2. To provide knowledge about the complexity of the algorithms that are used to develop the data structures.

Course Content:

Introduction: Basic Data Structures and Representation of Data. Data Structures Operations.
Linear Data Structures: Arrays, Records, Pointer, Linked Lists, Linked Lists with Sentinels, Stack, Queue, Dequeue and Priority Queue, Recursion, Data Structures' Operations on Them.
Non Linear Data Structures, Trees: Binary Tree, Traversing Binary Trees, Insertion Deletion and Searching, Binary Search Trees, B+ Trees, Indexing, Red-Black Trees, Operations on Red-Black Trees, Heap, Heapsort, Heap Property, Heapify, Building and Maintaining a Heap, Huffman's Algorithm, Binomial Heaps.
Graphs: Introduction to Graph, Sequential and Linked Representation of a Graph on Memory, Operations on Graph, Traversing a Graph,
Hashing Techniques: Characteristics of Hash Functions, Collision Resolution, Probing Chaining, Perfect Hashing.
Data Structures for Disjoint Sets: Disjoint Set Operations, Linked List Representation of Disjoint set, Disjoint Set Forests.
Augmenting Data Structures: Dynamic order Statistics, How to Augment a Data Structure, Interval Trees. Searching and Sorting Techniques in Different Structures.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Estimate the functionalities and applications of different data structures

CLO2 Demonstrate the operations of data structures in designing software procedures based on specific requirements.

CLO3 Apply specific search and sort algorithms using data structures given specific user requirements.

Mapping Course Learning Outcomes (CLOs) with the PLOs

CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2					√							
CLO3			√									

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Introduction	Lecture, Interactive discussions, Questions and answers	Class Test, Assignment, Exam
CLO2	Linear data structures, Non Linear Data Structures, tree, graph, Hashing Techniques, Data Structures for Disjoint Sets	Lecture, Discussion, Problem Solving	Class Test, Assignment, Exam
CLO3	Augmenting Data Structures	Lecture, Problem Solving	Written test, Presentation, Exam

Books Recommended:

1 *Seymour Lipschutz," Data Structure", Revised First edition, McGraw Hill Education.*

2. *Ellias Horowitz, Dinesh Mehta, Sartaj Sahni," Fundamental of Data Structures in C++", Second Edition, Silicon Pr.*

Course Code: CSE 218, Course Title: Data Structure Sessional

Course Code (BNQF): CSE-0613-218
Credit Hr.: 1.50, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any**):** None

Rationale:

This course demonstrates the programming of Data Structures and their practical applications. This course if offered to the students of 2nd year. This sessional course will provide students with hands on experience and knowledge about how to develop data structures and significantly how it relates and help to enhance a programs performance.

Course Objectives:

1. To provide the practical knowledge of how data can be stored and manipulated in computer's memory in an optimized way.
2. To facilitate necessary knowledge about the process of implementing data structures and performing major operations on them such as addition, deletion and location of data items in each of data structures.
3. To develop skills to build programs which solves problems using appropriate data structure
4. To facilitate necessary knowledge about how to design and analyze elementary algorithms and implement them using programs to perform operations on data structures.

Course Content:

Implementation of Linear Data Structures: Array, String, Stack, Queue, Linked List.
Implementation of Non-Linear Data Structures: Tree, Graph, Hash.
Operations on Different Data Structures: Insertion, Deletion, Update, Sorting.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Construct linear data structures: Stack and Queue using arrays and linked list in an application context.

CLO2 Prepare Non-linear data structures: Graph, Trees, Hash table in an application context.

CLO3 Apply specific sorting algorithms in different data structures.

Mapping Course Learning Outcomes (CLOs) with the PLOs

CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1					√							
CLO2				√								
CLO3			√									

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Implementation of Linear Data Structures	Lecture, Demonstration	Performance, Lab Report, Quiz Test
CLO2	Implementation of Non-Linear Data Structures:	Lecture, Interactive discussions, Demostration	Performance, Lab Report, Quiz Test
CLO3	Operations on Different Data Structures	Lecture, Problem Solving	Performance, Lab Report, Quiz Test

Books Recommended:

1. *Seymour Lipschutz," Data Structure", Revised First edition, McGraw Hill Education.*
2. *Ellias Horowitz, Dinesh Mehta, Sartaj Sahni," Fundamental of Data Structures in C++", Second Edition, Silicon Pr.*

Course Code: CSE 221, Course Title: Database Management Systems

Course Code (BNQF): CSE-0612-221
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any**):** None

Rationale:

This course introduces the core principles and techniques required in the design and implementation of database systems. This introductory application-oriented course covers the relational database systems RDBMS - the predominant system for business scientific and engineering applications at present. It includes Entity-Relational model, Normalization, Relational model, Relational algebra, and data access queries as well as an introduction to SQL. It also covers essential DBMS concepts such as: Transaction Processing, Concurrency Control, and Recovery. Through this course, the 3rd year students will acquire theoretical knowledge and practical skills in the use of databases and database management systems in information technology applications.

Course Objectives:

1. To explain basic database concepts, applications, data models, schemas and instances.
2. To demonstrate the use of constraints and relational algebra operations.
3. To emphasize the importance of normalization in databases.
4. To familiarize issues of concurrency control and transaction management.

Course Content:

Introduction: Purpose of Database Systems, Data Abstraction, Data Models, Instances and Schemes, Data Independence, Data Definition Language, Data Manipulation Language, Database Manager, Database administrator, Database Users, Overall System Structure, Advantages and Disadvantage of a Database Systems. Data Mining and analysis, Database Architecture, History of Database Systems.

Relationship Entity-Model: Entities and Entity Sets, Relationships and Relationship Sets, Attributes, Composite and Multivalued Attributes, Mapping Constraints, Keys, Entity-Relationship Diagram, Reducing of E-R Diagram to Tables, Generalization, Attribute Inheritance, Aggregation, Alternative E-R Notatios, Design of an E-R Database Scheme.

Relational Model: Structure of Relational Database, Fundamental Relational Algebra Operations, The Tuple Relational Calculus, The Domain Relational Calculus, Modifying the Database.

Relational Commercial Language: SQL, Basic structure of SQL Queries, Query-byExample, Query., Nested Sub queries, Complex queries, Integrity Constraints, Authorization, Dynamic SQL, Recursive Queries, Overview of PL/SQL.

Relational Database Design: Pitfalls in Relational Database Design, Functional Dependency Theory, Normalization using Functional Dependencies, Normalization using Multivalued Dependencies, Normalization using join Dependencies, Database Design Process.

File and System Structure: Overall System Structure, Physical Storage Media, File Organization, RAID, Organization of Records into Blocks, Sequential Files, Mapping Relational Data to Files, Data Dictionary Storage, Buffer Management.

Indexing and Hashing: Basic Concepts, Ordered Indices, B+ -Tree Index Files, B-Tree Index Files, Static and Dynamic Hash Function, Comparison of Indexing and Hashing, Index Definition in SQL, Multiple Key Access.

Query Processing and Optimization: Query Interpretation, Equivalence of Expressions, Estimation of Query-Processing Cost, Estimation of Costs of Access Using Indices, Join Strategies, Join Strategies for parallel Processing, Structure of the

query Optimizer, Transformation of Relational Expression.

Concurrency Control: Schedules, Testing for Serializability, Lock-Based Protocols, Timestamp-Based Protocols, Validation Techniques, Multiple Granularity, Multiversion Schemes, Insert and Delete Operations, Deadlock Handling.

Distributed Database: Structure of Distributed Databases, Trade-off in Distributing the Database, Design of Distributed Database, Transparency and Autonomy, Distributed Query Processing, Recovery in Distributed Systems, Commit Protocols, Concurrency Control, Shared Server Configuration.

Data Mining: Data analysis and OLAP, Data Warehouse, Data Mining, Overview of Data Mining Techniques Information Retrieval and Structured Data. Basic of Ontology.

Administrative Functionalities: Architecture of a Database, Concept of Physical and Logical Databases Table spaces, Database Creation, Maintaining Data Dictionary, Database Backup/Recovery, Database maintaining and Performance Tuning, Data Guard Physical, logical and Standby Database.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Analyze database concepts and structures and query language.

CLO2 Apply relational database theory and be able to describe relational algebra expression, tuple and domain relation expression for SQL queries.

CLO3 Design a RDBMS based on a data model (ER-diagram) considering the normalization to a specified level and design queries using SQL.

CLO4 Estimate the storage size of the database and design appropriate storage techniques.

CLO5 Explain the basic requirements for query processing and optimization, database backup and recovery.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3					√							
CLO4					√							
CLO5	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Introduction, Relationship Entity-Model	Lecture, Tutorial	Written test, Quiz
CLO2	Relational Model, Relational Commercial Language, Relational Database Design	Lecture, Tutorial	Written test, Quiz
CLO3	Concurrency Control, Distributed Database	Practical, Demonstration, Project	Practical Tests, Assignment
CLO4	File and System Structure, Indexing and Hashing, Data Mining	Practical, Demonstration, Project	Practical Tests, Assignment
CLO5	Query Processing and Optimization, Administrative Functionalities	Lecture, Tutorial	Written test, Quiz

Books Recommended:

1. *Abraham Silberschartz, Henry F. Korth and S Sudershan," Database System Concepts", Seventh edition, McGraw Hill Education.*
2. *Scott Urman, Ron Hardman and Michael McLaughlin," Oracle Database10g PL/SQL Programming", First Edition, McGraw Hill.*

Course Code: CSE 222, Course Title: Database Management Systems Sessional

Course Code (BNQF): CSE-0612-222
Credit Hr.: 1.50, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any**):** None

Rationale:

Developing and managing efficient and effective database applications requires understanding the fundamentals of database management systems, techniques for the design of databases, and principles of database administration. This course offered for 3rd year students emphasized database concepts, developments, use and management in three main sections: database concepts, practice, and emerging trends. Relational database systems are the main focus, but other types, including object-oriented databases, are studied. Practical design of databases and developing database applications using modern software tools will be emphasized.

Course Objectives:

1. To understand the fundamentals of relational, object-oriented, and distributed database systems including: data models, database architectures, and database manipulations.
2. To understand the theories and techniques in developing database applications and be able to demonstrate the ability to build databases using enterprise DBMS products such as Oracle or SQL Server.
3. To be familiar with managing database systems.
4. To understand new developments and trends in databases.

Course Content:

Introduction: Introduction to Database Management System Database Management System concept, components of database, uses and application. Creation of a simple database using Oracle. Introduction to Data Definition Language (DDL) Basic SQL concept, Different data types, DDL statements (create, alter, drop, truncate, rename) used for defining database objects. Introduction to Data Manipulation Language (DML) Inserting data, Basic structure of SQL queries (use of select, from, where clause), Update and Delete statements, String operation, Order by clause.

Relational Database: Basic of Relational Database Model Introduction to relational database, Schemas, Use of primary and foreign keys, Constraints, Referential integrity

Entity Relationship Model: Basics of Entity Relationship Model+ Term-project assignment Design process, Entity-Relationship diagram (ER diagram), General discussion on term projects, ER diagram design for specific project.

Query: Use of Aggregate functions, Null values, Group By, Having. Basic Join operations (inner join and outer join). JDBC connection + ERD details for term-project Using Java/JDBC/C# with Oracle. Basic report design, ERD for specific term-projects. Advanced Query Subqueries, Nested subqueries, Complex queries (derived relation, with clause), and View definition.

Project: Final presentation of assigned project (individually/ by group)

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1	Model Entity Relationship with E-R diagrams for a given problem-domain.
CLO2	Design database schema considering normalization and relationships within database.
CLO3	Write SQL queries to user specifications.
CLO4	Develop triggers, procedures, user defined functions and design accurate and PLSQL programs in Oracle and DB2.

Mapping Course Learning Outcomes (CLOs) with the PLOs:												
CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1		√										
CLO2			√									
CLO3					√							
CLO4									√			

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Introduction, Entity Relationship Model	Case Study, Project, Tutorial, Group Work	Presentation, Essay, Written Tests
CLO2	Introduction, Relational Database	Lecture, Tutorial, Case Study Practical,	Practical Tests, Assignment
CLO3	Query	Practical, Demonstration, Project	Practical Tests, Assignment
CLO4	Project	Case Study, Project, Group Work, Discussion	Project development, Industrial Attachment

Books Recommended:

1. *Abraham Silberschartz, Henry F. Korth and S Sudershan," Database System Concepts", Seventh edition, McGraw Hill Education.*
2. *Ivan Bayross," SQL, PL/SQL-The Programming Language of ORACLE", Revised Fourth Edition, BPB.*

Course Code: CSE 227, Course Title: Algorithms

Course Code (BNQF): CSE-0613-227

Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** Core,

Pre-requisites (if any): None

Rationale:

This course introduces different type of algorithm, their procedures and their applications. The student of B. Sc. (Engg.) program will learn this course to use in machine learning that allows a computer program to mimic how a human learns to classify certain types of data.

Course Objectives:

1. To analyze the asymptotic performance of algorithms. Write rigorous correctness proofs for algorithms.
2. To demonstrate a familiarity with major algorithms and data structures. Apply important algorithmic design paradigms and methods of analysis. Synthesize efficient algorithms in common engineering design situations.

Course Content:

Algorithms: The Role of Algorithms in Computing - Algorithms as a technology; Analyzing and Designing Algorithms; Growth of Functions-Asymptotic notations - standard notations and common functions.

Divide and Conquer Method: Solving recurrences; Probabilistic Analysis and Randomized Algorithms-Hiring problem-Randomized algorithm.

Dynamic programming: Matrix Chain Multiplication-Elements of dynamic programming; Greedy Algorithms-Elements of Greedy Strategy; Amortized Analysis-Aggregate analysis-Dynamic tables;

NP-Completeness: Polynomial time-NP-Complete problems; Approximation algorithms-The vertex-cover problem-travelling salesman problem-Randomization and linear programming.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1	Summarize the relevance of algorithms for computational problems solving and real time applications.
CLO2	Differentiate different algorithmic approaches, techniques and methods.
CLO3	Apply design and analysis techniques for a given algorithm and optimization techniques for improving the efficiency of algorithms.
CLO4	Analyze a given algorithm for its efficiency based on time and space it occupies and evaluate any given problem with mathematical rigor to provide an algorithmic based solution.

Mapping Course Learning Outcomes (CLOs) with the PLOs

CLO	PLO											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2			√									
CLO3						√						
CLO4					√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Introduction to Algorithms	Lecture, Discussion, Interactive discussions, Questions and answers, Problem Solving	Class Test, Assignment, Exam
CLO2	Divide and Conquer Method	Lectures, Questions and answers, Case Study	Presentation, Assignment
CLO3	Dynamic programming	Lecture, Class work, Problem Based Learning	Class Test, Assignment, Exam
CLO4	NP-Completeness	Case study analysis, Problem Based Learning	Written test, Presentation, Exam

Books Recommended:

1. *Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 3rd Ed, MIT, 2010.*
2. *Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", 2nd Ed., Galgotia Publications Pvt. Ltd, 2002.*
3. *Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 2nd Ed, Pearson Education, 2011.*
4. *Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 3rd Ed, Pearson Education, 2011.*

Course Code: CSE 228, Course Title: Algorithm Sessional

Course Code (BNQF): CSE-0613-228
Credit Hr.: 1.50, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any): None

Rationale:

The main goal of this course is to solve different mathematical and real-life problems. It covers the common algorithms, algorithmic paradigms, and data structures used to solve computational problems. This course emphasizes the relationship between algorithms and programming and explores algorithms from the programmer's perspective for solving problems efficiently using various programming languages. This course will satisfy a 100-level requirement for courses in computer science and engineering for undergraduate majors.

Course Objectives:

1. To analyze the asymptotic performance of algorithms.
2. To demonstrate familiarity with major algorithms and data structures
3. To implement important algorithmic design paradigms and methods of analysis

Course Content:

Implement elementary data structure: Queue implementation using arrays, Stack implementation-using arrays., Singly, doubly and circular liked list implementation and all possible operations on lists, Queue and Stack implementation using linked list
Binary search tree implementation using linked list and

Divide and Conquer Method: Implement Recursive Binary search and Linear search and determine the time taken to search an element, Sort a given set of elements using the Heap sort method and determine the time taken to sort the elements, Sort a given set of elements using Merge sort method, Sort a given set of elements using Selection sort.

Dynamic programming: Implement All Pair Shortest paths problem using Floyd'sAlgorithm, Implement 0/1 Knapsack problem using dynamic programming,

Advance design and analysis techniques: Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm, From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO 1 Recognize the working any balanced tree.

CLO 2 Demonstrate and define programs implementing graph algorithms in application context.

CLO 3 Build C programs for implementing greedy approach, dynamic programming and backtracking techniques.

CLO 4 Analyze time complexity and space complexity of algorithms.

Mapping Course Learning Outcomes (CLOs) with the PLOs												
CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1				√								
CLO2		√										
CLO3				√								
CLO4				√								

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Implement elementary data structure.	Lecture, Discussion, Interactive discussions, Questions and answers, Problem Solving, Lab Assignment	Quiz, Performance Test, Lab Report
CLO2	Divide and Conquer Method program	Lectures, Questions and answers, Case Study, Problem Solving, Lab Assignment	Quiz, Performance Test, Lab Report
CLO3	Dynamic programming problem	Lecture, Class work, Case study analysis, Problem Based Learning, Lab Assignment	Quiz, Performance Test, Lab Report
CLO4	Advance design and analysis techniques	Lecture, Problem Based Learning, Problem Solving, Lab Assignment	Quiz, Performance Test, Lab Report

Books Recommended:

1. *Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 3rd Ed, MIT, 2010.*
2. *Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", 2nd Ed., Galgotia Publications Pvt. Ltd, 2002.*
3. *Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 2nd Ed, Pearson Education, 2011.*
4. *Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 3rd Ed, Pearson Education, 2011.*

Course Code: CSE 231, Course Title: Operating System Concepts

Course Code (BNQF): CSE-0611-231

Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** Core

Pre-requisites (if any): **None**

Rationale:

This course introduces computing activities revolve around operating systems. An operating system is a program that serves as a bridge between a computer's user and its hardware. The student of B. Sc. (Engg.) program will learn this course to manage resources (such as CPU time and memory) and to control users and software. The aims of operating systems are frequently inconsistent and change based on the user, program, and hardware requirements. This course covers the fundamental concepts of operating systems and the methods for achieving design objectives.

Course Objectives:

1. To recognize how the applications interact with the operating system as the later working as intermediary program between the machine and the application
2. Help the students to know how the operating systems transport the application requests to the hardware. Understand how operating systems managing resources such as processors, memory and I/O. Realize the efficiency or the deficiency of the different techniques used by some operating systems..

Course Content:

Operating System Introduction: Basics, OS Architecture, OS Operations.
Process Management: Process states – Operations on process–Interrupts-Interposes communication-Thread concepts -Job and processor Scheduling
Concurrent Execution: Asynchronous Concurrent Processes- Concurrent Programming-Deadlock and indefinite postponement. Memory Management: Swapping, Paging, Segmentation, Virtual Memory – Demand paging, Page Replacement.
File & Storage Management: File System, File Organization, Allocation methods, free space management, Disk Structure, Disk Scheduling, Swap-Space Management. Linux Programming - Command Line and Shell Scripting Basics.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1	Describe the evolution, types, structure and functions of operating systems
CLO2	Describe security and protection measures used in operating systems and explain techniques involved in process, memory, device and file management
CLO3	Analyze the code for the resource allocation.
CLO4	Implement processor scheduling, synchronization, deadlocks and disk allocation algorithms for a given scenario

Mapping Course Learning Outcomes (CLOs) with the PLOs												
CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1		√										
CLO2			√									
CLO3			√									
CLO4					√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Operating System Introduction	Lecture, Discussion, Interactive discussions, Questions and answers, Problem Solving	Class Test, Assignment, Exam
CLO2	Process Management	Lectures, Questions and answers, Case Study	Presentation, Assignment
CLO3	Concurrent Execution	Lecture, Class work, Problem Based Learning	Class Test, Assignment, Exam
CLO4	File & Storage Management	Case study analysis, Problem Based Learning	Written test, Presentation, Exam

Books Recommended:

1. *Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Concepts", 6th Ed, Addison-Wesley, 2003.*
2. *William Stallings, "Operating Systems", 5th Ed., Prentice Hall, 2011.*
3. *Andrew Tanenbaum, "Modern Operating Systems", 4th Ed, Prentice Hal, 2008.*
4. *Andrew Tanenbaum & Albert Woodhull, "Operating Systems: Design", 1st Ed, Prentice Hal, 2007.*
5. *A.M. Lister, "Fundamentals of Operating Systems", 2nd Ed, Macmillan, 1979.*

Course Code: CSE 232, Course Title: Operating System Concept Sessional

Course Code (BNQF): CSE-0611-232

Credit Hr.: 1.50, **Contact Hr.:** 3.00, **Course Type:** Core

Pre-requisites (if any)**:** None

Rationale:

The course will look at the relevance of the operating system, its role, and the various approaches it employs to achieve its resource management goals. The course also looks at how applications work with operating systems and how operating systems work with machines. In addition, the course illuminated several of the currently available operating systems and how the ideas covered in the course are implemented in these systems. Some of the ideas in the course are put into practice by using the programs. This course demonstrates the different type of operating system and procedure, their practical implementation. This course will satisfy a 100-level requirement for courses in computer science and engineering for undergraduate majors.

Course Objectives:

1. To provide an understanding of the design aspects of operating system.
2. To learn Unix commands and shell programming.
3. To implement Deadlock Avoidance and Deadlock Detection Algorithm
4. To implement File Organization and File Allocation Strategies.

Course Content:

Explain the functions, structure operations of operating system and discuss about the Linux installation process **and** implement memory management techniques through administrative shell.
Analyze the SJRF, RR CPU scheduling algorithm and solve.
The Priority scheduling and solve.
All file allocation strategies using shell.
bankers algorithm and implement
All page replacement algorithm.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Describe all the CPU Scheduling algorithms based on the theory course.

CLO2 Define all file allocation strategies based on the theory course.

CLO3 Apply all File Organization Techniques on the basis on theory course.

CLO4 Analysis Banker's Algorithm for Dead Lock Avoidance and prevention.

Mapping Course Learning Outcomes (CLOs) with the PLOs												
CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1				√								
CLO2		√										
CLO3		√										
CLO4				√								

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Basics of UNIX commands. Implement memory management techniques through administrative shell. To analyze the SJRF, RR CPU scheduling algorithm and solve.	Lecture, Discussion, Interactive discussions, Questions and answers, Problem Solving, Lab Assignment	Quiz, Performance Test, Lab Report
CLO2	the Priority scheduling and solve . problem of FCFS and SJFS	Lectures, Questions and answers, Case Study, Problem Solving, Lab Assignment	Quiz, Performance Test, Lab Report
CLO3	Implement all file allocation strategies using shell.	Lecture, Class work, Case study analysis, Problem Based Learning, Lab Assignment	Quiz, Performance Test, Lab Report
CLO4	implement all page replacement algorithm	Lecture, Problem Based Learning, Problem Solving, Lab Assignment	Quiz, Performance Test, Lab Report

Books Recommended:

1. *Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Concepts", 6th Ed, Addison-Wesley, 2003.*
2. *William Stallings, "Operating Systems", 5th Ed., Prentice Hall, 2011.*
3. *Andrew Tanenbaum, "Modern Operating Systems", 4th Ed, Prentice Hal, 2008.*
4. *Andrew Tanenbaum & Albert Woodhull, "Operating Systems: Design", 1st Ed, Prentice Hal, 2007.*
5. *A.M. Lister, "Fundamentals of Operating Systems", 2nd Ed, Macmillan, 1979.*

Course Code: CSE 317, Course Title: Theory of Computing

Course Code (BNQF): CSE-0613-317
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any**):** None

Rationale:

This course focuses on learning how problems can be efficiently solved on a model of computation using algorithms and the elementary ways in which a computer works. The essence of the theory of computation is to help the students to develop mathematical and logical models that run efficiently and to the point of halting. Additionally, the course gives the learners an insight into computer hardware and software limitations.

Course Objectives:

1. To understand the mathematical foundations of computation including automata theory.
2. To have a solid foundation of the theory of formal languages and grammars.
3. To analyze and design finite automata, pushdown automata, Turing machines, formal languages and languages, and grammars.

Course Content:

Basics of Computing: Automata, Computability, and Complexity, Mathematical Notation and Terminology, Sets, Sequences and Tuples, Functions and Relations, Strings and Languages, Definitions, Theorems and Proofs.
Finite Automata Formal Definition of a Finite Automaton with examples.
Uses of Operations: The Regular Operations Union operation, Concatenation operation, Star operation, Closure under the Regular Operations**,** Non determinism Equivalence of NFAs and DFAs Closure under the Regular Operations
Regular Expressions and Languages: Formal definition of a regular expression, nonregular Languages, The Pumping Lemma for Regular Languages, Context-Free Languages, Context-Free Grammars, Formal Definition of CFG, Examples of CFG, Designing CFG, Ambiguity, Chomsky Normal Form
Concept of Automata and Turing Machine: Pushdown Automata, Formal Definition of a Pushdown Automaton, Examples of Pushdown Automata, Turning Machines, Formal Definition of a Turing Machine, Examples of Turing Machines.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Describe formal models of computation, such as finite automata, pushdown automata, and Turing machines.

CLO2 Apply the pumping lemma for regular languages to determine if a language is regular.

CLO3 Convert between grammars and push-down automata for context-free languages

CLO4 Convert between finite automata, regular grammars, and regular expression representations of regular languages.

Mapping Course Learning Outcomes (CLOs) with the PLOs												
CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1		√										
CLO2			√									
CLO3			√									
CLO4			√									

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Basics of Computing:	Lecture, Interactive discussions, Questions and answers, Online video, Group Discussion, Lab Assignment.	Class Test, Assignment, Exam
CLO2,	Uses of Operations:	Lecture, Interactive discussions, Questions and answers, PowerPoint demonstration, Online video, Group Discussion, Lab Assignment.	Written test, Presentation
CLO2, CLO3	Regular Expressions and Languages:	Lecture, Interactive discussions, Questions and answers, Online video, Group Discussion, Lab Assignment.	Class Test, Assignment, Exam
CLO3, CLO4	Concept of Automata and Turing Machine:	Lecture, Interactive discussions, Questions and answers, PowerPoint demonstration, Online video, Group Discussion, Lab Assignment.	Written test, Presentation, Exam

Learning Materials:

1. *Michael Sipser ,Introduction to the Theory of Computation, 3rd edition, 2012.*
2. *J. E. Hopcroft, R. Motwani, and J. D. Ullman , "Introduction to Automata Theory, Languages, and Computation", Addison-Wesley Longman Publishing Co., Inc., 3rd ed., 2006.*
3. *H. R. Lewis and C. H. Papadimitriou, "Elements of the Theory of Computation", Upper Saddle River, NJ, USA: Prentice Hall PTR, 2nd edition, 1997.*

Course Code: CSE 321, Course Title: Software Engineering

Course Code (BNQF): CSE-0613-321
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any**):** CSE 315

Rationale:

The purpose of this course is to present software engineering as a body of knowledge. The course is designed to present software engineering concepts and principles in parallel with the software development life cycle. The course will begin with an introduction to software engineering, giving you a definition of this body of knowledge, as well as a discussion of the main methodologies of software engineering. Student will then acquire knowledge about the Software Development Life Cycle (SDLC), major methodologies followed by software modeling using Unified Modeling Language (UML), a standardized general-purpose modeling language used to create visual models of object-oriented software.

Course Objectives:

1. To furnish the student the idea of decomposing the given problem into Analysis, Design, Implementation, Testing, and Maintenance phases.
2. To provide the idea of using various process models in the software industry according to given circumstances.
3. To familiarize the students the knowledge of how Analysis, Design, Implementation, Testing and Maintenance processes are conducted in a software project.
4. To introduce the software life cycle models.

Course Content:

Introduction: Concepts of software engineering, Requirements definition, modularity, Data specifications, functional specifications, Verification, documentation, software maintenance, software support tools.

Concept and Principles: Software project organization, quality assurance and communication skills, Project Metrics, estimation for software concepts, project metrics, estimation for software concepts, Agility, agility principles, extreme programming, review, risk management, requirement Analysis.

Design and Technique: Analysis modeling, data modeling, design concept, structured design, Software testing strategies, white-box testing, control structure testing, black-box testing, basis path testing.

Protecting Data and Ethics: Protecting programs and data (copyright, patents and trade secrets), legal and ethical l issues in selling and producing correct and usable software, threats to integrity and confidentiality

Case Study and Professional Conducts: Case studies of ethics (use of computer services, privacy rights, ownership of programs, Ethics of hacking or cracking, Codes of ethics and professional conducts: IEEE, ACM, Computer Ethics Institute.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Prepare the SRS, Design document, and Project plan of a given software system.

CLO2 Apply Project Management and Requirement analysis.

CLO3 Analyze and apply the cost estimate and problem complexity using various estimation techniques, Principles to S/W project development.

CLO4 Generate test cases using the techniques involved in selecting: (a) White Box testing (b) Block Box testing.

CLO5 Solve the legal and ethical issues in computer society.

Mapping Course Learning Outcomes (CLOs) with the PLOs:												
CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO 4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO1 2
CLO1						√						
CLO2	√											
CLO3	√											
CLO4	√											
CLO5											√	

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Introduction	Lecture, Discussion, Interactive discussions, Questions and answers, Group discussion, Problem Solving	Assignment, Exam
CLO2	Concept and Principles	Lectures, Online Video, Questions and answers, Case Study, Powerpoint Demonstration.	Presentation, Assignment, Exam
CLO3	Design and Technique	Lecture, Class work, Group Study, Problem Based Learning, Case Study	Presentation, Assignment
CLO4	Protecting Data and Ethics	PowerPoint Demonstration, Case study analysis, Online Video, Problem Based Learning	Class Test, Assignment, Exam
CLO5	Case Study and Professional Conducts	Lectures, Group Study for Data Analysis, Questions and answers, Case Study, Group discussion	Written test, Presentation, Exam

Books Recommended:

1. *Roger S. Pressman, "Software Engineering: A Practitioner's Approach", 6th Ed., McGraw Hill, 2004.*
2. *Sommerville, "Software Engineering", 8th Ed., Pearson, 2006.*

Course Code: CSE 322, Course Title: Software Engineering Sessional

Course Code (BNQF): CSE-0613-322

Credit Hr.: 1.50, **Contact Hr.:** 3.00, **Course Type:** Core

Pre-requisites (if any): None

Rationale:

This course demonstrates to the student the design and build of high-quality software and exposes them to real-world strategies and procedures that will give them a competitive edge in the market. There are several areas to focus on within software engineering, such as design, development, testing, maintenance, and management. Software development outside of the classroom is a very complex process, mostly because real-world software is much larger and more complex. Student can apply these strategies and techniques in different circumstances.

Course Objectives:

1. To provide the idea of decomposing the given problem into Analysis, Design, Implementation, Testing, and Maintenance phases.
2. To introduce an idea of using various process models in the software industry according to given circumstances.
3. To acquire the knowledge of how Analysis, Design, Implementation, Testing, and Maintenance processes are conducted in a software project.
4. To develop any application using any programming language.

Course Content:

Introduction of the project: Develop requirement specification of our project.

Model: Develop DFD model (level-0, level-1 DFD and Data dictionary) of the project, Develop UML Use case model for a problem.

Diagram: Develop sequence diagram, Develop sequence diagram.

Protecting Data and Ethics: Protecting programs and data (copyright, patents and trade secrets), legal and ethical l issues in selling and producing correct and usable software, threats to integrity and confidentiality

Evaluation: Project Evaluation, Project Presentation.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Apply SDLC to software development.

CLO2 Prepare SRS document for a given application.

CLO3 Prepare UML design document for a given application.

CLO4 Develop any application using any programming language.

CLO5 Analyze test developed software by using any testing strategy.

Mapping Course Learning Outcomes (CLOs) with the PLOs:												
CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO 4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO1 2
CLO1			√									
CLO2					√							
CLO3					√							
CLO4			√									
CLO5											√	

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Introduction of the project	Lecture, Discussion, Interactive discussions, Questions and answers, Problem Solving	Assignment, Exam
CLO2	Model	Lectures, Online Video, Questions and answers, Case Study, Group Study for Data Analysis	Presentation, Assignment, Performance test
CLO3	Diagram	Lecture, Class work, Online Video, Problem Based Learning	Assignment, Performance test
CLO4	Protecting Data and Ethics	Case study analysis, PowerPoint Demonstration, Problem Based Learning	Performance test, Presentation, Exam
CLO5	Evaluation	Powerpoint Demonstration, Case study analysis, Problem Based Learning	Assignment, Presentation, Viva, Exam

Books Recommended:

1. *Roger S. Pressman,* "*Software Engineering: A Practitioner's Approach*"*, 6th Ed., McGraw Hill, 2004.*

Course Code: CSE 331, Course Title: Pattern Recognition

Course Code (BNQF): CSE-0613-331
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any**):** CSE 227, MATH 135

Rationale:

This course focuses on the core element of modeling and recognizing patterns in data through learning. Students will learn the concepts of pattern recognition through this course. As an introductory course at the senior level and first-year graduate level, the course will cover the concepts of traditional and modern pattern recognition, train students to wield probability theory tools to solve pattern recognition problems, and prepare students for advanced research/industrial projects in this field.

Course Objectives:

1. To explain and compare a variety of pattern classification, structural pattern recognition, and pattern classifier combination techniques.
2. To provide the necessary theoretical background and demonstrates the application of computer science to pattern recognition.
3. To apply pattern recognition techniques to real-world problems such as document analysis and recognition.

Course Content:

Introduction to Pattern Recognition: Introductory Concepts of Pattern Recognition System, Design Cycle, Learning and Adaptation: Supervised Learning, Unsupervised Learning, Reinforcement Learning, Regularizes, Cross-validation, Learning curves, and Performance Matrices.
Classification and Decision Trees: Bayesian Decision Theory-Continuous Features, Minimum-Error-Rate Classification, Classifier, Discriminant Functions and Decision Surfaces, Bayes Decision Theory-Discrete Features, Splitting Criteria, CART. Ensemble Methods: Boosting, Bagging, Random Forests, Maximum Likelihood and Maximum Likelihood Estimation, Bayesian Estimation, Hidden Markov Model.
Concept on Nonparametric Techniques and functions: K-nearest neighbor estimation, Parzen Window, Discriminant Functions: Linear Discriminant Functions and Decision Surfaces, Minimum Square Error Procedures, Principal Component Analysis, Fischer's Discriminant Analysis
Concept of Methods and Algorithms: Stochastic Search: Simulated Annealing, Evolutionary Methods: Genetic Algorithms, Decision Tress, Recognition with Strings, Naive Bayes' classifier.
Introduction to Deep Learning/Neural Networks: Neural Network, Overview on Multi-layer Neural Networks, Feed-forward neural networks, Backpropagation, Convolutional neural networks
SVM and Clustering: Separating hyperplanes, linearly separable case, non-separable case, nonlinear classification via kernels, support vector machines, multiclass SVMs, K-means clustering, K-medoids clustering, Unsupervised Bayesian Learning: The Bayes classifier, Data Description and Clustering: Similarity Measures, Criterion Function for clustering, Hierarchical Clustering.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Describe and critique pattern recognition, machine learning and deep learning techniques.
CLO2 Identify and select suitable modelling, learning and prediction techniques to solve a complex data problem.
CLO3 Summarize, analyze, and relate research in the pattern recognition area verbally and in writing.
CLO4 Design a refined machine learning solution.
CLO5 Compare various supervised and unsupervised learning techniques in data mining.

Mapping Course Learning Outcomes (CLOs) with the PLOs

CLO	PLO											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1			√									
CLO2			√									
CLO3		√										
CLO4					√							
CLO5					√							

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

CLOs	Topics	Teaching-Learning Strategy	Assessment Strategy
CLO1	Introduction to Pattern Recognition:	Lecture, Interactive discussions, Questions and answers, Online video, Group Discussion, Lab Assignment.	Class Test, Assignment, Exam
CLO2, CLO3	Classification and Decision Trees:	Lecture, Interactive discussions, Questions and answers, PowerPoint demonstration, Online video, Group Discussion, Lab Assignment.	Presentation, Assignment
CLO2, CLO3	Concept on Nonparametric Techniques and functions:	Lecture, Interactive discussions, Questions and answers, PowerPoint demonstration, Online video, Group Discussion, Lab Assignment.	Written test, Presentation, Exam
CLO2, CLO3	Concept of Methods and Algorithms:	Lecture, Interactive discussions, Questions and answers, Online video, Group Discussion, Lab Assignment.	Class Test, Assignment, Exam
CLO4, CLO5	Introduction to Deep Learning/Neural Networks:	Lecture, Interactive discussions, Questions and answers, PowerPoint demonstration, Online video, Group Discussion, Lab Assignment.	Written test, Presentation, Exam
CLO4, CLO5	SVM and Clustering:	Lecture, Interactive discussions, Questions and answers, Online video, Group Discussion, Lab Assignment.	Class Test, Assignment, Exam

Books Recommended:

1 *R.O. Duda, P.E. Hart and D. Stork. (2001), "Pattern Classification", (2nd edition), Wiley.*

2 *C. Bishop. (2006), "Pattern Recognition and Machine Learning", Springer.*

3 *C. Bishop. (1995), "Neural Networks for Pattern Recognition", Oxford University Press.*

4 *S. Theodoridis and K. Koutroumbas. (2009), "Pattern Recognition", (4th edition), Academic Press.*

5 *K. Fukunaga. (1972), "Introduction to Statistical Pattern Recognition", Academic Press.*

6 *P. Devijver and Y. Kittler. (1982), "Pattern Recognition: A Statistical Approach", Prentice-Hall.*

7 *K.S. Fu. (1982), "Syntactic Pattern Recognition and Applications", Prentice-Hall.*

Course Code: CSE 332, Course Title: Pattern Recognition Sessional

Course Code (BNQF): CSE-0613-332
Credit Hr.: 1.50, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any): None

Rationale:

This course offers project topics that are connected to our current research in the fields of medical image processing, speech processing and understanding, computer vision and digital humanities. Students will learn practical implementation of pattern recognition through this course.

Course Objectives:

1. To study the differences of the metabolite expression profiles acquired under different physiological conditions.
2. To cover wide understanding of different related topics, i.e., pattern recognition systems, preprocessing and feature extraction, theories of supervised and unsupervised learning, object classification and recognition, artificial neural networks, and other topics as well.

Course Content:

Introduction to programming in Python/R/MATLAB: Introductory concept of coding tools and ide.
Practical implementation: Implementation of feature extraction, selection, Analysis of data, representation and plotting
Working with Deep neural networks: Analyze problem, Design systems and algorithms or apply algorithms for pattern recognition**,** Working with machine learning problem solving in the lab
Working with different pattern recognition concepts: object detection, template matching etc.
Project Follow up and presentation: Implementation of a simple project using the concept of the course.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Apply data gathering and representation techniques.

CLO2 Apply typical pattern recognition algorithms in Python/R/MATLAB.

CLO3 Illustrate ideas and findings of pattern recognition effectively.

CLO4 Assess critically and learn independently to solve pattern recognition problems.

CLO5 Analyze a given problem, design and develop an artificial system for pattern recognition.

Mapping Course Learning Outcomes (CLOs) with the PLOs												
CLO	**PLO**											
	PLO1	POL2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1		√										
CLO2					√							
CLO3			√									
CLO4		√										
CLO5					√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Introduction to programming in Python/R/MATLAB:	Lecture, Interactive discussions, Questions and answers, Online video, Group Discussion, Lab Assignment.	Class Test, Assignment, Exam
CLO2	Practical implementation	Lecture, Interactive discussions, Questions and answers, PowerPoint demonstration, Online video, Group Discussion, Lab Assignment.	Presentation, Assignment
CLO3, CLO4	Working with Deep neural networks	Lecture, Interactive discussions, Questions and answers, PowerPoint demonstration, Online video, Group Discussion, Lab Assignment.	Written test, Presentation, Exam
CLO3, CLO4	Working with different pattern recognition concepts	Lecture, Interactive discussions, Questions and answers, Online video, Group Discussion, Lab Assignment.	Class Test, Assignment, Exam
CLO5	Project Follow up and presentation	Lecture, Interactive discussions, Questions and answers, Online video, Group Discussion, Lab project.	Presentation, Assignment

Books Recommended:

1. *R.O. Duda, P.E. Hart and D. Stork. (2001), "Pattern Classification", (2nd edition), Wiley.*
2. *Machine Learning Mastery, https://machinelearningmastery.com/machine-learning-in-python-step-by-step/*
3. *Math works, https://www.mathworks.com/discovery/pattern-recognition.html.*
4. *Data Camp, https://cran.r-project.org/web/packages/bpa/vignettes/introduction.html.*

Course Code: CSE 341, Course Title: Artificial Intelligence

Course Code (BNQF): CSE-0613-341
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any**):** None

Rationale:

The main goal of this course is to provide most fundamental knowledge for understanding AI. This course is designed for undergraduate students who will able to introduce some basic search algorithms for problem solving; knowledge representation and reasoning; pattern recognition; fuzzy logic; and neural networks. This course can help students to acquire knowledge in a better and faster way with high-quality learning materials. This course will satisfy a 100-level requirement for courses in computer science and engineering for undergraduate majors.

Course Objectives:

1. To provide with understanding of the role of Artificial Intelligence, Expert Systems and Decision Models in real life scenario.
2. Develop abilities to apply, build and modify decision models to solve real problems.
3. Explore the issues involved in the design and development of Artificial Intelligence Based Decision Support Systems and discuss the role these systems play in the business environment.
4. Gain the knowledge to build a prototype.

Course Content:

Introduction: The AI Problems, The Underlying Assumption,AI Technique, Defining the Problem as a State Space Search, Production System, and Problem Characteristics.

Heuristics Search Techniques: Generate and Test, Hill Climbing, Best First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis.

Knowledge Representation Issues: Representation and Mappings, Approaches to Knowledge Representation, Issues in Knowledge Representation.

Using Predicate Logic: Representing Simple Facts in Logic, Representing Instance and Isa Relationships, Computable Functions and Predicates, Resolution.

Representing Knowledge Using Rules: Procedural versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning, Matching.

Game Playing: Overview, the Minimax Search Procedure, Adding Alpha-Beta Cutoffs, Additional Refinements, Iterative Deepening.

Planning&Understanding: Overview, an Example Domain: The Blocks World, Components of a Planning System, Goal Stack Planning, What Is Understanding, What Makes Understanding Hard, And Understanding as Constraint Satisfaction.

Natural Language Processing: Introduction, Syntactic Processing, Semantic Analysis, Discourse and Pragmatic Processing.

Course Learning Outcomes (CLO):

After successfully completion of the course students will be able to:

CLO1 Explain what constitutes "Artificial" Intelligence and how to identify systems with Artificial Intelligence.

CLO2 Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.

CLO3 Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.

CLO4 Evaluate proficiency developing applications in an 'AI language', expert system shell, or data mining tool.

Mapping Course Learning Outcomes (CLOs) with the PLOs

CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3					√							
CLO4					√							

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

CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Introduction	Lecture, Discussion, Interactive discussions, Questions and answers, Problem Solving	Class Test, Assignment, Exam
CLO2	Heuristics Search Techniques, Knowledge Representation Issues, Using Predicate Logic, Representing Knowledge Using Rules	Lectures, Questions and answers, Case Study	Presentation, Assignment
CLO3	Game Playing, Planning & Understanding	Lecture, Class work, Case study analysis, Problem Based Learning	Class Test, Assignment, Exam
CLO4	Natural Language Processing	Lecture, Problem Based Learning	Written test, Presentation, Exam

Books Recommended:

1. *Russell and Norvig, "Artificial Intelligence: A modern approach", 3rd Ed.,Prentice Hall, 2009.*
2. *Elaine Ritch& Kevin Knight,"Artificial Intelligence", 3rd Ed.,Mc Graw Hill India, 2017.*
3. *Neils J. Nilsson,"Principles of Artificial Intelligence", 2nd Ed.,Morgan Kaufmann, 2014.*

Course Code: CSE 342, Course Title: Artificial Intelligence Sessional

Course Code (BNQF): CSE-0613-342
Credit Hr.: 1.50, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any): None

Rationale:

The main goal is to not only comprehend the nature of intelligence, but also to create intelligent computer systems. This lab is significant because it permits software to carry out human being potentials such as thinking, reasoning, planning, communication, and perception more productively, accurately, and affordable. This course is designed for undergraduate students who are inspecting at developing AI and ML on modern architecture. This lab can help students learn better and faster when paired with high-quality learning materials and instruction. It will satisfy a 100-level requirement for courses in computer science and engineering for undergraduate majors.

Course Objectives:

1. To introduce and strengthen systems thinking, problem solving, analysis, design, and research.
2. To learn with team work and develop for lifelong learning in areas of artificial intelligence, machine learning, and deep learning.
3. To apply knowledge representations in applications: healthcare and smart living, speech recognition and natural language processing.

Course Content:

Introduction to Prolog: Give some simple examples of Prolog programs, explain other concepts, such as the role of logic, unification with the help of variables.

Basic Problem-Solving Strategies: Solve any problem using depth first search, best first search: 8-puzzle problem, solve robot (traversal) problem using means end analysis, solve traveling salesman problem.

Expert Systems: Representing and using domain knowledge, expert system shells explanation, and knowledge acquisition.

Project Documentation: Finally, solve real world problems effectively using image processing techniques and create a suitable presentation slide and documentation/report individually or group.

Course Learning Outcomes (CLO):

At the end of this course, students should be able to:

CLO1	Get the basic idea of how to program in prolog and its working environment.
CLO2	Analyze the fundamentals of knowledge representation, inference and theorem proving using AI tools.
CLO3	Solve real-world problems by using knowledge representation, reasoning, and machine learning techniques individually or group.
CLO4	Create a suitable presentation slide and documentation/report based on the implemented project.

Mapping Course Learning Outcomes (CLOs) with the PLOs:												
CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1		√										
CLO2				√								
CLO3					√							
CLO4					√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1 CLO2	Introduction to Prolog	Lecture, Interactive discussions, White Board illustration, Problem based learning	Performance test, Lab report, quiz, mcq
CLO3	Basic Problem-Solving Strategies, Expert System	Lecture, Discussion, Case study, Problem based learning	Performance test, Lab report, quiz, mcq
CLO4	Project Documentation	Case study, Problem based learning, Problem solving sessions	Lab report/documentation

Books Recommended:

1. *C. Townsend, "Introduction to Turbo Prolog", 2nd Ed., BPB Publications, 1988.*

Course Code: CSE 434, Course Title: Web Technology Sessional

Course Code (BNQF): CSE-0613-434
Credit Hr.: 1.50, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any**):** None

Rationale:

The aim of this course is to design and implement static and dynamic website. The undergraduate students will be able to learn the role of languages like HTML, CSS, XML, JavaScript, ASP and protocols in the workings of the web and web applications. This course will satisfy a 100-level requirement for courses in computer science and engineering for undergraduate majors.

Course Objectives:

1. Design and implement dynamic websites with good aesthetic sense of designing and latest technical know-how's.
2. Have a good grounding of Web Application Terminologies, Internet Tools, E – Commerce and other web services.
3. Get introduced in the area of online game programming.

Course Content:

Understanding Web Apps: REST, XML, JSON, RSS Parsing.

Server-Side Technology: Web Application Frameworks (Example: Silverlight, Adobe Flex), Web 2.0 and Web Apps.

Front-End Technology: HTML, XHTML, XML. CSS Styling, Layout, Selector, Document Object Model and JavaScript.

Client-Programming: Web Apps with JavaScript (Example: Google Ajax API).

MVC: Understanding Model, View and Controller Model.

JavaScript Exercise: The Goal of This Assignment Is to Allow You to Explore and Use as Many of JavaScript's Objects, Methods, and Properties as Possible in A Small Assignment.

PHP Exercise: Build a set of PHP Scripts that perform some dynamic server-side functionality.

Understanding Plug-ins: Develop a Firefox Extension

Course Learning Outcomes (CLO):

After successfully completion of the course students will be able to:

CLO1 Identify any suitable real time web application and select suitable technology as per the application requirements.

CLO2 Build application in different frameworks.

CLO3 Display real time web applications in web servers and in the cloud.

CLO4 Construct applications for any IT problems using Web Technologies.

Mapping Course Learning Outcomes (CLOs) with the PLOs												
CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PlO9	PO10	PO11	PO12
CLO1			√									
CLO2				√								
CLO3				√								
CLO4				√								

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Understanding Web Apps	Lecture, Discussion, Interactive discussions, Questions and answers, Problem Solving, Lab Assignment	Quiz, Performance Test, Lab Report
CLO2	Server-Side Technology, Front-End Technology, Client-Programming, MVC	Lectures, Questions and answers, Case Study, Problem Solving, Lab Assignment	Quiz, Performance Test, Lab Report
CLO3	JavaScript Exercise, PHP Exercise	Lecture, Class work, Case study analysis, Problem Based Learning, Lab Assignment	Quiz, Performance Test, Lab Report
CLO4	Understanding Plug-ins	Lecture, Problem Based Learning, Problem Solving, Lab Assignment	Quiz, Performance Test, Lab Report

Books Recommended:

1. *Jon Duckett,* "*Web programming with HTML, XHTML and CSS*", *2nd Ed., Wiley India.*
2. *Julie Meloni, Sams,* "*HTML, CSS and JavaScript All in One*", *2nd Ed.,Pearson, 2014.*
3. *Luke Welling and Laura Thomson, "PHP and MySQL Web Development", 5th Ed., Addison Wesley, 2016.*
4. *Valeri Karpov, Diego Netto, Wrox*, *"Professional AngularJS", 2015.*
5. *Paul Deitel, Harvey Deitel, Abbey Deitel, "Internet and WWW How to Program", 5th Ed., Tata McGraw Hill, 2011.*

Course Code: CSE 411, Course Title: Compiler

Course Code (BNQF): CSE-0613-411
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any**):** CSE 317

Rationale:

This course introduces the design and implementation of *compilers* for programming languages. Specifically, undergraduate students will learn how to systematically translate modern, high-level, programming languages into efficient, executable machine code.The course introduces a number of important concepts, such as parsing and program analysis that are useful in many other contexts beyond compilers, such as software engineering and security. The students will deeply understand the capabilities and limitations of modern compilers, and how they can be used most effectively. This knowledge is important for aspiring language designers and implementors, but also for debugging and optimizing just about any application. This course will satisfy a 100-level requirement for courses in computer science and engineering for undergraduate majors.

Course Objectives:

1. To introduce the basic structure of a compiler.
2. To solve problems universally encountered in designing language translator.
3. To know about building lexical analyzers, context-free grammars and syntax-directed definitions.
4. To know the techniques of the optimization that is used in program verifiers and in programs.

Course Content:

Introduction to Compilers: Introductory Concepts,Types of Compilers, Applications, Phases of A Compiler.

Lexical Analysis: Role of The Lexical Analyzer, Input Buffering, token Specification, Recognition of tokens, SymbolTables.

Parsing: Parser and Its Role, Context Free Grammars, top-Down Parsing.

Syntax-Directed Translation: Syntax-Directed Definitions, Construction of Syntax Trees, top-Down Translation.

Type Checking: Type Systems, Type Expressions, Static and Dynamic Checking of Types, Error Recovery.

Run-Time Organization: Run-Time Storage Organization, Storage Strategies.

Intermediate Code Generation: Intermediate Languages, Declarations, Assignment Statements.

Code Optimization: Basic Concepts of Code Optimization, Principal Sources of Optimization.

Code Generation. Features of Some Common Compilers: Characteristic Features of C, Pascal and Fortran Compilers.

Course Learning Outcomes (CLO):

After successfully completion of the course students will be able to:

CLO1	Indicate a language processing system, design of a compiler including the phases of a typical compiler and its front- and back ends and role of a symbol table.
CLO2	Explain the basic techniques used in compiler construction such as lexical analysis, top-down, bottom-up parsing, context-sensitive analysis, intermediate code generation, DFA, NFA, SDD, DAG, annotated parse tree representation.
CLO3	Describe the basic data structures and their purpose which are used in compiler construction, the role of semantic analyzer and type checking different types of runtime environments and memory organization for implementation of typical programming languages.
CLO4	Identify the dataflow problem(s) required for a given dataflow optimization, construct and solve the dataflow

equations for a given dataflow problem.

Mapping Course Learning Outcomes (CLOs) with the PLOs												
CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3					√							
CLO4			√									

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Introduction to Compilers	Lecture, Discussion, Interactive discussions, Questions and answers, Problem Solving	Class Test, Assignment, Exam
CLO2	Lexical Analysis, Parsing, Syntax-Directed Translation	Lectures, Questions and answers, Case Study	Presentation, Assignment
CLO3	Type Checking, Run-Time Organization	Lecture, Class work, Case study analysis, Problem Based Learning	Class Test, Assignment, Exam
CLO4	Intermediate Code Generation, Code Optimization, Code Generation. Features of Some Common Compilers	Lecture, Problem Based Learning	Written test, Presentation, Exam

Books Recommended:

1. *Aho, Ulman & Ravishethi,* "*Principle of Compiler Design*"*, 2nd Ed., Addison-Wesley, 2006.*
2. *Philip M. Lewis,* "*Compiler Design Theory*"*, 1st Ed.,AddisonWesley, 1976.*
3. *Willam A. Barrette, "Compiler Construction: Theory and Practice", Revised, Sra, 1979.*

Course Code: CSE 412, Course Title: Compiler Sessional

Course Code (BNQF): CSE-0613-412
Credit Hr.: 1.50, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any**):** None

Rationale:

The main goal of this course is to enlighten knowledge base in compiler design and its applications. This lab provides deep understanding of how programming language Syntax, Semantics are used in translation into machine equivalents apart from the knowledge of various compiler generation tools like LEX,YACC etc. The undergraduate students will be able to gather more knowledge by doing the course practically and following proper instructions. This course will satisfy a 100-level requirement for courses in computer science and engineering for undergraduate majors.

Course Objectives:

1. To implement Lexical Analyzer using Lex tool & Syntax Analyzer or parser using YACC Tool.
2. To implement NFA and DFA from a given regular expression.
3. To implement front end of the compiler by means of generating Intermediate codes.
4. To implement code optimization techniques.

Course Content:

Design a lexical analyzer for given language

Test whether a given identifier.
Simulating lexical analyzer for validating operators, Implement the lexical analyzer using JLex, flex or other lexical analyzer generating tools.
Implementing the functionalities of predictive parser, constructing of LL (1) parsing
Implement and construct different parsing
Convert the BNF rules into Yacc form and write code to generate abstract syntax tree, generating machine code from abstract syntax tree generated by the parse.

Course Learning Outcomes (CLO):

After successfully completion of the course students will be able to:

CLO1 Recognize the working of lex and yacc compiler for debugging of programs.

CLO2 Demonstrate and define the role of lexical analyzer, use of regular expression and transition diagrams.

CLO3 Construct parse tree and use Context free grammar.

CLO4 Build program for solving parser problems.

Mapping Course Learning Outcomes (CLOs) with the PLOs												
CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1				√								
CLO2		√										
CLO3				√								
CLO4				√								

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Design a lexical analyzer for given language, Test whether a given identifier.	Lecture, Discussion, Interactive discussions, Questions and answers, Problem Solving, Lab Assignment	Quiz, Performance Test, Lab Report
CLO2	Simulating lexical analyzer for validating operators, Implement the lexical analyzer using JLex, flex or other lexical analyzer generating tools.	Lectures, Questions and answers, Case Study, Problem Solving, Lab Assignment	Quiz, Performance Test, Lab Report
CLO3	Convert the BNF rules into Yacc form and write code to generate abstract syntax tree, generating machine code from abstract syntax tree generated by the parse.	Lecture, Class work, Case study analysis, Problem Based Learning, Lab Assignment	Quiz, Performance Test, Lab Report
CLO4	Implementing the functionalities of predictive parser, constructing of LL (1) parsing, Implement and construct different parsing	Lecture, Problem Based Learning,Problem Solving, Lab Assignment	Quiz, Performance Test, Lab Report

Books Recommended:

1. *Aho, Ulman & Ravishethi,* "*Principle of Compiler Design*"*, 2nd Ed., Addison-Wesley, 2006.*
2. *Philip M. Lewis,* "*Compiler Design Theory*"*, 1st Ed.,AddisonWesley, 1976.*
3. *Willam A. Barrette, "Compiler Construction: Theory and Practice", Revised, Sra, 1979.*

Course Code: CSE 421, Course Title: Computer Graphics

Course Code (BNQF): CSE-0613-421
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any**):** None

Rationale:

This course is an introductory course in Computer Graphics, and covers a wide range of the field of interactive computer graphics at all levels of abstraction, with an emphasis on both theory and practice. The students will get familiar with the fundamental algorithms and data structures used in today's interactive graphics systems as well as the programming and architecture of high-resolution graphics computers.

Course Objectives:

1. To introduce the basic concepts of computer graphics
2. To provide the necessary theoretical background and demonstrates the application of computer science to graphics
3. To develop programming skills in computer graphics through programming assignments

Course Content:

Introduction to Computer Graphics: Work using CISCO Packet Tracer and introduce with networking devices.
Introduction: Introductory Concepts, history of computer graphics, I/O in Graphics
Graphics and GPU Programming: GPU programming, OpenGL and DirectX APIs, Shaders.
Mathematical concept of Computer Graphics: The Virtual Camera. Euclidean space and basic terminology. Rigid body Transformations. Transformations: Translation, Scale, Rotation. 2D vs 3D transformations, Primitive Objects. Constructive solid geometry. Polygons. Voxels. Boundary representation. Level of Detail and Tessellation. Acceleration Data structures.
Materials of Computer Graphics: Texture Mapping. Bump Mapping, Light to Surface Interactions, OpenGL lighting/reflectance model. Bidirectional Reflectance Distribution Functions.
Basics of Drawing and Image Processing: Fonts Basics, Drawing lines, Scan conversion, Rasterisation, Signal processing. Common Image Formats, Sampling and Reconstruction, Filtering and convolution, Aliasing, visual system, Strengths and weaknesses of the human visual system.
Measuring Light in graphics: Radiometry and Photometry, Colour models, Spectral Radiance, Illumination and Rendering.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Describe possible applications of Computer Graphics and current trends

CLO2 Explain the mathematical foundation of the concepts of computer graphics

CLO3 Discuss various algorithms for scan conversion and filling of basic objects and their comparative analysis.

CLO4 Use of geometric transformations on graphics objects and their application in composite form.

CLO5 Select scene with different clipping methods and its transformation to graphics display device.

Mapping Course Learning Outcomes (CLOs) with the PLOs												
CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1		√										
CLO2	√											
CLO3			√									
CLO4			√									
CLO5			√									

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Introduction to Computer Graphics	Lecture, Interactive discussions, Questions and answers, Problem Solving, Online Video.	Class Test, Assignment, Exam
CLO1, CLO2	Introduction	Lectures, Questions and answers, Case Study, Powerpoint Demonstration, Group Discussion,	Presentation, Assignment
CLO3	Graphics and GPU Programming	Lecture, Class work, Problem Based Learning.	Class Test, Assignment, Exam
CLO3, CLO4	Mathematical concept of Computer Graphics	Lectures, Questions and answers, Case Study, Powerpoint Demonstration, Group Discussion,	Written test, Presentation, Exam
CLO3, CLO4	Materials of Computer Graphics	Lecture, Interactive discussions, Questions and answers, Problem Solving, Online Video.	Class Test, Assignment, Exam
CLO4, CLO5	Basics of Drawing and Image Processing	Lectures, Questions and answers, Case Study, Powerpoint Demonstration, Group Discussion,	Presentation, Assignment
CLO5	Measuring Light in graphics	Lecture, Interactive discussions, Questions and answers, Problem Solving, Online Video.	Class Test, Assignment, Exam

Books Recommended:

1 *Peter Shirley et al., "Fundamentals of Computer Graphics", 3rd edition (2009), CRC Press, ISBN 978-1568814698 (cf. Material)*

0. *Shreiner and Angel, "Interactive Computer Graphics: A Top-Down Approach with Shader-Based OpenGL", Pearson Education ISBN 978-0273752264*

0. *Foley, Van Dam, Feiner, & Hughes, Addison-Wesley "Computer Graphics: Principles and Practice", ISBN 0201848406*

0. *John Vince, "Mathematics for Computer Graphics" ,ISBN 1849960224*

0. *Akenine-Möller, T., Haines, E., & Hoffman , "Real-time Rendering", N. (2019). CRC Press, ISBN 978-1138627000*

0. *Philip Dutre , "Global Illumination Compendium", (websource: https://people.cs.kuleuven.be/~philip.dutre/GI/)*

0. *Hearn, Baker and Carithers , "Computer Graphics with OpenGL", ISBN 978-0132484572*

Course Code: CSE 422, Course Title: Computer Graphics Sessional

Course Code (BNQF): CSE-0613-422
Credit Hr.: 1.50, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any)**:** None

Rationale:

This course provides applied learning opportunities for learners with an interest in computer graphics who are looking to foster a career within design-based industries and/or wish to prepare for further study in Computer Graphics.

Course Objectives:

1. To allow learners to develop a practically based understanding of form and functional design contexts using computer graphics and associated digital technologies
2. To engage learners in solving design challenges and presenting their ideas or solutions as digital graphic solutions
3. To demonstrate their skills and understandings of design principles and processes

Course Content:

Introduction to OpenGL: Fundamental knowledge about OpenGl, installation and working with some basic built in functions.
Implementing drawing algorithms and Tranformations: Working with different shapes by changing colors like star, home. DDA line drawing algorithm, Bresenham's Line Drawing algorithm, Circle Drawing algorithm, Working with 2D 3Dtransformations.
Introduction to Colors, Shadings and Animations: Working with the basics of shading and animation in computer graphics.
Project Presentation: A project implementation based on the above topics.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Demonstrate effective OpenGL programs to solve graphics programming issues including different shapes.
CLO2 Identify the concepts of different type of geometric transformation of objects in 2D and 3D.
CLO3 Analyze and solve real world problems related to animation or graphics.

Mapping Course Learning Outcomes (CLOs) with the PLOs

CLO	PLO											
	PLO1	POL2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1		√										
CLO2			√									

CLO3					√							

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

CLOs	Topics	Teaching-Learning Strategy	Assessment Strategy
CLO1	Introduction to OpenGL	Lecture, Interactive discussions, Questions and answers, Online video, Group Discussion, Lab Assignment.	Class Test, Assignment, Exam
CLO2	Implementing drawing algorithms and transformation's	Lecture, Interactive discussions, Questions and answers, PowerPoint demonstration, Online video, Group Discussion, Lab Assignment.	Presentation, Assignment
CLO1, CLO3	Introduction to Colors, Shadings and Animations	Lecture, Interactive discussions, Questions and answers, PowerPoint demonstration, Online video, Group Discussion, Lab Assignment.	Written test, Presentation, Exam
CLO3	Project Presentation	Lecture, Interactive discussions, Questions and answers, Online video, Group Discussion, Lab Assignment.	Class Test, Assignment, Exam

Books Recommended:

1 *Dave Shreiner, Mason Woo, Jackie Neider, and Tom Davis, "OpenGL Programming Guide: The Official Guide to Learning OpenGL", 4th Edition, Addison-Wesley.*

0. *Roy A. Plastock, and Gordon Kalley, "Schaum's Outline of Theory and Problems of Computer Graphics", 2nd Ed., McGraw-Hill.*

Course Code: CSE 423, Course Title: Simulation and Modeling

Course Code (BNQF): CSE-0613-423
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any**):** None

Rationale:

Simulation and modeling aims to give an introduction to the B.Sc. (Engg.) students to model methods and simulation tools for a wide range of natural phenomena. This course is important for creating and analyzing a digital prototype of a physical model to predict its performance in the real world. It will satisfy a 100-level requirement for courses in computer science and engineering for undergraduate majors.

Course Objectives:

1. To give a clear understanding of the concepts of simulation and modeling.
2. To enhance knowledge of simulation and model in a range of important application areas.
3. To demonstrate the ability to apply the techniques of modeling and simulation to a range of problem areas and evaluate a simulation, highlighting the benefits and the drawbacks.

Course Content:

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 discrete-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 simulation outputs, input modeling; Generating random numbers and random variants; Output analysis.
Simulation Languages: Analysis and modeling of some practical systems.

Course Learning Outcomes (CLO):

At the end of this course, students should be able to:

CLO 1 Illustrate the role of important elements of discrete event simulation and modeling paradigm.

CLO 2 Revise real world situations related to systems development decisions, originating from source requirements and goals.

CLO 3 Plan simulation model to construct and execute goal-driven system models.

CLO 4 Create the model and apply the results to resolve critical issues in a real-world environment.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

CLO	**PO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1		√										
CLO2			√									

CLO3					√							
CLO4					√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Simulation Modeling Basics	Lecture, Discussion, White Board work, Interactive discussions, Questions and answers, Problem solving	Class test, Assignment, Exam
CLO2 CLO3	Building Valid and Credible Simulation Models	Lectures, Questions and answers, Class work, , Case study analysis, Problem based learning	Presentation, Assignment, Exam
CLO3 CLO4	Simulation Languages	Lecture, Case study analysis, Problem based learning	Class test, Assignment, Exam

Books Recommended:

1. *J. Banks, J. S. Carson, B. L. Nelson, D. M Nicol, "Discrete Event system Simulation" 4th Ed, Pearson Education, 2007.*
2. *G. Gordon, "System Simulation", 2nd Ed, Prentice Hall publication, 1978.*

Course Code: CSE 424, Course Title: Simulation and Modeling Sessional

Course Code (BNQF): CSE-0613-424
Credit Hr.: 1.50, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any): None

Rationale:

Simulation and modeling solves real-world problems safely and efficiently. Across industries and disciplines, simulation and modeling provides valuable solutions by giving clear insights into complex systems. The interested undergraduate students are the targeted audience in modeling and simulation, and with a foundation in both physics and numerical methods. It will satisfy a 100-level requirement for courses in computer science and engineering for undergraduate majors.

Course Objectives:

1. To introduce various system modeling and simulation techniques, and highlight their applications in different areas. It includes modeling, design, simulation, planning, verification and validation.
2. To learn the simulation techniques to solve real world problems those cannot be solved strictly by mathematical approaches.
3. To demonstrating the usefulness of simulation as a tool for problem solving in business, industry, government, and society.

Course Content:

Simulation Modeling Basics: Usage of common excel formulas and excel built in functions for simulation, writing program to show the customer no, interarrival time and arrival time on clock, writing program to simulate the customer service time, service begin time and service end time for single server system and multi-server system, single-channel queue problem in excel, simulation software, and in C or C++ or Java.

Building Valid and Credible Simulation Models: Writing program to simulate the newspaper seller's problem, the reliability problem of milling machine, generate random numbers using linear congruential method, generate random numbers using mixed congruential method, analyze the outcome and make prediction, and also analysis and modeling of some other practical systems.

Course Learning Outcomes (CLO):

At the end of this course, students should be able to:
CLO1 Refine the role of important elements of discrete event simulation and modeling paradigm.
CLO2 Revise real world situations related to systems development decisions, originating from source requirements and goals.
CLO3 Test simulation software to construct and execute goal-driven system models.
CLO4 Analyze the results or outcomes and make predictions to resolve critical issues in a real-world environment.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

CLO	PLO											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1				√								
CLO2			√									
CLO3				√								
CLO4					√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1 CLO2	Simulation Modeling Basics	Lecture, Interactive discussions, Problem based learning	Performance test, Lab report, quiz, mcq
CLO3 CLO4	Building Valid and Credible Simulation Models	Lecture, Discussion, Case study, Problem based learning, Problem solving sessions	Performance test, Lab report, quiz, mcq

Books Recommended:

1. *J. Banks, J. S. Carson, B. L. Nelson, D. M Nicol, "Discrete Event system Simulation" 4th Ed, Pearson Education, 2007.*
2. *G. Gordon, "System Simulation", 2nd Ed, Prentice Hall publication, 1978.*

Course Code: CSE 447, Course Title: Multimedia System Design

Course Code (BNQF): CSE-0613-447
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any**):** None

Rationale:

In this course, students will be introduced to principles and current technologies of multimedia systems, multimedia standards. Issues in effectively representing, processing, and retrieving multimedia data such as sound and music, graphics, image and video will be addressed. This course is offered to the students of the 4th year.

Course Objectives:

1. Accumulate basic idea about the complete process of multimedia system specification, design, testing, and prototyping, including the tools and techniques for integrating multimedia content (text, graphics, images, sound, animation, motion video and virtual reality) into a product.
2. Make the students understand the design principles and techniques to maximize the effectiveness of such products
3. To facilitate necessary introductory knowledge about multimedia systems, multimedia applications and development tools.

Course Content:

Media and Data Streams: Medium, Main properties of a Multimedia System, Traditional Data Stream Characteristics.
Sound/audio: Basic sound concepts, MIDI basic concepts, MIDI devices and messages, Speech generation & analysis.
Image and Graphics: Digital image representation, image format, graphics format, image synthesis, image analysis, image transmission.
Video and animation: Computer video format, Conventional television systems, Enhanced definition systems, High Television definition systems, computer based animation.
Data Compression: Coding requirements, Source, Entropy and hybrid coding, Lossless and lossy compression, JPEG, H.261, MPEG, MP3 and etc.
Computer Technology Issues: Communication architecture, Multimedia workstations, cache systems, Storage systems and optical storage.
Multimedia OS: Real-time operation, Resource management, Process management, file systems and multimedia networking.
Multimedia Database: Data organization, indexing and retrieval.
Web Technologies Issues: Elements of web styling, Usability, Accessibility and information architecture and Content Management Systems (CMS).
Multimedia Applications: Digital libraries, System software, Toolkits, Conferencing paradigms, Structured interaction support and examples from video/audio/graphics conferencing.

Course Learning Outcomes (CLO):	
After completing the course, students will be able to:	
CLO1	Determine fundamentals principles of multimedia, including digitization and data compression for non-textual information.
CLO2	Analyze issues in representing, processing, and transmitting multimedia data.
CLO3	Evaluate core multimedia technologies and standards.
CLO4	Correlate to image, sound and video editing and to some aspects of multimedia authoring (incorporating images, sound, video, and animation) and the characteristics of human's audio system.

CLO5	Analyze multimedia techniques design and implementation, different compression principles, different compression techniques, different multimedia compression standards, and develop multimedia systems according to the requirements of multimedia applications.

Mapping Course Learning Outcomes (CLOs) with the PLOs												
CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2			√									
CLO3			√									
CLO4			√									
CLO5					√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Media and Data Streams	Lecture, Interactive discussions, Questions and answers	Class Test, Assignment, Exam
CLO2	Data Compression	Lecture, Discussion, Problem Solving	Class Test, Assignment, Exam
CLO3	Image and Graphics, Video and animation, Sound/audio	Lecture, Problem Solving	Written test, Exam
CLO4	Computer Technology Issues, Multimedia Database, Web Technologies Issues:	Lecture, Discussion, Problem Solving	Class Test, Assignment, Exam
CLO5	Multimedia Applications	Lecture, Interactive discussions, Questions and answers	Class Test, Assignment, Exam

Books Recommended:

1. *Ze-Nian Li and Mark S. Drew "Fundamentals of Multimedia", 1st Ed., Prentice-Hall, 2004.*
2. *ennifer J Burg, "The Science of Digital Media", 8th Ed., Upper Saddle River, NJ : Prentice Hall/Pearson Education, 2009.*

Course Code: CSE 448, Course Title: Multimedia System Design Sessional

Course Code (BNQF): CSE-0613-448
Credit Hr.: 1.50, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any)**:** None

Rationale:

In this course, students will get hands on experience on current technologies of multimedia systems, multimedia standards. This course is intended for the 4th year students to get them acquainted with the practical application of the multimedia systems.

Course Objectives:

1. To facilitate necessary knowledge about current technologies of multimedia systems.
2. To develop skills to use current multimedia system to build projects.

Course Content:

Animation: Procedure to create an animation to represent the growing moon, to indicate a ball bouncing on steps, to simulate movement of a cloud, to draw the fan blades and to give proper animation, to create an animated cursor using startdrag ("ss", true); mouse.hide(),to display the background given (filename: tulip.jpg) through own name, to create an animation with the following features, to simulate a ball hitting another ball,
Graphics Design: Procedure to design a visiting card containing at least one graphic and text information, to take a photographic image, Give a title for the image, Put the border. Write own name, Write the name of institution and place, Procedure to prepare a cover page for the book in any subject area to extract the flower only from a given photographic image and organize it on a background, to adjust the brightness and contrast of the picture so that it gives an elegant look, to position the picture preferably on a plain background of a color of your choice positioning includes rotation and scaling, to remove the arrows and text from the given photographic image, to type a word and apply the effects shadow emboss
Documentary work and Cartoon animation.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Develop understanding of the Technical Aspect of Multimedia Systems.

CLO2 Identify the storage mechanism and applicability of Various File Formats for Audio, Video and Text Media.

CLO3 Develop Various Multimedia Systems Applications Applicable in Real Time.

CLO4 Asses problems and develop solutions with computing and information technologies in multimedia area by team work and group-based project.

Mapping Course Learning Outcomes (CLOs) with the PLOs

CLO	**PLO**											
	PLO1	POL2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1				√								
CLO2				√								
CLO3			√									
CLO4												√

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1, CLO2, CLO3	Animation, Graphics Design	Lecture, Demonstration	Performance, Lab Report, Quiz Test
CLO4	Documentary work and Cartoon animation	Lecture, Interactive discussions, Demonstration	Performance, Lab Report, Quiz Test

Books Recommended:

1. *Ze-Nian Li and Mark S. Drew "Fundamentals of Multimedia", 1st Ed., Prentice-Hall, 2004.*
2. *ennifer J Burg, "The Science of Digital Media", 8th Ed., Upper Saddle River, NJ : Prentice Hall/Pearson Education, 2009.*

Course Code: CSE 453, Course Title: Digital Image Processing

Course Code (BNQF): CSE-0613-453
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any**):** None

Rationale:

This course deals with processing of images including representation, sampling and quantization, image acquisition, imaging geometry, image transforms, image enhancement, image smoothing and sharpening, and image restoration. The student of B. Sc. (Engg.) program will learn this course to improve the appearance of an image to a human observer, to extract from image quantitative information that is not readily apparent to the eye, and to calibrate an image in photometric or geometric terms. It will satisfy a 100-level requirement for courses in computer science and engineering for undergraduate majors.

Course Objectives:

1. To provide the basic concepts of image processing and analytical methods necessary for image processing.
2. To facilitate the necessary knowledge of image enhancement, restoration, and image compression procedures.
3. Help the students to conceptualize the basic techniques for utilizing motion in image segmentation, to develop skill in mathematical tools used in feature extraction, and classification algorithms.

Course Content:

Introduction: Digitization of images and its properties, data structures for image analysis, image processing.

Segmentation: Detection of discontinuities, edge Linking and boundary detection, thresholding, and region oriented segmentation, use of motion in segmentation.

Image Transforms: Z-transform, 2D Fourier transform, discrete cosine transform, Hadamard transform, Walsh transform, slant transform.

Image Compression: Run-length coding, transform coding standards.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO 1 Analyze the techniques for image enhancement and image restoration.

CLO 2 Interpret the need for image transforms, different types of image transforms and their properties.

CLO 3 Elucidate the mathematical modeling of image segmentation techniques.

CLO 4 Evaluate the usefulness of various techniques of image compression.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1		√										
CLO2		√										

CLO3			√									
CLO4					√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Introduction	Lecture, Discussion, Interactive discussions, Questions and answers, Problem solving	Class test, Assignment, Exam
CLO2	Image Transforms	Lectures, Questions and answers, Case study	Presentation, Assignment
CLO3	Segmentation	Lecture, Class work, Problem based learning	Class test, Assignment, Exam
CLO4	Image Compression	Case study analysis, Problem based learning	Written test, Presentation, Exam

Books Recommended:

1. *R.C. Gonzalez, R. E. Woods, "Digital Image processing", 3rd Ed, Pearson edition, 2016.*
2. *I. Pitas & A. N. Venetsanopoulos, "Non-Linear Digital Filter: Principles and Applications", Kluwer Academic Publications, 1990.*

Course Code: CSE 454, Course Title: Digital Image Processing Sessional

Course Code (BNQF): CSE-0613-454
Credit Hr.: 1.50, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any): None

Rationale:

This course will supplement the existing hands-on lab based on the theory courses currently being taught in the department. The aim of this *course* is to familiarize the intended undergraduate students with the implementation in *MATLAB* of the basic techniques for handling *images* and developing algorithms. This course is designed for undergraduate students who are analyzing and creating applications to solve real world problem. It will satisfy a 100-level requirement for courses in computer science and engineering for undergraduate majors.

Course Objectives:

1. To introduce the practical concepts of image processing and basic analytical methods to be used in image processing.
2. To familiarize students with image enhancement and restoration techniques.
3. To explain different image compression techniques.
4. To introduce segmentation and morphological processing techniques.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO 1 Organize the mathematical foundations for digital manipulation of images; image acquisition; preprocessing; segmentation; Fourier domain processing, compression and analysis by using the MATLAB library and MATLAB, Digital Image Processing Toolbox (IPT).

CLO 2 Analyze a wide range of problems and provide solutions related to the design of image processing systems alone or as a member of a small group.

CLO 3 Create a suitable documentation/report based on the implemented project.

Course Content:

Introduction: Writing program to extract different attributes of an image, image negation, histogram mapping and equalization, image smoothening and sharpening, edge detection, morphological operations on binary images.

Segmentation: Writing program for image segmentation.

Image Transforms: Writing program for different transformation of images.

Image Compression: Writing program for image compression.

Project Documentation: Finally, solve real world problems effectively using image processing techniques and create a suitable presentation slide and documentation/report individually or group.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

CLO	PLO											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1		√										

CLO2			√									
CLO3						√						

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Introduction, Image Compression	Lecture, Interactive discussions, White Board illustration, Problem based learning	Performance test, Lab report, quiz, mcq
CLO2	Segmentation, Image Transforms	Lecture, Discussion, Case study, Problem based learning	Performance test, Lab report, quiz, mcq
CLO3	Project Documentation	Case study, Problem based learning, Problem solving sessions	Lab report/Documentation

Books Recommended:

1. *R.C. Gonzalez, R.E. Woods, "Digital Image processing", 3rd Ed, Pearson edition, 2016.*
2. *I. Pitas & A. N. Venetsanopoulos, "Non-Linear Digital Filter: Principles and Applications", Kluwer Academic Publications, 1990.*

Course Code: CSE 113, Course Title: Electrical Engineering

Course Code (BNQF): CSE-0713-113
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** General
Pre-requisites (if any**):** None

Rationale:

Electrical engineering is an engineering discipline concerned with the study, design, and application of equipment, devices, and systems which use electricity, electronics, and electromagnetism. This course is designed to provide basic knowledge on Op-Amp, feedback amplifier, oscillator and filters. This course helps the first year students to gain knowledge regarding electrical machines and apply them for practical problems.

Course Objectives:

1. To provide the knowledge of electrical engineering concepts and to acquaint students with the knowledge and the tools to analyze linear electric circuits.
2. Make the students understand the working diode and transistor.
3. Getting idea about basic circuits using diodes and transistors.
4. To understand the concept of feedback and design feedback amplifier.
5. To enhancing the skills on oscillators and power amplifiers using transistor.

Course Content:

Introduction: Ohm's Law, DC voltage, current, Series Network & Parallel network, Series parallel combination
Network analysis: Methods of Analysis, Network Theorem
Ac circuit components: Capacitor, Inductor, Magnetic circuit and it's laws.
Ac circuit analysis: Ac circuit analysis, phasor, TTL, ECL, IIL and CMOS logic with operation details.
Electronic circuits: Flip-flops, counters and register, LED, LCD find optically coupled oscillators, Non-linear applications of OP AMPs.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Demonstrate the basic concepts of electrical circuits.

CLO2 Formulate the compute solutions to first and second order networks.

CLO3 Ability to construct Ac circuit components.

CLO4 Identify the types of R-L and R-C circuits and their design for circuit implementation.

CLO5 Analyze electronic networks and its parameters.

Mapping Course Learning Outcomes(CLOs) with PLOs:

CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2			√									
CLO3	√											

CLO4			√									
CLO5			√									

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLO	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Introduction	Lecture, Discussion, Interactive discussions, Questions and answers, Problem Solving	Class Test, Assignment, Exam
CLO2	Network analysis	Lecture, Class work, Problem Based Learning	Class Test, Assignment
CLO3	Ac circuit components	Lecture, Class work, Problem Based Learning	Presentation, Assignment, Exam
CLO4	Ac circuit analysis	Lecture, Class work, Problem Based Learning	Class Test, Assignment, Exam
CLO5	Electronic circuits	Lecture, Case study analysis, Problem Based Learning	Class Test, Assignment, Exam

Books Recommended:

1. *Robert L. Boylestad, "Introductory Circuit Analysis", 11th Ed., Pearson education Ltd., 2013-2014.*
2. *Boylestad&Nashelsky "Electronic Devices and Circuit Theory", 11th Ed., Pearson education Ltd., 2013-2014.*
3. *M.Moris Mano "Digital logic and Computer design", Pearson education Ltd., 2014-2015.*
4. *B.L. Theraja. "Electrical Technology,"1st Ed., Pearson education Ltd., 2005.*
5. *Korchner&Corcorn "Altering Current Circuits." 4th Ed., Wliey International Edition, 2005.*

Course Code: CSE 114, Course Title: Electrical Engineering Sessional

Course Code (BNQF): CSE-0713-114
Credit Hr.: 1.50, **Contact Hr.:** 3.00, **Course Type:** General
Pre-requisites (if any): None

Rationale:

This course is to study different techniques of measurement of resistance, measurement of power, study the operations and range extension of ammeter, voltmeter, study the operations of C.T. and P.T. and measurement of their transformation ratio. This course helps the 1st year students to develop skills in transients, passive filters, coupled circuits, poly phase circuits, electrical circuit design, implementation and analysis to understand the theories and apply the knowledge in future courses and industry.

Course Objectives:

1. To facilitate necessary knowledge about basic concepts of semi-conductor diode and its current-voltage relationship.
2. Make the students understand the effect of temperature on these semiconductor devices is highlighted.
3. To work the principles of Op-Amps and MOSFETS and their critical parameters impacting design of amplifiers are talked about in detail. A variety of applications of various types of transistors, Op-Amps and MOSFETS are dealt with.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Acquainted with different meters and elements for measurement of electrical quantities.

CLO2 Demonstrates how to implement basic circuit rule.

CLO3 Design and experiment basic circuit laws.

CLO4 Verify the basic circuit theorems.

CLO5 Draw phasor diagrams for circuit analysis.

Course Content:

Measurement of electrical quantities: Familiarization with the components & devices used in Circuit Lab, Verification of Ohm's law,
Implement of basic circuit: Verification of KVL and Voltage Divider Rule, Verification of KCL and Current Divider Rule

Design and experiment: Branch current analysis, Maximum power transfer theorem.

Verification of basic circuit theorems: Verification of Thevenin's theorem, Verification of Reciprocity theorem, Verification of Superposition theorem

Phasor diagrams: To draw the vector diagram of R-L-C series circuit

Mapping Course Learning Outcomes (CLOs) with the PLOs												
CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1		√										
CLO2				√								
CLO3		√										
CLO4				√								
CLO5		√										

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLO	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Measurement of electrical quantities	Lecture, Discussion, Lab Assignment	Performance Test, Lab Report
CLO2	Implement of basic circuit	Lecture, Group Discussion, Lab Assignment	Performance Test, Lab Report
CLO3	Design and experiment	Lecture, Discussion, Class Work	Performance Test, Lab Report
CLO4	Verification of basic circuit theorems	Lecture, Case Study, Lab Assignment	Performance Test, Lab Report
CLO5	Phasor diagrams	Lecture, Discussion, Lab Assignment	Performance Test, Lab Report

Books Recommended:

1. *Robert L Boylestad, "Introductory Circuit Analysis", 12th Ed., Pearson Edition Limited, 2014.*
2. *Charles K. Alexander, Matthew N.O. Sadiku, "Fundamentals of Electrical Circuits", 4th Ed., The McGraw-Hill Companies, 2009.*

Course Code: CSE 123, Course Title: Electronics

Course Code (BNQF): CSE-0714-123
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** General
Pre-requisites (if any**):** None

Rationale:

This course provides the 1st year student with the fundamental skills to understand the basic of semiconductor and components like diode, transistor, FET, MOSFET and operational amplifier It will build mathematical and numerical background for design of electronics circuit & component value.

Course Objectives:

1. To provide a comprehensive understanding of electronic devices and circuits.
2. Make the students to understand the working diode and transistor.
3. To provide the knowledge about basic circuits using diodes and transistors.
4. Getting idea about concept of feedback and design feedback amplifier.
5. To enhancing the skills oscillators and power amplifiers using transistor.

Course Content:

Introduction: Semiconductors, Semiconductors diode, diode characteristics.
Bipolar device: Bipolar transistors, Characteristics of BJT.

Oscillator and amplifier: Oscillators, Operational amplifiers, Differentials amplifiers.
Diode characteristics: Diode wave shaping: Clipping, Clamping, switching circuits.
Bipolar device and multivibrators : MOSFET and its characteristics, Monostable, Bistable Multivibrators, Schmitt Trigger.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Explain the current voltage characteristics of semiconductor devices.

CLO2 Analyze dc circuits and relate ac models of semiconductor devices with their physical Operation.

CLO3 Design and analyze of electronic circuits.

CLO4 Point out the basic operations of MOSFET.

CLO5 Classify different amplifier circuits, their design and use in electronics and communication circuits.

Mapping Course Learning Outcomes(CLOs) with PLOs

CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3			√									
CLO4			√									
CLO5					√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLO	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Introduction	Lecture, Discussion, Interactive discussions, Questions and answers, Problem Solving	Class Test, Assignment, Exam
CLO2	Bipolar device, Diode characteristics	Lecture, Class work, Problem Based Learning	Class Test, Assignment
CLO3	Oscillator and amplifier	Lecture, Class work, Problem Based Learning	Presentation, Assignment, Exam
CLO4	Bipolar device and multivibrators	Lecture, Class work, Problem Based Learning	Class Test, Assignment, Exam
CLO5	Oscillator and amplifier	Lecture, Case study analysis, Problem Based Learning	Class Test, Assignment, Exam

Books Recommended:

1. *Thomas L. Floyd., "Electronic Devices", 9th Ed. 2019, Prentice Hall, 2011.*
2. *David A. Bell "Electronic Devices and Circuits", 3rd.* New Delhi Prentice Hall*, 2002.*

Course Code: CSE 124, Course Title: Electronics Sessional

Course Code (BNQF): CSE-0714-124
Credit Hr.: 1.50, **Contact Hr.:** 3.00, **Course Type:** General
Pre-requisites (if any)**:** None

Rationale:

This course provides the student with the fundamental skills to understand the basic of semiconductor and components like diode, transistor, FET, MOSFET and operational amplifier. This subject is classified under the Applied Technology group and intended to teach the students the concepts, principles and working of basic electronic circuits. It is targeted to provide a basic foundation for technology areas like electronics devices, communication systems, industrial electronics as well as instrumentation, control systems and various electronic circuit design.

Course Objectives:

1. To provide a comprehensive knowledge of electronic devices and circuits.
2. Make the students to understand the working diode and transistor.
3. To facilitate necessary knowledge about amplifier.

Course Content:

Semiconductor Devices: Familiarization of semiconductor devices.
Diode Characteristics Curve: I-V characteristics curve of a diode.
Diode Rectifiers: Half wave rectifier, full wave rectifier using center tapped transformer, full wave bridge rectifier**.**
Transistor Configuration: Characteristics curve of Common Emitter Configuration, Common Base Configuration and Common Collector Configuration.
Operational Amplifier: Observation of OPAMP characteristic.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Familiarize with core semiconductor devices.

CLO2 Point out the V-I characteristics of semiconductor diode.

CLO3 Practical knowledge on rectification process.

CLO4 Compare different transistor configuration and observation of their characteristics in respective applications.

CLO5 Analyze the operational OPAMP characteristics.

Mapping Course Learning Outcomes (CLOs) with the PLOs												
CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1		√										
CLO2				√								
CLO3				√								
CLO4		√										
CLO5				√								

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLO	**Contents**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Semiconductor Devices	Lecture, Discussion, Lab Assignment	Performance Test, Lab Report
CLO2	Diode Characteristics Curve: I-V	Lecture, Discussion, Lab Assignment	Performance Test, Lab Report
CLO3	Diode Rectifiers	Lecture, Group Discussion, Lab Assignment	Performance Test, Lab Report
CLO4	Transistor Configuration	Lecture, Class Work, Lab Assignment	Quiz Test, Lab Report
CLO5	Operational Amplifier	Lecture, Discussion, Lab Assignment	Performance Test, Lab Report

Books Recommended:

1. *S. Sedra and K. C. Smith, "Microelectronic Circuits", 5th Ed., Oxford University Press, 2003.*
2. *Robert L. Boylestad, "Electronic Devices and Circuit Theory", 8th Ed., Prentice- all, 2002..*

Course Code: CSE 213, Course Title: Digital Logic Design

Course Code (BNQF): CSE-0714-213
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any): None

Rationale:

This course provides a modern introduction to logic design and the basic building blocks used in digital systems, in particular digital computers. The purpose is to make students familiar with modern hierarchy of digital hardware and enlighten them the state-of-the-art computer hardware design methodologies. Moreover, the contents of the course provide students the basic idea of how to design and simulate logic circuit. This course is offered to the students of 2nd year.

Course Objectives:

1. To facilitate necessary knowledge about number systems, Boolean algebra, Boolean function minimization, fault diagnosis in circuits etc.
2. Getting idea about different logic gates, combinational circuits, flip flops and sequential circuits including counter, register, state recognizer etc.

Course Content:

Number System: Review of Number system, Binary, Octal, Hexadecimal, BCD, and ASCII.
Basic Logic Circuits: Boolean algebra, De Morgan's Theorem, logic gates and their truth tables, Canonical forms, Combinational Logic Circuits, Mapping Technique - Karnaugh Map, Minimization techniques.
Combinational Circuits: Half and Full Adders, Subtractor, Combinational Circuit design, Encoders, Decoders; Comparator; Parity generator, ALU, Multiplexer, De-multiplexers, PLA
Sequential Circuits: Flip-flops, race around problems, Counters: asynchronous counters, synchronous counters and their applications, Synchronous and asynchronous logic design: State diagram, Mealy and Moore machines, State minimizations and assignments, pulse mode logic, Fundamental mode design; PLA design;
Memory Circuit & System: Introduction to memories, ROM, Static and Dynamic RAM, Flash memories, Charge coupled device and magnetic bubble memories.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1	Identify the applications of number system and Boolean algebra in details.
CLO2	Recognize the basic logic gates, logic gates combination, universal gates.
CLO3	Utilize Boolean functions and design the circuits for the minimized functions.
CLO4	Locate the faults in combinational circuits and correct them.
CLO5	Apply different synchronous and asynchronous sequential circuits including counter, register, finite state recognizer etc.

Mapping Course Learning Outcomes (CLOs) with the PLOs												
CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3					√							
CLO4			√									
CLO5					√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Introduction and Number Systems	Lecture, Interactive discussions, Questions and answers	Class Test, Assignment, Exam
CLO1, CLO2	Basic Logic Circuits	Lecture, Discussion, Problem Solving	Class Test, Assignment, Exam
CLO3, CLO4, CLO5	Combinational Circuits, Sequential Circuits, Memory Circuit & System	Lecture, Problem Solving	Written test, Presentation, Exam

Books Recommended:

1. *M. Morris Mano," Digital Logic and Computer Design", 1st edition, Pearson India, 2016.*
2. *Thomas L. Floyd, "Digital Fundamental", 11th edition, Pearson, 2014.*

Course Code: CSE 214, Course Title: Digital Logic Design Sessional

Course Code (BNQF): CSE-0714-214
Credit Hr.: 1.50, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any): None

Rationale:

The main goal of this course is to teach students the fundamental concepts in classical digital design and to demonstrate clearly the way in which digital circuits are designed and analyzed today. The purpose is to make students familiar with modern hierarchy of digital hardware and enlighten them the state-of-the-art computer hardware design methodologies. Moreover, the contents of the course provide students the basic idea of how to design and simulate logic circuits. This course in intended for the students of the 2nd year.

Course Objectives:

1. To provide the practical knowledge of implementation of digital circuits.

Course Content:

Implementation of Logic Gates: Implementation of basic gates, university implementation of NAND and NOR gates.
Circuit Design: Implementation of Half-adder, Half-Substractor, Binary to Gray code, Gray code to Binary, Multiplexer, De-multiplexer, Decoder, BCD to 7-Segment decoder, Encoder, Flip-Flops.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Demonstrate the behavior of Logic Gates and prove the universality of Universal Logic Gates and familiarization with Digital Integrated Circuits.

CLO2 Employ ICs to demonstrate combinational circuits such as Adder, Subtractor, Multiplier, BCD adder, Comparator, Decoder, Multiplexer etc.

CLO3 Relate how computer memory works in the context of the advanced programming languages.

Mapping Course Learning Outcomes (CLOs) with the PLOs

CLO	PLO											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1		√										
CLO2		√										
CLO3			√									

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Implementation of Logic Gates	Lecture, Demonstration	Performance, Lab Report, Quiz Test
CLO2, CLO3	Circuit Design	Lecture, Interactive discussions, Demonstration	Performance, Lab Report, Quiz Test

Books Recommended:

1. *M. Morris Mano," Digital Logic and Computer Design", 1st edition, Pearson India, 2016.*
2. *Thomas L. Floyd, "Digital Fundamental", 11th edition, Pearson, 2014.*

Course Code: CSE 233, Course Title: Computer Organization and Architecture

Course Code (BNQF): CSE-0611-233
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any): None

Rationale:

Computer Organization and Architecture is a core curriculum which deals with recent high-performance microprocessors, vector processors, and memory systems design to improve cache performance, multi-programming and I/O design improvements like: program I/O VS Interrupt driven I/O. This course aims to enable the B.Sc. students to cultivate students' abilities towards the basic architecture of uniprocessor in terms of system performance. This course in intended for the students of the 2nd year.

Course Objectives:

1. Getting idea about organizational and architectural issues of a digital computer and classify and compute the performance of machines, Machine Instructions.
2. To develop ideas about various data transfer techniques in digital computer and the I/O interfaces
3. To estimate the performance of various classes of Memories, build large memories using small memories for better performance and Relate to arithmetic for ALU implementation
4. To understand the basics of hardwired and micro-programmed control of the CPU, pipelined architectures, Hazards and Superscalar Operations.

Course Content:

Basic Structure of Computer: Fundamentals of computer design, Performance and cost, Instruction set design and examples, Measurements.
Basic processor implementation techniques: Hardwired and micro-programmed control; Caches and multiprocessor caches, Design I/O systems, I/O performances, Information representation and transfer, instruction and data access methods,
The control unit: hardwired and micro programmed, memory organization, 1/0 systems, channels, DMA and interrupt, Van Neumann SISD organization, RISC and CISC machines.
Pipelining: Pipelined machines, interleaved memory system, caches, Hardware and architectural issues of parallel machines, Array processors, associative processors, multiprocessors, systolic processors, data flow computer and interconnection networks, High level language concept of computer architecture

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Determine design principles and methods used in processors and memory systems and apply them to new designs.

CLO2 Identify sources of potential performance bottlenecks in a processor design and determine techniques to address them.

CLO3 Locate sources of low memory system performance for a workload and determine techniques to address them.

CLO4 Interpret tradeoffs between hardware and software techniques to achieve a performance goal.

Mapping Course Learning Outcomes (CLOs) with the PLOs												
CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2			√									
CLO3			√									
CLO4		√										

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1, CLO2, CLO3	Basic Structure of Computer, Basic processor implementation techniques, The control unit	Lecture, Interactive discussions, Questions and answers	Class Test, Assignment, Exam
CLO4	Pipelining	Lecture, Discussion, Problem Solving	Written Test, Presentation, Exam

Books Recommended:

1. *David A. Patterson and John L. Hennessy, "The hardware / software interface", 3rd Edition, Morgan Kaufmann, 2004.*
2. *Carl Hamacher, ZvonkoVranesic, SafwatZaky, "Computer Organization", 5th Edition, Tata McGraw-Hill Education Pvt. Ltd,2011*
3. *William Stallings, "Computer Organization and Architecture Designing for Performance", 8th Edition, Prentice Hall, 2009.*
4. *John L. Hennessy and David A. Patterson, "Computer Architecture A Quantitative Approach", 4th Edition, Morgan Kaufmann, 2006.*

Course Code: CSE 234, Course Title: Computer Organization and Architecture Sessional

Course Code (BNQF): CSE-0611-234
Credit Hr.: 1.50, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any)**:** None

Rationale:

This course demonstrates the programming of Computer Organization, their practical applications. This course covers the fundamentals of computers, including their construction and operation. It includes the definition of the machine's instruction set architecture, its use in program creation, and its hardware implementation. The course covers both assembly language (representing software) and HDL programming to bridge the gap between gate logic and executable software (representing hardware). It will focus on system-level challenges, analyzing process performance, and the use of abstraction as a tool to manage complexity using a standard processor. It will next go through how memory systems are designed to work in tandem with processors. It will then go through input/output (I/O) systems, which connect the processor and memory to a variety of devices.

Course Objectives:

1. To objective of this subject are to introduce some basic concepts to deal with computers.
2. To make students primarily understand about different parts of a computer system, solving problems and writing general programs.

Course Content:

The basic design of a computer, computation of performance and cost, instruction set design.
Hardwired and micro-programmed control, analyze the speed of a device.
Basics of assembly programming to manipulate the devices with instructions.
Performance evaluation of different systems.
Manipulating the microprocessor and analyzing the memory system performance.
Analyzing the performance of hardware and architectural issues of parallel machines, High level language concept of computer architecture

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO 1 Describe the design principles and methods used in processors and memory systems.
CLO 2 Analyze different parts of a computer learning all the basics of assembly programming.
CLO 3 Apply the hardware parts with the help of assembly programming.
CLO 4 Analyze the performance of a modern computer through programming.

Mapping Course Learning Outcomes (CLOs) with the PLOs

CLO	PLO											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1				√								
CLO2		√										
CLO3		√										
CLO4				√								

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	basic design of a computer, computation of performance and cost, instruction set design.	Lecture, Discussion, Interactive discussions, Questions and answers, Problem Solving, Lab Assignment	Quiz, Performance Test, Lab Report
CLO2	Hardwired and micro-programmed control, analyze the speed of a device.	Lectures, Questions and answers, Case Study, Problem Solving, Lab Assignment	Quiz, Performance Test, Lab Report
CLO3	C Basics of assembly programming to manipulate the devices with instructions. Performance evaluation of different systems.	Lecture, Class work, Case study analysis, Problem Based Learning, Lab Assignment	Quiz, Performance Test, Lab Report
CLO4	Manipulating the microprocessor and analyzing the memory system performance. Analyzing the performance of hardware and architectural issues of parallel machines, High level language concept of computer architecture	Lecture, Problem Based Learning, Problem Solving, Lab Assignment	Quiz, Performance Test, Lab Report

Books Recommended:

1. *David A. Patterson and John L. Hennessy, "The hardware / software interface", 3rd. Morgan Kaufmann, 2004.*
2. *Carl Hamacher, Zvonko Vranesic, Safwat Zaky, "Computer Organization", 5th Ed., Tata McGraw-Hill Education Pvt. Ltd, 2011.*
3. *William Stallings, "Computer Organization and Architecture Designing for Performance", 8th Ed, Prentice Hall, 2009.*
4. *John L. Hennessy and David A. Patterson, "Computer Architecture A Quantitative Approach", 4th Ed, Morgan Kaufmann, 2006.*

Course Code: CSE 323, Course Title: Computer Networks

Course Code (BNQF): CSE-0612-323
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any**):** CSE 435

Rationale:

The course objectives include learning about computer network organization and implementation, obtaining a theoretical understanding of data communication and computer networks, and gaining practical experience in installation, monitoring, and troubleshooting of current LAN systems. Students are introduced to computer communication network design and its operations, and discuss the following topics: Open Systems Interconnection (OSI) communication model; error detection and recovery; local area networks; bridges, routers and gateways; network naming and addressing; and local and remote procedures. On completion of the course, students should be able, in part to design, implement and maintain a typical computer network (LAN).

Course Objectives:

1. To make the students understand the idea of different networks and commands.
2. To recognize the idea of using various models in the networks according to given circumstances.
3. To classify the knowledge of different networking functions and features for implementing optimal solutions.
4. To assemble different routing concepts for implementing network solutions.

Course Content:

Introduction: Uses of computer networks, Network Hardware, Network Software, Reference Models, Transmission & switching, Network protocols, Fiber optic network, Satellite networks, Packet radio networks.

OSI Network model: The Physical Layer: the theoretical basis for data communication, Guided transmission media, wireless transmission, communication satellites, The Data link layer: Data link layer design issues, Error detection and correction, Elementary data link protocols, The medium access control sub layer: the channel allocation problem, Multiple Access Protocols, Ethernet, Wireless LANs, Broadband Wireless, Bluetooth etc. The Network layer: Network layer design issues, Internet working.

Subnetting and Routing Mechanisms: IP Subnetting, Routing Algorithms, Congestion Control Algorithms, Quality of service, Interior Gateway Protocols: OSPF, IS-IS, and EIGRP, and the Inter-Domain Routing

Protocol: The Transport layer: The transport service, Elements of transport protocols, A simple transport protocols. The Transport layer: UDP, TCP, performance issues. The Application layer: The Domain Name System, Electronic Mail, World Wide Web, Multimedia etc.

Network Security: Cryptography, Symmetric-key Algorithm, Digital signature, Communication Security, Web security etc.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Describe and apply the building blocks of Computer Networks.

CLO2 Explain and differentiate the functionalities and protocols of various layers in OSI Network model.

CLO3 Prepare and apply the building skills of subnetting and routing mechanisms.

CLO4 Identify and organize the purpose of each component of the TCP/IP protocol.

CLO5 Audit the impact of network security.

Mapping Course Learning Outcomes (CLOs) with the PLOs:												
CLO	**PLO**											
	PLO 1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO 10	PLO 11	PLO 12
CLO1	√											
CLO2	√											
CLO3					√							
CLO4			√									
CLO5			√									

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Introduction	Lecture, Discussion, Interactive discussions, Questions and answers, Group discussion, Problem Solving	Assignment, Exam
CLO2	OSI Network model	Lectures, Online Video, Questions and answers, Case Study, Powerpoint Demonstration.	Presentation, Assignment, Exam
CLO3	Subnetting and Routing Mechanisms	Lecture, Class work, Group Study, Problem Based Learning, Case Study	Presentation, Assignment
CLO4	Protocol	PowerPoint Demonstration, Case study analysis, Online Video, Problem Based Learning	Class Test, Assignment, Exam
CLO5	Network Security	Lectures, Group Study for Data Analysis, Questions and answers, Case Study, Group discussion	Written test, Presentation, Exam

Books Recommended:

1. *J James F. Kurose and Keith W. Ross,* "*Computer Networking, a top-down approach*"*, 7th Ed., Pearson, 2016.*
2. *Andrew S. Tanenbaum,* "*Computer Networks*"*, 5th Ed., Pearson, 2012.*

Course Code: CSE 324, Course Title: Computer Networks Sessional

Course Code (BNQF): CSE-0612-324
Credit Hr.: 1.50, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any)**:** None

Rationale:

This course is designed to impart knowledge about detailed knowledge of Computer Networks, various protocols used in Communication, Managing and configuring Cisco Switches and Routers, and various WAN technologies. Computer networking is an important skill for students who are keen to work in a technical field. Having a strong understanding of computer networking can help the students to demonstrate knowledge that will help to make them professional in the networking sector.

Course Objectives:

1. To explain network technologies and how devices access local and remote networks.
2. To explain how switching operates in a small to a medium-sized business network.
3. To implement basic network connectivity between devices.
4. To configure initial settings on a network device using the Cisco command-line interface (CLI).

Course Content:

Introduction to tools and devices: Work using CISCO Packet Tracer and introduce with networking devices.
Implementing networking basics: Exploring IPv4, Subnet Masks and Gateway, Analyzing packets from real network, PING test, ARP process and MAC Learning, VLSM using sub netting.
Implementing Routing Protocols: Introducing basics of routing and implementing Static and Dynamic Routings such as, RIPv2, Routing loops etc. Demonstrate the prevention mechanism, route summarization, re-distribution of routes.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1	Identify the fundamental technologies for the hardware and software of the internet and their addressing mechanism.
CLO2	Analyze the conceptual and implementation aspects of network applications and their use in most of the applications.
CLO3	Apply the knowledge of the basic binary systems to solve sub-netting problems and can identify and make an evaluation on the underlying principles of routing algorithms and their related protocols being applied to the Internet.

Mapping Course Learning Outcomes (CLOs) with the PLOs

CLO	**PLO**											
	PLO1	POL2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1			√									
CLO2		√										

CLO3				√								

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Introduction to tools and Devices	Lecture, Interactive discussions, Questions and answers, Online video, Group Discussion, Lab Assignment.	Performance test, Lab report, quiz, mcq.
CLO2	Implementing networking basics:	Lecture, Interactive discussions, Questions and answers, PowerPoint demonstration, Online video, Group Discussion, Lab Assignment.	Performance test, Lab report, quiz, mcq.
CLO3	Implementing Routing Protocols:	Lecture, Interactive discussions, Questions and answers, PowerPoint demonstration, Online video, Group Discussion, Lab Assignment.	Performance test, Lab report, quiz, mcq.

Books Recommended:

1. *James F. Kurose & Keith W. Ross, "Computer Networking- A Top-Down Approach", 6th Edition.*
0. *Behrouz A. Forouzan , "Data Communications and Networking", 4th Edition.*
1. *Tod Lammle , "CCNA, Study Guide", 6th Edition.*

Course Code: CSE 333, Course Title: Computer Peripheral & Interfacing

Course Code (BNQF): CSE-0611-333
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any**):** None

Rationale:

This course will give an overview of computer interface components and their characteristics to the 3rd year students. It will cover details discussion on some programmable interfacing ICs, sensor, hardware, and software calibration on sensor interfacing, some processing devices which can interface computer with the real world and some output devices. This course also includes high power interface devices, LED, LCD, Seven segment display, transducers, stepper motors, and peripheral devices. In addition, it will also introduce some software simulation tools to develop an interfacing system. Some advanced topics like Human-Computer Interface (HCI), Brain-Computer Interface (BCI) would be also discussed with some real-life applications.

Course Objectives:

1. To help the students to know the vast idea about how this digital devices interact with analog environment and make this environment a digital platform.
2. To teach different types of processors, tools, software, sesnor, working mechanism of I/O devices.
3. To design and develop efficient interfacing technology, digital system, peripherals and IoT devices by interfacing through sensors using modern MCU/MPU with standard protocols.
4. To select and use necessary tools for implementing Interfacing Systems.

Course Content:

Basic I/O Interface: Literature components and their characteristics**,** Interface Components and Their Characteristics, Microprocessor I/O. Microprocessor Bus Signals, Peripheral Devices, I/O devices, Interrupt and Interrupt Responses, Hardware Interrupt Applications, 8254 Software Programmable Timer/Counter, 8259 Priority Interrupt Controller, Software Interrupt Applications, Direct Memory Access (DMA).

Digital Interfacing: Programming Parallel Ports and I/O Handshaking, 8255A PPI device, Interfacing to a Micro-Computer Lathe, Interfacing Microprocessor to Keyboards, Interfacing to Alphanumeric Displays, SCSI, Serial Interface Principles, Asynchronous and Synchronous Transmission, RS232 and EIA-562 Standards, USB, PCIE.

Analog Interfacing and Control: Op-Amp Characteristics and Circuits, Sensors and Transducers. D/A and A/D Converters – Types Operations.

Microcomputer System Peripherals: Microcomputer Displays, Computer Vision, Disk Data Storage Systems, Disk Controllers and Interfaces, Printer Mechanism and Interfacing.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Explain and Design the interface between computer and the outside world.

CLO2 Examine various peripheral chips.

CLO3 Relate the operation of various devices to interfacing.

CLO4 Explain the operation of Op-Amp circuits, sensors, transducers and D/A and A/D converters.

Mapping Course Learning Outcomes (CLOs) with the PLOs:												
CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1					√							
CLO2			√									
CLO3			√									
CLO4			√									

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Basic I/O Interface	Practical, Demonstration, Project	Practical Tests, Assignment
CLO2	Microcomputer System Peripherals	Lecture, Tutorial, Case Study Practical,	Practical Tests, Assignment
CLO3	Basic I/O Interface, Digital Interfacing	Lecture, Tutorial, Case Study Practical,	Practical Tests, Assignment
CLO4	Analog Interfacing and Control	Lecture, Tutorial, Case Study Practical,	Practical Tests, Assignment

Books Recommended:

1. *N. Mathivanan," Microprocessors, PC Hardware and Interfacing", Second edition, Prentice Hall.*
2. *Douglas Hall," Microprocessors and Interfacing: Programming and Hardware", Third Edition, McGraw Hill.*

Course Code: CSE 334, Course Title: Computer Peripheral & Interfacing Sessional

Course Code (BNQF): CSE-0611-334
Credit Hr.: 1.50, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any): None

Rationale:

This course demonstrates to the student programming and interconnection of Microprocessor and different peripheral, their practical applications. This course covers the role of computer peripherals such as display units, input and output devices, etc. Topics discussed include: Analogous signal input output; Graphic systems; Output devices; OMR, OCR and MCR; Backing stores; Data communication; Interfacing components and their characteristics; Important peripheral, for example, Arduino, etc and their uses and applications in different systems; Microprocessor I/O; Disk I/O; Optical displays and sensors; High power interface devices; Interfacing for Transducers, stepper motors and peripheral devices; Design and operation of interface between computer and the outside world. Student can apply these techniques, design and application in real-life peripheral devices such as robot.

Course Objectives:

1. To introduce the internal and external architecture of microprocessor 8085 and Arduino.
2. To make the student understand the arithmetic and logic operation of the 8085 Microprocessor through Microprocessor kit.
3. To facilitate about arithmetic and logic operation of the Arduino.
4. To help the students to conceptualize the knowledge to design the real time applications of the Microcontroller.
5. To explain the interconnection of microprocessor and different peripheral devices.

Course Content:

Introduction: Setting up the programming environment and basic introduction to the Arduino microcontroller, Arduino IDE and Sketch Overview.

Basic Programming Concepts: Explore how loops, functions, conditionals, variables parameters can be used with LED circuits, Digital Input and Output with Arduino Boards.

Using a Display: Introduce how to use premade Arduino libraries, how to use the LCD display, interfacing 4*4 matrix keypad and LCD display with Arduino.

Interfacing Motors and Sensors: Introduce three different types of motors: servo, DC motor and stepper motor, analog input and LEDs – IR sensor, temperature sensor, fire sensor and humidity sensor

Final Project : Line follower robot.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Identify the environment and functionalities of Arduino.

CLO2 Apply basic programming concepts using Arduino.

CLO3 Analyze different types of motors.

CLO4 Apply the application of sensors.

CLO5 Design and build line follower robot.

Mapping Course Learning Outcomes (CLOs) with the PLOs:												
CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1			√									
CLO2			√									
CLO3			√									
CLO4					√							
CLO5					√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Introduction	Lecture, Discussion, Interactive discussions, Questions and answers, Problem Solving	Assignment, Exam
CLO2	Basic Programming Concepts	Lectures, Online Video, Questions and answers, Case Study, Group Study for Data Analysis	Presentation, Assignment, Performance test
CLO3	Using a Display	Lecture, Class work, Online Video, Problem Based Learning	Assignment, Performance test
CLO4	Interfacing Motors and sensors	Case study analysis, PowerPoint Demonstration, Problem Based Learning	Performance test, Presentation, Exam
CLO5	Final Project	Powerpoint Demonstration, Case study analysis, Problem Based Learning	Assignment, Presentation , Viva, Exam

Books Recommended:

1. *N. Mathivanan,* "*Microprocessors, PC Hardware and Interfacing*"*, 2nd Ed., Prentice Hall PTR, 2004.*
2. *Douglas Hall,* "*Microprocessors and Interfacing: Programming and Hardware*"*, 3rd Ed., McGraw Hill,1986.*

Course Code: CSE 413, Course Title: Microprocessor & Assembly Programming

Course Code (BNQF): CSE-0611-413
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any**):** CSE 213

Rationale:

This course introduces students to basic computer organization and architecture concepts. It is, therefore, necessary to develop a good understanding of their operation and how they can be used as building blocks for automated systems and control applications. This course explores the inner workings of a microprocessor from the programmer's perspective. This course is offered to the 3rd year students.

Course Objectives:

1. To learn about the internal architecture and addressing modes of Intel 8086 Microprocessor and analyze the comparison between several microprocessor of the same thread.
2. To learn and analyze the theoretical implications of memory access in the microprocessor.

Course Content:

Introduction to Microprocessor: Introduction to different types of microprocessors, generation of microprocessor, characteristics of 8-bit, 16-bit, 32-bit microprocessors.

Architecture of Microprocessor: Microprocessor architecture, instruction set interfacing, I/O operation, interrupt structure, advanced microprocessor concept, microprocessor based system design.

Addressing Modes: Data addressing modes, program memory addressing modes, stack memory addressing modes.

Hardware Specifications: 8086 PIN-OUTS and PIN functions, clock generator, bus buffering and latching, bus timing.

Assembly Language Data Movement Instructions: Machine and Assembly instruction types and their formats, instruction execution, Machine language programming, instruction sets and their implementations.

Arithmetic and Logic Instructions: Different types of arithmetic and logical instruction in assembly language.

Program Control Instructions: The assembly process, Addressing methods, Subroutines, macros and files.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Describe the architecture and organization of microprocessor along with instruction set format.

CLO2 Describe memory addressing modes and functional blocks of 8086.

CLO3 Describe and use different types of instructions, directives and interrupts.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

CLO	PLO											
	PLO 1	PLO 2	PLO3	PLO 4	PL O5	PLO6	PLO7	PLO 8	PLO9	PLO1 0	PLO1 1	PLO1 2
CLO1	√											
CLO2	√											
CLO3					√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Introduction to Microprocessor, Architecture of Microprocessor	Lecture, Tutorial	Written Tests, Quiz
CLO2	Addressing Modes, Hardware Specifications	Lecture, Tutorial	Written Tests, Quiz
CLO3	Assembly Language Data Movement Instructions, Arithmetic and Logic Instructions, Program Control Instructions	Practical Tests, Assignment	Practical Tests, Assignment

Books Recommended:

1. *Barry B. Brey," The Intel Microprocessor", Eighth edition, Pearson (Dorling Kindersley).*
2. *Douglas Hall," Microprocessors and Interfacing Programming and Hardware", Third Edition, McGraw Hill.*

Course Code: CSE 414, Course Title: Microprocessor & Assembly Programming Sessional

Course Code (BNQF): CSE-0611-414

Credit Hr.: 1.50, **Contact Hr.:** 3.00, **Course Type:** Core

Pre-requisites (if any**):** None

Rationale:

Microprocessors and assembly language have been the most used methods of incorporating intelligence into automated devices. This course includes several laboratory exercises based on microprocessor utilizing the assembly language. This course is offered to the 3rd year students.

Course Objectives:

1. To apply the arithmetic and logical operations using assembly language based instructions for Intel 8086 microprocessor.
2. To apply branching and looping structures for solving computational problems using assembly instructions in simulation based software.

Course Content:

Learning Opcode of Assembly Language: The Assembly language programming with ADD, DIV, JUMP, CMP, LOOP, and ARRAY using EMU8086.
8086 TASM/MASM: Introduction to features, commands, and PIN Diagram.
Applications: Display 7 on Seven Segment Display; Turn on the Red, Green, Yellow and Red LED in clockwise direction in LED display; Turn on the Red, Green, Yellow and Red LED in anticlockwise direction in LED display. At first, turn on the Red LED in the LED display. Then show 5, 4, 3, 2, 1, 0 on Seven Segment display respectfully. Turn off the Red LED, and then turn on the Yellow LED and show 3, 2, 1, 0. Turn off the Yellow LED and then turn on the Green LED in LED display; Show 6 and 7 in Seven Segment display and then turn on the PB0, PB1, PB2 and PB3 sequentially. At last show their addition in the Seven Segment display (At first, show 1 and then show 3 which is, 6+7=13); Display 9 on Seven Segment Display and then turn on the PB0, PB1, PB2, and PB3 in clockwise direction; Display 8 and then turn on the PB0, PB1, PB2, and PB3 in anticlockwise direction. Show 1 in Seven Segment Display and then make the Red LED blink 5 times. Then show 7 in Seven Segment Display and then make the Green LED blink 5 times (9+8=18).

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Apply the fundamentals of assembly level programming of microprocessors.

CLO2 Build assembly level program on a microprocessor using instruction set of 8086.

CLO3 Summarize the concepts of Assembly level language programming and its applications.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1			√									
CLO2		√										
CLO3		√										

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Learning Opcode of Assembly Language	Lecture, Tutorial, Case Study Practical,	Practical Tests, Assignment
CLO2	8086 TASM/MASM	Case Study, Project, Tutorial, Group Work	Presentation, Essay, Written Tests
CLO3	Applications	Case Study, Project, Tutorial, Group Work	Presentation, Essay, Written Tests

Books Recommended:

1. *Ytha Yu, Charles Marut," Assembly Language Programming And Organization of the IBM PC", First edition, McGraw Hill Education.*
2. *Kip R. Irvine," Assembly Language for Intel-Based Computers", Fifth Edition, Prentice Hall.*

Course Code: CSE 315, Course Title: System Analysis and Design

Course Code (BNQF): CSE-0613-315

Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** Core

Pre-requisites (if any): None

Rationale:

This course deals with investigating a system or its components in order to determine its goals. It's a problem-solving strategy that enhances the system and ensures that all of its components work together to achieve their goals. The system's behavior is defined by the analysis. The student of B. Sc. (Engg.) program will learn this course to objective of a computer application early in the analysis for a successful design and conversion.

Course Objectives:

1. To facilitate the principles, concepts and practice of System Analysis and Design process.
2. Acquaint students to explain the processes of constructing the different types of information systems.
3. To develop the skill to object oriented concepts to capture a business requirements.
4. To provide object oriented concepts to capture a business requirements.

Course Content:

The systems analyst and information systems development: Introduction, The Systems Analyst, Systems Analyst Skills , Systems Analyst Roles, The Systems Development Life Cycle, Planning, Analysis, Design, Implementation, Project Identification and Initiation, System Request, Applying the Concepts at Tune Source, Feasibility Analysis, Technical Feasibility, Economic Feasibility, Organizational Feasibility, Applying the Concepts at Tune Source.

Requirements determination: Requirements Determination, Requirements elicitation Techniques, Requirements Analysis Strategies, Comparing Analysis Strategies, Eliciting and Analyzing Requirements.

Use case analysis: Use Cases, Data Flow Diagrams, The Entity Relationship Diagram, Creating An Entity Relationship Diagram.

Moving into design: Transition from Requirements to Design, System Acquisition Strategies, Elements of an Architecture Design, Creating An Architecture Design, Hardware And Software Specification

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO 1 Describe the life cycle of a systems development project;

CLO 2 Demonstrate techniques required as a team member of a medium-scale information systems development project.

CLO 3 Exhibit analyst's interaction with system sponsors and users play a part in information systems development.

CLO 4 Recognize the information systems models;

Mapping Course Learning Outcomes (CLOs) with the PLOs

CLO	PLO											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1				√								
CLO2					√							

CLO3			√									
CLO4					√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	The systems analyst and information systems development	Lecture, Discussion, Interactive discussions, Questions and answers, Problem Solving	Class Test, Assignment, Exam
CLO2	Requirements determination	Lectures, Questions and answers, Case Study	Presentation, Assignment
CLO3	Use case analysis	Lecture, Class work, Problem Based Learning	Class Test, Assignment, Exam
CLO4	Moving into design	Case study analysis, Problem Based Learning	Written test, Presentation, Exam

Books Recommended:

1. *Elias M. Awad, "Systems Analysis and Design", 2nd Ed, Galgotia Publications, **1997**.*
2. *I. T. Hawryszkiewycz, "Introduction to Systems Analysis & Design", 4th Ed., Prentice Hall of India, 2008.*

Course Code: CSE 427, Course Title: VLSI Design

Course Code (BNQF): CSE-0613-427
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any**):** CSE 123, CSE 213

Rationale:

This is an introductory course which covers basic theories and techniques of digital VLSI design in CMOS technology. Through this course, the 4th year students will study the fundamental concepts and structures of designing digital VLSI systems include CMOS devices and circuits, standard CMOS fabrication processes, CMOS design rules, static and dynamic logic structures interconnect analysis, CMOS chip layout, simulation and testing, low power techniques, design tools and methodologies, VLSI architecture to gather knowledge about VLSI design.

Course Objectives:

1. To impart knowledge about the miniaturization of Electronic Systems.
2. To introduce the fundamental concepts relevant to VLSI fabrication.
3. To enable the students to understand the various VLSI fabrication techniques.

Course Content:

Introduction: Design and analysis techniques for VLSI circuits.

Design: Design of reliable VLSI circuits, noise considerations, design and operation of large fan out and fan in circuits.

Architecture & Techniques: Clocking methodologies, techniques for data path and data control design, Simulation techniques, Parallel processing, special purpose architectures in VLSI, VLSI layouts partitioning and placement routing and wiring in VLSI, Reliability aspects of VLSI design.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Analyze and design basic VLSI circuits.

CLO2 Analyze sequential logic circuits and understand memory architecture and low power memory circuits.

CLO3 Analyze different techniques of control design and simulation.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3			√									

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Introduction, Design	Lecture, Tutorial	Written Tests, Quiz
CLO2	Design	Case Study, Project, Tutorial, Group Work	Presentation, Essay, Written Tests
CLO3	Architecture & Techniques	Lecture, Tutorial, Case Study Practical,	Practical Tests, Assignment

Books Recommended:

1. *Kamran Eshraghian, Eshraghian Douglesand A. Pucknell," Essentials of VLSI circuits and systems", Third edition, PHI Learning Publication.*
2. *John P. Uyemura, John Wiley," Introduction to VLSI Circuits and Systems", First Edition, Paperback Publication.*

Course Code: CSE 435, Course Title: Data Communication

Course Code (BNQF): CSE-0612-435
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any): None

Rationale:

This course introduces to the student the basic concepts of data communication, layered model, protocols and inter- working between computer networks and switching components in telecommunication systems. To make effective communication between the gadgets it is critical to play out every single essential apparatus and their fundamental design precisely. Therefore, to comprehend the system structure, segments and other applicable devices and procedure is an absolute necessity. So the student can make effective communication between the gadgets it is critical to play out every single essential apparatus and their fundamental design precisely. This course will give a prologue to the field data communications, Layered design of LAN, MAN and WAN, fundamentals of signalling, basic transmission concepts, error detection and correction etc.

Course Objectives:

1. To familiarize the students with the basics of data communications, OSI model and techniques, applications and control of modern data communications networks
2. To introduce topics included are network models, digital and analog transmission, multiplexing, circuit and packet switching.
3. To develop engineering skills in troubleshooting and designing data networks.

Course Content:

Introduction: Introduction to Communication Systems and Data Networks, Introduction to modulation techniques: pulse modulation, pulse amplitude, Modulation, pulse width modulation and pulse position modulation, Multiplexers.

Pulse Code Modulation: Quantization, Delta Modulation Time, Division Multiplexing (TDM), Frequency Division, Multiplexing (FDM), Wavelength Division Multiplexing (WDM), Frequency-Shift Keying (FSK), Phase-Shift Keying (PSK), Quadrature Phase Shift Keying.

Spread Spectrum: Frequency Hopping Spread Spectrum (FHSS), Direct Sequence Spread Spectrum (DSSS).

Noise, Threshold and Channel Coding: Representation of noise, Threshold effects in PCM, Threshold effects in FM, Probability of error for pulse systems, Concepts of channel coding, Concepts of channel capacity, Asynchronous communications.

Transmission Mode: Asynchronous communications, Synchronous communications.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Apply Communication Systems and different modulation techniques.

CLO2 Distinguish about different types of multiplexing techniques, Shift keying, PCM.

CLO3 Analyze spread spectrum techniques in data transmission, noises in data communication, Threshold effects.

CLO4 Analyze about channel coding, channel capacity and probability error for pulse system.

CLO5 Interpret the knowledge about data communication hardware, types in term of synchronization.

Mapping Course Learning Outcomes (CLOs) with the PLOs:												
CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2			√									
CLO3			√									
CLO4			√									
CLO5										√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Introduction	Lecture, Discussion, Interactive discussions, Questions and answers, Group discussion, Problem Solving	Assignment, Exam
CLO2	Pulse Code Modulation	Lectures, Online Video, Questions and answers, Case Study, Powerpoint Demonstration.	Presentation, Assignment, Exam
CLO3	Spread Spectrum	Lecture, Class work, Group Study, Problem Based Learning, Case Study	Presentation, Assignment
CLO4	Noise, Threshold and Channel Coding	PowerPoint Demonstration, Case study analysis, Online Video, Problem Based Learning	Class Test, Assignment, Exam
CLO5	Transmission Mode	Lectures, Group Study for Data Analysis, Questions and answers, Case Study, Group discussion	Written test, Presentation, Exam

Books Recommended:

1. *Behrouz A. Forouzan, "Data Communications and Networking", 4th Ed., McGraw-Hill Education, 2006.*

Course Code: CSE 441, Course Title: Optical Fiber Communication

Course Code (BNQF): CSE-0612-441
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any**):** CSE 323

Rationale:

This course will aim to introduce students to the fundamentals of fiber optic communications, which constitute the backbone of the internet. The course will start with a refresher on the operation of key components needed for an effective fiber optic communication system, and then show how these components interact at a system level. Finally, the course will conclude with outlook for future research in extending the capabilities of these networks to higher bandwidths and quantum-secured communications.

Course Objectives:

1. To provide the idea of the basic elements of optical fiber transmission link, fiber modes configurations and structures
2. To familiarize the students the knowledge of the different kind of losses, signal distortion, SM fibers
3. To furnish the student the idea of the various optical sources, materials and fiber splicing
4. To acquire the knowledge of the fiber optical receivers and noise performance in photo detector
5. To accumulate basic idea about link budget, WDM, solitons and SONET/SDH network.

Course Content:

Introduction: Introduction to optical fiber communication system, Historical development, working principle, advantages, limitations and applications of Optical fiber communication system, Ray optics theory and propagation of light through optical fiber, Principles of fiber optical communication and network, ray theory transmission, total internal reflection, acceptance angle, numerical apertures, skew rays.

Loss and Dispersion: Fiber losses: Intrinsic absorption, scattering losses, Bending losses, attenuation and Fiber dispersion: Modal dispersion, chromatic dispersion and polarization mode dispersion.

Working Principle: Working principle of optical sources (LED, LASER), Working principle of optical detectors, Practice theory related mathematical problems.

Amplifier: Basics of optical amplifier, Comparison of booster, Inline amplifier, pre amplifier, Working Principle of SOA, RA and EDFA, Comparison and application different types of optical amplifier.

Multi-channel optical system: Frequency division multiplexing, wavelength division multiplexing and co-channel interference

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1	Illustrates the basic knowledge of Ray optics theory and Explain the Transmission Characteristics of fiber
CLO2	Compare Step Index, Graded index fibers and compute mode volume.
CLO3	Identify the various types of fiber loss.
CLO4	Analyze various coupling losses. Discuss the channel impairments like losses and dispersion.
CLO5	Classify the Optical sources and detectors, discuss their principle and compare the different types of optical amplifier in basis of their principles and applications, Receiver analysis. .

Mapping Course Learning Outcomes (CLOs) with the PLOs:												
CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2			√									
CLO3			√									
CLO4			√									

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Introduction	Lecture, Discussion, Interactive discussions, Questions and answers, Group discussion, Problem Solving	Assignment, Exam
CLO2	Loss and Dispersion	Lectures, Online Video, Questions and answers, Case Study, Powerpoint Demonstration.	Presentation, Assignment, Exam
CLO3	Working Principle	Lecture, Class work, Group Study, Problem Based Learning, Case Study	Presentation, Assignment
CLO4	Amplifier	PowerPoint Demonstration, Case study analysis, Online Video, Problem Based Learning	Class Test, Assignment, Exam
CLO5	Multi-channel optical system	Lectures, Group Study for Data Analysis, Questions and answers, Case Study, Group discussion	Written test, Presentation, Exam

Books Recommended:

1. *John M. Senior and M. yousifJamro,* "*Optical Fiber communication principles Practice*"*, 3rd Ed., Dorling Kindersley(India)Pvt. Ltd., licesnsees of Pearson Education in South Asia, 2010.*
2. *Gerd Keiser,* "*Optical fiber communications*"*, 5th Ed., McGraw-Hill Education. Co.,2015*

Course Code: CSE 443, Course Title: Mobile and Telecommunication

Course Code (BNQF): CSE-0612-443
Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** Core
Pre-requisites (if any**):** CSE 435

Rationale:

The main goal of this course is to provide a comprehensive coverage of different mobile services and adequate knowledge in cellular communication, adequate mastery in solving technical problems. This comprehensive course is designed for undergraduate students to address all major segments of wireless & cellular telecommunications. This course will satisfy a 100-level requirement for courses in computer science and engineering for undergraduate majors.

Course Objectives:

1. To address the evaluation of fundamental and advanced Internet and software technologies relevant for E-Commerce.
2. To describe, identify and classify E-Commerce applications and systems.
3. To classify and identify existing and emerging E-Commerce business models.

Course Content:

Introduction: Concept, evaluation and fundamentals of cellular telephony, mobile standards, mobile system architecture, design, performance and operation. Voice digitization and modulation techniques.

Cellular System Design: Introduction, Frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Trunking&GoS, Capacity and coverage improvement.

Statistical Multipath Channel: Time varying Channel impulse response, Narrow band fading model, Wideband fading models, Discrete time model. Space-time channel model.

Spread Spectrum: SS principle, DSSS system model, spreading codes, system model, spreading codes, synchronization, RSKE receiver, FHSS, Spreading code for Multi-user DSSS, DL & UL channel, Multi-user detection, MC-CDMA, Multiuse FHSS.

Multi carrier modulation: Data transmission using multi carrier, MCM with overlapping sub channel, Sub carrier fading mitigation, Cyclic Prefix, OFDM, Matrix reorientation of OFDM, MIMO-OFDM, MC-CDMA.

Crossbar Switching: Principles of Common Control, Touch Tone Dial Telephone, Principles of Cross Bar Switching, Cross Bar Switch Configurations, Cross Point Technology, and Cross Bar Exchange Organization.

Time Division Switching: Basic Time Division Space Switching, Basic Time Division Time Switching, Time Multiplexed Space Switching, Time Multiplexed Time Switching, Combination Switching.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1	Recognize and identify the GSM, GPRS and Bluetooth software model for mobile computing.
CLO2	Demonstrate applications that are mobile-device specific and demonstrate current practice in mobile computing contexts.
CLO3	Categorize the characteristics and limitations of mobile hardware devices including their user-interface modalities.
CLO4	Analyze QoS over wire and wireless channels.

Mapping Course Learning Outcomes (CLOs) with the PLOs												
CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1			√									
CLO2		√										
CLO3			√									
CLO4			√									

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Introduction, Cellular System Design	Lecture, Discussion, Interactive discussions, Questions and answers, Problem Solving	Class Test, Assignment, Exam
CLO2	Statistical Multipath Channel	Lectures, Questions and answers, Case Study	Presentation, Assignment
CLO3	Spread Spectrum, Multi carrier modulation	Lecture, Class work, Case study analysis, Problem Based Learning	Class Test, Assignment, Exam
CLO4	Crossbar Switching, Time Division Switching	Lecture, Problem Based Learning	Written test, Presentation, Exam

Books Recommended:

1. *Jochen Schiller,* "*Mobile communications*"*, 2nd Ed., Addison-Wesley, Pearson Education, 2003.*
2. *W. Stallings,* "*Wireless Communications and Networks*"*, 2nd Ed.,Pearson Prentice Hall, 2005.*
3. *Theodore S Rappaport, "Wireless communications principle and practice", 2nd Ed, Prentice Hall PTR, 2007.*
4. *John Proakis, "Digital Communication", 4th Ed, McGraw-Hill Science/Engineering/Math, 2005.*

Course Code: CSE 449, Course Title: Fault Tolerance Systems

Course Code (BNQF): CSE-0613-449

Credit Hr.: 3.00, **Contact Hr.:** 3.00, **Course Type:** Core

Pre-requisites (if any**):** None

Rationale:

Fault-Tolerant Systems course introduces basic concepts of design and implementation of fault tolerance mechanisms in general systems. Specific kinds of fault tolerance are addressed, such as physical fault tolerance, fault tolerance for information, and temporal fault tolerance. This course aims to introduce the B.Sc. students to the quantitative and qualitative methodology used in the evaluation of specific fault tolerance principles. It will satisfy a 100-level requirement for courses in computer science and engineering for undergraduate majors.

Course Objectives:

1. Introduce students to concepts such as fault detection for combinatorial and sequential circuits, and fault test generation for combinatorial and sequential circuits.
2. Train students for developing skills in digital simulation and automatic test pattern generation.
3. Instruct students to analyze the process of fault modeling, self-checking circuits, burst error correction, and maintenance of processors.

Course Content:

Introduction to Fault-Tolerant Systems: Fault detection and location in combinational circuits, fault detection and location in sequential circuits, fault test generation for combinational circuits, fault test generation for sequential circuits.

Digital simulation: Digital simulation as a diagnostic tool, automatic test pattern generator.

Fault modeling: Automatic test equipment, memory test pattern, and reliability, performance self-checking circuits, burst error correction.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1 Analyze the fundamental concepts of fault tolerance for achieving fault tolerance in electronic, communication, and software systems.

CLO2 Develop skills in modeling and evaluating fault-tolerant architectures in terms of reliability, availability, and safety.

CLO3 Justify the pros and contras of different redundancy techniques and select a suitable one for a specific application.

CLO4 Apply the knowledge to design a small electronic or embedded system with enhanced dependability

Mapping Course Learning Outcomes(CLOs) with PLOs

CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2			√									
CLO3			√									
CLO4	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:			
CLOs	**Topics**	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1 CLO2	Introduction to Fault-Tolerant Systems	Lecture, Discussion, Interactive discussions	Quiz, Class Test
CLO3	Digital simulation	Lecture, Class work, Problem Based Learning	Class Test, Assignment, Exam
CLO4	Fault modeling	Lectures, Questions and answers, Case Study	Presentation, Assignment

Books Recommended:

1. *Israel Koren, C. Mani Krishna, "Fault Tolerant System", 1st Ed., Morgan Kaufmann Publishers Inc., 2007.*
2. *Barry W. Johnson, "Design and Analysis of Fault Tolerant Digital Systems", 1st Ed., Addison-Wesley, 1989.*

Course Code: CSE 400, Course Title: Project & Thesis

Course Code (BNQF): CSE-0613-400

Credit Hr.:3.00, **Contact Hr.:** 3.00, **Course Type:** Thesis/Project

Pre-requisites (if any**):** 120 credits by completing theory and lab courses in previous trimesters.

Rationale:

This course gives students the opportunity to combine engineering principles learnt in earlier years of study and apply them to creatively address challenges such as the development of a specific design, method, or hypothesis analysis. Thesis and projects are open-ended, difficult problems that allow for creativity as well as data collection, analysis, and interpretation. The projects that students work on usually have numerous viable solutions or conclusions and are complicated enough to necessitate some project planning. The thesis necessitates the formulation of issues in engineering terms, the management of an engineering project, and the application of engineering methodologies to discover solutions. The student of B. Sc. (Engg.) program will also learn how to work in a research and development setting during. This course will satisfy a 100-level requirement for courses in computer science and engineering for undergraduate majors.

Course Objectives:

1. To plan, manage and execute a substantial thesis or project.
2. To demonstrate proficiency of a technical competence in a scientific or engineering domain.
3. To demonstrate written and verbal communication skills.

Course Content:

Relevant to Thesis or Project.

Course Learning Outcomes (CLO):

After completing the course, students will be able to:

CLO1	Analyze complex engineering problems related to computer science and engineering to reach substantiated conclusions by applying knowledge of mathematics, engineering fundamentals and engineering specialization.
CLO2	Conduct literature survey to make necessary assumptions and approximations about possible solution and design an appropriate solution process of a complex engineering problem.
CLO3	Utilize quantitative and mathematical tools to solve complex engineering problems.
CLO4	Explain the relationship of an engineering system towards environmental, societal, health, safety, legal, cultural issues and needs.
CLO5	Perform effectively apply engineering and management principles as an individual or as a member or leader in diverse team to manage projects in multidisciplinary environments.
CLO6	Demonstrate ability to plan and communicate effectively in order to perform complex jobs.

Mapping Course Learning Outcomes(CLOs) with PLOs												
CLO	**PLO**											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√		√									
CLO2		√			√							
CLO3				√								
CLO4									√	√	√	
CLO5							√					√
CLO6						√		√				

- Proper guidelines for ‘Project & Thesis’ are given in the “Final Year Thesis Project Guidelines”.

Part D

20. Grading/Evaluation
Grading System (UGC Approved)

The Department of Computer Science and Engineering in Port City International University follows the University Grants Commission (UGC) approved grading system. This grading system is also used by the other departments of the University. The performance of the students in the course work is evaluated by letter grading system as described below:

Marks Range/ Grading Scale	Grade	Grade point	Interpretation
80% and above	A+	4.00	Outstanding
75% to below 80%	A	3.75	Excellent
70%to below 75 %	A-	3.50	Very Good
65% to below 70%	B+	3.25	Good
60% to below 65%	B	3.00	Satisfactory
55% to below 60%	B-	2.75	Above Average
50% to below 55%	C+	2.50	Average
45% to below 50%	C	2.25	Below Average
40% to below 45%	D	2.00	Pass
Less than 40%	F	0.00	Fail
	I	0.00	Incomplete

Assessment strategy, course evaluation process and mark distributions (Theory Courses):

<table>
<tr><th>Assessment Strategy</th><th colspan="3">Course Evaluation Process and Mark Distributions</th></tr>
<tr><td rowspan="6">Continuous Assessment:
Class Test, Assignment, Presentation
Summative:
Mid-Term and Final Term Exams</td><td>Sl.</td><td>Category</td><td>Mark %</td></tr>
<tr><td>1.</td><td>Attendance:</td><td>10%</td></tr>
<tr><td>2.</td><td>Mid Term</td><td></td></tr>
<tr><td></td><td>a. Class Test:</td><td>5%</td></tr>
<tr><td></td><td>b. Assignment/Presentation:</td><td>5%</td></tr>
<tr><td></td><td>c. Exam</td><td>30%</td></tr>
<tr><td>Make-up Procedures</td><td>3.</td><td>Final Term</td><td></td></tr>
<tr><td rowspan="4">Repeat Course, Mid-Term Incomplete Exam, Final Term Incomplete Exam</td><td></td><td>a. Class Test</td><td>5%</td></tr>
<tr><td></td><td>b. Assignment/ Presentation:</td><td>5%</td></tr>
<tr><td></td><td>c. Exam</td><td>40%</td></tr>
<tr><td colspan="2">Total:</td><td>100%</td></tr>
</table>

Assessment strategy, course evaluation process and mark distributions (Lab Courses):

<table>
<tr><th>Assessment Strategy</th><th colspan="3">Course Evaluation Process and Mark Distributions</th></tr>
<tr><td rowspan="8">Continuous Assessment:
Class Test, Assignment, Presentation

Summative:
Mid-Term and Final Term Exams</td><td>Sl.</td><td>Category</td><td>Mark%</td></tr>
<tr><td>1.</td><td>Attendance:</td><td>10%</td></tr>
<tr><td>2.</td><td>Mid Term</td><td></td></tr>
<tr><td></td><td>a. Quiz:</td><td>10%</td></tr>
<tr><td></td><td>b. Viva:</td><td>10%</td></tr>
<tr><td></td><td>c. Performance Test:</td><td>10%</td></tr>
<tr><td></td><td>d. Lab Report:</td><td>10%</td></tr>
<tr><td>Make-up Procedures</td><td>3.</td><td>Final Term</td><td></td></tr>
<tr><td rowspan="5">Repeat Course, Mid-Term Incomplete Exam, Final Term Incomplete Exam</td><td></td><td>a. Quiz:</td><td>15%</td></tr>
<tr><td></td><td>b. Viva:</td><td>10%</td></tr>
<tr><td></td><td>c. Performance Test:</td><td>15%</td></tr>
<tr><td></td><td>d. Lab Report:</td><td>10%</td></tr>
<tr><td colspan="2">Total:</td><td>100%</td></tr>
</table>

Calculation of Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA)

Grade Point Average (GPA) or Cumulative Grade Point Average (CGPA) is the average of the grade points obtained in all the courses passed/completed by a student. For example, if a student passes/completes four courses in a trimester having credit hours of C1, C2, C3, & C4 and his/her grade points in these courses are G1, G2, G3, & G4 respectively then

$$GPA/CGPA = \frac{\sum C_n G_n}{\sum C_n}$$

Suppose a student got grade point "4.0" in a 3 credit hours course and 3.0 in 1.5 credit hours course then his/her GPA/CGPA will be as follows:

$$GPA/CGPA = \frac{(3 \times 4) + (1.5 \times 3)}{3 + 1.5} = 3.67$$

Course Withdrawal

Students will be allowed to withdraw any of their registered course(s) without any fee within 7 days of commencement of trimester/semester. They may be allowed to withdraw regular course(s) for valid reasons with withdrawal fee of Tk.300/- per credit hour by the day before beginning of the midterm examination. After the midterm examination, no student will be allowed to withdraw any of the registered courses even if the student does not appear in the examination. Courses once registered for repeat/incomplete/improvement cannot be withdrawn.

Incomplete (I) Courses

1. Students failing to appear for either mid-term or trimester final examination of a course with valid reason (like serious illness, accident, sudden death of father & mother etc.) will be awarded the grade 'I' or 'Incomplete' in that course.
2. To complete the course student will be allowed to appear for the mid-term or trimester final examination once only whichever he/she missed.
3. A Student has to complete the incomplete examination in the immediate subsequent trimester when the course will be offered.
4. If a student fails to appear for an incomplete exam in the immediate subsequent trimester when the course is offered, he/she will be awarded an 'F" grade in that particular course.
5. Incomplete exam fee for each course is Tk. 500/-. Students will not be allowed to register for the "Incomplete" course as "Improvement" course.
6. Students may be allowed to register "Incomplete" course as "repeat" course.

Retake/Repeat

Students will have to repeat the course:

a. If any student secured "F" grade in any course
b. If any student does not appear at both mid-term and trimester final examination, which will be treated as failed in that course.

1. In such case, he/she will have to repeat that course in the immediate following trimester/whenever the course will be offered. The tuition fee for repeating the course is the same as the regular tuition fee.
2. If any student fails to secure a pass mark in the theoretical part of a course but secures a pass mark in sessional, he will be considered pass in sessional.
3. In the same way, if any student fails to secure pass marks in the sessional part of the course but secures pass marks in theoretical part, he will be considered pass in theoretical part.
4. Courses having 'C' and 'D' grade may be registered for repeat but courses having 'C+' and above grade will not be allowed to repeat.
5. Students may be allowed to register for the "Incomplete" course as a "repeat' course.
6. Repeating a course implies that the student has to attend all the classes, class tests, midterm and final examinations as a regular student. No student will be allowed to repeat a course more than three times in three consecutive trimesters. If any student fails to improve the grade within the stipulated times, he/she will not be allowed to take any further course(s) to continue until he/she improves the grade.
7. No student will be allowed to withdraw any repeat course.
8. Students must appear for both midterm and trimester final examinations of a repeat course If any student does not appear for midterm or trimester final examination, he/she will be treated as failed in that repeat course.

Grade Improvement

Students having grades from "D" to" B+" (B Plus) in any course(s) will be allowed to register that course as 'Improvement' and once only. Improvement examination fee per credit hour is Tk. 600/- (Six Hundred only). For improvement, students have the option to appear for any one or both mid-term and trimester final examinations of a course in the same trimester. Maximum 6 credit hours can be registered in a single trimester for improvement examination.

Course Dropout

If a student fails to register for two consecutive trimesters, he/she becomes an irregular student and as such his/her studentship will be cancelled. So, the student will need to take readmission to continue the studies.