



UNITED INTERNATIONAL UNIVERSITY

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

BSCSE Curriculum

Contents

Admission Requirements	2
Degree Requirements	2
List of Courses	3
Summary of Courses	7
Course Equivalence	7
Course Sequence	11
Course Contents	16
Language Courses	16
General Education Courses	18
Basic Sciences Courses	29
Mathematics Courses	32
Other Engineering Courses	36
Core Courses	40
Elective Courses	71
University Required Courses	106
Final Year Design Project	107

BSCSE Curriculum

Bachelor of Science in Computer Science and Engineering primarily involves the study of a number of core courses which every CSE graduate should know and a significant number of courses from specialized areas. Core courses build the foundation and specialized courses prepare the students for the specific areas of Computer Science and Engineering. To understand the underpinning theory of the courses of Computer Science and Engineering, a number of courses on Mathematics and Basic Science have been felt mandatory to include in the syllabus. In addition some social science, management, accounting, economics and communication-skills development related courses have been incorporated to make the syllabus a balanced and reasonably complete one. The objective of the undergraduate program in Computer Science and Engineering is to develop skilled and competent graduates to meet the current and future needs at home and abroad.

Admission Requirements

Every applicant, without any exception, must fulfill the admission requirements as laid down by the university. Admission test and interview for admission into a trimester will be held as decided by the university.

A higher secondary certificate or its equivalent in science with mathematics and physics or other fields of study is the basic educational requirement.

Degree Requirements

The B.Sc. in CSE degree requirements will be as follows:

- (a) Completion of 137.0 credit hours
- (b) Completion of the final year design project with at least a 'C' grade
- (c) Passing of all courses individually and maintaining a minimum CGPA of 2.0

A specialization will be declared in one of the following areas if at least three courses are completed from the elective courses: theory, communication, hardware, systems, software, data science and ICT.

List of Courses

(A) Language (9 credits)

1	ENG 1105	Intensive English I	4.5
2	ENG 1207	Intensive English II	4.5

(B) General Education (12 credits)

Compulsory (6 credits)

1	SOC 2101	Society, Environment and Engineering Ethics	3.0
2	PMG 4101	Project Management	3.0

Optional (Any two: 6 credits)

1	ECO 4101	Economics	3.0
2	SOC 4101	Introduction to Sociology	3.0
3	ACT 2111	Financial and Managerial Accounting	3.0
4	IPE 3401	Industrial and Operational Management	3.0
5	TEC 2499	Technology Entrepreneurship	3.0
6	PSY 2101	Psychology	3.0
7	BDS 2201	Bangladesh Studies	3.0
8	BAN 2501	Bangla	3.0

(C) Basic Sciences (7 credits)

1	PHY 2105	Physics	3.0
2	PHY 2106	Physics Laboratory	1.0
3	BIO 3105	Biology for Engineers	3.0

(D) Mathematics (12 credits)

1	MATH 1151	Fundamental Calculus	3.0
2	MATH 2183	Calculus and Linear Algebra	3.0
3	MATH 2201	Coordinate Geometry and Vector Analysis	3.0
4	MATH 2205	Probability and Statistics	3.0

(E) Other Engineering (10 credits)

1	EEE 2113	Electrical Circuits	3.0
2	EEE 2123	Electronics	3.0
3	EEE 2124	Electronics Laboratory	1.0
4	EEE 4261	Green Computing	3.0

(F) Core Courses (65 credits)

Programming Compulsory (10 credits)

1	CSE 1110	Introduction to Computer Systems	1.0
2	CSE 1111	Structured Programming Language	3.0
3	CSE 1112	Structured Programming Language Laboratory	1.0
4	CSE 1115	Object Oriented Programming	3.0
5	CSE 1116	Object Oriented Programming Laboratory	1.0
6	CSE 2118	Advanced Object Oriented Programming Laboratory	1.0

Programming Optional (Any one: 3 credits)

1	CSE 4165	Web Programming	3.0
2	CSE 4181	Mobile Application Development	3.0

Hardware (11 credits)

1	CSE 1325	Digital Logic Design	3.0
2	CSE 1326	Digital Logic Design Laboratory	1.0
3	CSE 3313	Computer Architecture	3.0
4	CSE 4325	Microprocessors and Microcontrollers	3.0
5	CSE 4326	Microprocessors and Microcontrollers Laboratory	1.0

Logics and Algorithms (14 credits)

1	CSE 2213	Discrete Mathematics	3.0
2	CSE 2215	Data Structure and Algorithms I	3.0
3	CSE 2216	Data Structure and Algorithms I Laboratory	1.0
4	CSE 2217	Data Structure and Algorithms II	3.0
5	CSE 2218	Data Structure and Algorithms II Laboratory	1.0
6	CSE 2233	Theory of Computation	3.0

Software Engineering (8 credits)

1	CSE 3411	System Analysis and Design	3.0
2	CSE 3412	System Analysis and Design Laboratory	1.0
3	CSE 3421	Software Engineering	3.0
4	CSE 3422	Software Engineering Laboratory	1.0

Systems (19 credits)

1	CSE 4531	Computer Security	3.0
2	CSE 3521	Database Management Systems	3.0
3	CSE 3522	Database Management Systems Laboratory	1.0
4	CSE 4509	Operating Systems	3.0
5	CSE 4510	Operating Systems Laboratory	1.0
6	CSE 3711	Computer Networks	3.0
7	CSE 3712	Computer Networks Laboratory	1.0
8	CSE 3811	Artificial Intelligence	3.0
9	CSE 3812	Artificial Intelligence Laboratory	1.0

(G) Elective Courses (Any five: 15 credits)

Computational Theory

1	CSE 4601	Mathematical Analysis for Computer Science	3.0
2	CSE 4633	Basic Graph Theory	3.0
3	CSE 4655	Algorithm Engineering	3.0
4	CSE 4611	Compiler Design	3.0
5	CSE 4613	Computational Geometry	3.0
6	CSE 4621	Computer Graphics	3.0

Network and Communications

1	CSE 3715	Data Communication	3.0
2	CSE 4759	Wireless and Cellular Communication	3.0
3	CSE 4793	Advanced Network Services and Management	3.0
4	CSE 4783	Cryptography	3.0
5	CSE 4777	Networks Security	3.0
6	CSE 4763	Electronic Business	3.0

Systems

1	CSE 4547	Multimedia Systems Design	3.0
2	CSE 4519	Distributed Systems	3.0
3	CSE 4523	Simulation and Modeling	3.0
4	CSE 4521	Computer Graphics	3.0
5	CSE 4587	Cloud Computing	3.0
6	CSE 4567	Advanced Database Management Systems	3.0

Data Science

1	CSE 4889	Machine Learning	3.0
2	CSE 4891	Data Mining	3.0
3	CSE 4893	Introduction to Bioinformatics	3.0
4	CSE 4883	Digital Image Processing	3.0
5	CSE 4817	Big Data Analytics	3.0

Software Engineering

1	CSE 4451	Human Computer Interaction	3.0
2	CSE 4435	Software Architecture	3.0
3	CSE 4165	Web Programming	3.0
4	CSE 4181	Mobile Application Development	3.0
5	CSE 4495	Software Testing and Quality Assurance	3.0
6	CSE 4485	Game Design and Development	3.0

Hardware

1	CSE 4329	Digital System Design	3.0
2	CSE 4379	Real-time Embedded Systems	3.0
3	CSE 4327	VLSI Design	3.0
4	CSE 4337	Robotics	3.0
5	CSE 4397	Interfacing	3.0

Information and Communication Technology

1	CSE 4941	Enterprise Systems: Concepts and Practice	3.0
2	CSE 4943	Web Application Security	3.0
3	CSE 4463	Electronic Business	3.0
4	CSE 4165	Web Programming	3.0
5	CSE 4181	Mobile Application Development	3.0
6	CSE 4945	UI: Concepts and Design	3.0
7	CSE 4949	IT Audit: Concepts and Practice	3.0
8	CSE 4587	Cloud Computing	3.0
9	CSE 4495	Software Testing and Quality Assurance	3.0

(H) University required courses (3 credits)

1	URC 1101	Life Skills for Success	3.0
---	----------	-------------------------	-----

(I) Final Year Design Project (4 credits)

1	CSE 4000A	Final Year Design Project - I	2.0
2	CSE 4000B	Final Year Design Project - II	2.0

Summary of Courses

#	Group	Theory	Laboratory	Final Year Design Project	Total
1	Language	9.0	–	–	9.0
2	General Education	12.0	–	–	12.0
3	Basic Sciences	6.0	1.0	–	7.0
4	Mathematics	12.0	–	–	12.0
5	Other Engineering	9.0	1.0	–	10.0
6	Core Courses	51.0	14.0	–	65.0
7	Elective Courses	15.0	–	–	15.0
8	University Required Courses		3.0	–	3.0
9	Final Year Design Project	–	–	4.0	4.0
Total		114.0	19.0	4.0	137.0

Course Equivalence

Old Course			New Course		
Course Code	Course Title	Cr.	Course Code	Course Title	Cr.
PHY 105	Physics	3.0	PHY 2105	Physics	3.0
PHY 106	Physics Laboratory	1.0	PHY 2106	Physics Laboratory	1.0
SOC 101	Society, Technology and Engineering Ethics	3.0	SOC 2101	Society, Environment and Engineering Ethics	3.0
ACT 111	Financial and Managerial Accounting	3.0	ACT 2111	Financial and Managerial Accounting	3.0
ECO 213	Economics	3.0	ECO 4101	Economics	3.0
IPE 401	Industrial Management	3.0	IPE 3401	Industrial and Operational Management	3.0
PSY 101	Psychology	3.0	PSY 2101	Psychology	3.0
SOC 103	Sociology	3.0	SOC 4101	Introduction to Sociology	3.0
ENG 005	Spoken English	3.0	-	-	-

Old Course			New Course		
Course Code	Course Title	Cr.	Course Code	Course Title	Cr.
ENG 101	English I	3.0	ENG 1105	Intensive English I	3.0
ENG 103	English II	3.0	ENG 1207	Intensive English II	3.0
MATH 003	Elementary Calculus	3.0	-	-	
MATH 151	Differential and Integral Calculus	3.0	MATH 1151	Fundamental Calculus	3.0
MATH 183	Linear Algebra, Ordinary & Partial Differential Equations	3.0	MATH 2183	Calculus and Linear Algebra	3.0
MATH 187	Fourier and Laplace Transformations and Complex Variables	3.0	-	-	-
MATH 201	Coordinate geometry and Vector Analysis	3.0	MATH 2201	Coordinate geometry and Vector Analysis	3.0
STAT 205	Probability and Statistics	3.0	MATH 2205	Probability and Statistics	3.0
CSI 121	Structured Programming Language	3.0	CSE 1111	Structured Programming Language	3.0
CSI 122	Structured Programming Language Laboratory	1.0	CSE 1112	Structured Programming Language Laboratory	1.0
CSI 211	Object-Oriented Programming	3.0	CSE 1115	Object-Oriented Programming	3.0
CSI 212	Object-Oriented Programming Laboratory	1.0	CSE 1116	Object-Oriented Programming Laboratory	1.0
CSI 217	Data Structure	3.0	CSE 2215	Data Structure and Algorithms I	3.0
CSI 218	Data Structure Laboratory	1.0	CSE 2216	Data Structure and Algorithms I Laboratory	1.0
CSI 219	Discrete Mathematics	3.0	CSE 2213	Discrete Mathematics	3.0
CSI 21	Database Management Systems	3.0	CSE 3521	Database Management Systems	3.0

Old Course			New Course		
Course Code	Course Title	Cr.	Course Code	Course Title	Cr.
CSI 222	Database Management Systems Laboratory	1.0	CSE 3522	Database Management Systems Laboratory	1.0
CSI 227	Algorithms	3.0	CSE 2217	Data Structure and Algorithms II	3.0
CSI 228	Algorithms Laboratory	1.0	CSE 2218	Data Structure and Algorithms II Laboratory	1.0
CSI 233	Theory of Computing	3.0	CSE 2233	Theory of Computing	3.0
CSI 309	Operating System Concepts	3.0	CSE 4509	Operating System Concepts	3.0
CSI 310	Operating System Concepts Laboratory	1.0	CSE 4510	Operating System Concepts Laboratory	1.0
CSI 311	System Analysis and Design	3.0	CSE 3411	System Analysis and Design	3.0
CSI 312	System Analysis and Design Laboratory	1.0	CSE 3412	System Analysis and Design Laboratory	1.0
CSI 321	Software Engineering	3.0	CSE 3421	Software Engineering	3.0
CSI 322	Software Engineering Laboratory	1.0	CSE 3422	Software Engineering Laboratory	1.0
CSI 341	Artificial Intelligence	3.0	CSE 3841	Artificial Intelligence	3.0
CSI 342	Artificial Intelligence Laboratory	1.0	CSE 3842	Artificial Intelligence Laboratory	1.0
CSI 411	Compiler	3.0	CSE 4611	Compiler Design	3.0
CSI 412	Compiler Laboratory	1.0	-	-	-
CSI 421	Computer Graphics	3.0	CSE 4621	Computer Graphics	3.0
CSI 422	Computer Graphics Laboratory	1.0	-	-	-
CSI 423	Simulation & Modeling	3.0	CSE 4523	Simulation and Modeling	3.0
CSI 424	Simulation & Modeling Laboratory	1.0	-	-	-
CSI 447	Multimedia Systems Design	3.0	CSE 4547	Multimedia Systems Design	3.0
CSI 448	Multimedia Systems Design Laboratory	1.0	-	-	-
CSE 427	VLSI Design	3.0	CSE 4327	VLSI Design	3.0
CSE 428	VLSI Design Laboratory	1.0	-	-	-
CSE 471	Advanced Object Oriented Programming	3.0	-	-	-

Old Course			New Course		
Course Code	Course Title	Cr.	Course Code	Course Title	Cr.
CSE 472	Advanced Object Oriented Programming Laboratory	1.0	-	-	-
CSE 113	Electrical Circuits	3.0	EEE 2113	Electrical Circuits	3.0
CSE 123	Electronics	3.0	EEE 2123	Electronics	3.0
CSE 124	Electronics Laboratory	1.0	EEE 2124	Electronics Laboratory	1.0
CSE 225	Digital Logic Design	3.0	CSE 1325	Digital Logic Design	3.0
CSE 226	Digital Logic Design Laboratory	1.0	CSE 1326	Digital Logic Design Laboratory	1.0
CSE 236	Assembly Programming Laboratory	1.0	-	-	-
CSE 313	Computer Architecture	3.0	CSE 3313	Computer Architecture	3.0
CSE 315	Data Communication	3.0	CSE 3715	Data Communication	3.0
CSE 323	Computer Networks	3.0	CSE 3711	Computer Networks	3.0
CSE 324	Computer Networks Laboratory	1.0	CSE 3711	Computer Networks Laboratory	1.0
CSE 429	Digital System Design	3.0	CSE 4329	Digital System Design	3.0
CSE 430	Digital System Design Laboratory	1.0	-	-	-
CSE 425	Microprocessor, Microcontroller and Interfacing	3.0	CSE 4325	Microprocessors and Microcontrollers	3.0
CSE 426	Microprocessor, Microcontroller and Interfacing Laboratory	1.0	CSE 4326	Microprocessors and Microcontrollers Laboratory	1.0
CSE 453	Optical Fiber Communication	3.0	-	-	-
CSE 457	Mobile Cellular Communication	3.0	CSE 4759	Wireless and Cellular Communication	3.0
CSE 461	Wireless Communication	3.0	CSE 4759	Wireless and Cellular Communication	3.0
CSE 463	E-Commerce	3.0	CSE 4763	Electronic Business	3.0
CSE 465	Web Programming	3.0	CSE	4165 Web Programming	3.0
CSE 467	Advanced DBMS	3.0	CSE 4567	Advanced Database Management Systems	3.0

Old Course			New Course		
Course Code	Course Title	Cr.	Course Code	Course Title	Cr.
CSE 469	Project Management	3.0	PMG 4101	Project Management	3.0
CSE 473	Advanced Network Services and Management	3.0	CSE 4773	Advanced Network Services and Management	3.0
CSE 475	Mobile Computing	3.0	-	-	-
CSE 477	Network Security	3.0	CSE 4777	Network Security	3.0
CSE 479	Embedded Systems	3.0	CSE 4379	Real-time Embedded Systems	3.0
CSE 481	Mobile Application Development	3.0	CSE 4181	Mobile Application Development	3.0
CSE 483	Digital Image Processing	3.0	CSE 4883	Digital Image Processing	3.0
CSE 485	Game Design and Development	3.0	CSE 4485	Game Design and Development	3.0
CSE 487	Cloud Computing	3.0	CSE 4587	Cloud Computing	3.0
CSE 489	Machine Learning	3.0	CSE 4889	Machine Learning	3.0
CSE 491	Data Mining	3.0	CSE 4891	Data Mining	3.0
CSE 493	Introduction to Bioinformatics	3.0	CSE 4893	Introduction to Bioinformatics	3.0
CSE 495	Software Testing, Verification and Quality Assurance	3.0	CSE 4495	Software Testing, Verification and Quality Assurance	3.0
CSE 451	Human Computer Interaction	3.0	CSE 4451	Human Computer Interaction	3.0
CSE 455	Advanced Algorithms	3.0	CSE 4655	Algorithm Engineering	3.0
CSE 499	Building a Tech Startup	3.0	TEC 2499	Technology Entrepreneurship	3.0

Course Sequence

Trimester 1

Sl. No.	Course Code	Course Title	Credit Hr.
1	ENG 1105	Intensive English - I	4.5
2	CSE 1110	Introduction to Computer Systems	1.0
3	URC 1101	Life Success Skills	3.0
Subtotal			8.5

Trimester 2

Sl. No.	Course Code	Course Title	Credit Hr.
1	ENG 1207	Intensive English - II	4.5
2	CSE 1111	Structured Programming Language	3.0
3	CSE 1112	Structured Programming Language Laboratory	1.0
Subtotal			8.5

Trimester 3

Sl. No.	Course Code	Course Title	Credit Hr.
1	MATH 1151	Fundamental Calculus	3.0
2	CSE 1325	Digital Logic Design	3.0
3	CSE 1326	Digital Logic Design Laboratory	1.0
4	CSE 1115	Object Oriented Programming	3.0
5	CSE 1116	Object Oriented Programming Laboratory	1.0
Subtotal			11.0

Trimester 4

Sl. No.	Course Code	Course Title	Credit Hr.
1	MATH 2183	Calculus and Linear Algebra	3.0
2	PHY 2105	Physics	3.0
3	PHY 2106	Physics Laboratory	1.0
4	CSE 2213	Discrete Mathematics	3.0
5	CSE 2118	Advanced Object Oriented Programming Laboratory	1.0
Subtotal			11.0

Trimester 5

Sl. No.	Course Code	Course Title	Credit Hr.
1	MATH 2201	Coordinate Geometry and Vector Analysis	3.0
2	SOC 2101	Society, Environment and Engineering Ethics	3.0
3	CSE 2215	Data Structure and Algorithms - I	3.0
4	CSE 2216	Data Structure and Algorithms - I Laboratory	1.0
5	EEE 2113	Electrical Circuits	3.0
Subtotal			13

Trimester 6

Sl. No.	Course Code	Course Title	Credit Hr.
1	MATH 2205	Probability and Statistics	3.0
2	CSE 2217	Data Structure and Algorithms - II	3.0
3	CSE 2218	Data Structure and Algorithms - II Laboratory	1.0
4	EEE 2123	Electronics	3.0
5	EEE 2124	Electronics Laboratory	1.0
6	CSE 2233	Theory of Computation	3.0
Subtotal			14.0

Trimester 7

Sl. No.	Course Code	Course Title	Credit Hr.
1	CSE 3521	Database Management Systems	3.0
2	CSE 3522	Database Management Systems Laboratory	1.0
3	CSE 3313	Computer Architecture	3.0
4	CSE 3841	Artificial Intelligence	3.0
5	CSE 3842	Artificial Intelligence Laboratory	1.0
Subtotal			11.0

Trimester 8

Sl. No.	Course Code	Course Title	Credit Hr.
1	CSE 4325	Microprocessors and Microcontrollers	3.0
2	CSE 4326	Microprocessors and Microcontrollers Laboratory	1.0
3	CSE 3411	System Analysis and Design	3.0
4	CSE 3412	System Analysis and Design Laboratory	1.0
5	CSE 3711	Computer Networks	3.0
6	CSE 3712	Computer Networks Laboratory	1.0
Subtotal			12.0

Trimester 9

Sl. No.	Course Code	Course Title	Credit Hr.
1	BIO 3105	Biology for Engineers	3.0
2	CSE 3421	Software Engineering	3.0
3	CSE 3422	Software Engineering Laboratory	1.0
4	CSE ***	Programming Optional	3.0
5	GED OPT I	General Education Optional	3.0
Subtotal			13.0

Trimester 10

Sl. No.	Course Code	Course Title	Credit Hr.
1	PMG 4101	Project Management	3.0
2	CSE ***	Elective - I	3.0
3	CSE 4000A	Final Year Design Project - I	2.0
4	CSE 3509	Operating Systems	3.0
5	CSE 3510	Operating Systems Laboratory	1.0
Subtotal			12.0

Trimester 11

Sl. No.	Course Code	Course Title	Credit Hr.
1	GED OPT II	General Education Optional	3.0
2	CSE ***	Elective - II	3.0
3	CSE ***	Elective - III	3.0
4	CSE 4000B	Final Year Design Project - II	2.0
Subtotal			11.0

Trimester 12

Sl. No.	Course Code	Course Title	Credit Hr.
1	CSE 4513	Computer Security	3.0
2	EEE 4261	Green Computing	3.0
3	CSE ***	Elective - IV	3.0
4	CSE ***	Elective - V	3.0
Subtotal			12.0

Credit hours distribution in twelve trimesters

Trimester	Theory Credits	Laboratory Credits	Total Credits
Trimester 1	7.5	1.0	8.5
Trimester 2	7.5	1.0	8.5
Trimester 3	9.0	2.0	11.0
Trimester 4	9.0	2.0	11.0
Trimester 5	12.0	1.0	13.0
Trimester 6	12.0	2.0	14.0
Trimester 7	9.0	2.0	11.0
Trimester 8	9.0	3.0	12.0
Trimester 9	12.0	1.0	13.0
Trimester 10	11.0	1.0	12.0
Trimester 11	11.0	0.0	11.0
Trimester 12	12.0	0.0	12.0
Total	118.0	16.0	134.0

Course Contents

Language Courses

Intensive English I

	Existing	Updated
Course Code	ENG 101	ENG 1105
Course Title	English I	Intensive English I
Prerequisite Course		
Course Contents	The course aims at developing proficiency in speaking, listening, reading, and writing of English. It is generalized as a remedial course for students whose English need considerable repair and as a foundation course for ENG 102. The contents include parts of speech, count and uncountable nouns and articles, agreement between subject and verb, adverbs of frequency, tense and the sequence of tenses, active and passive voices, types of sentences, prepositions: time, place, action, directions, questions forms, multi-word verbs, capitalization.	<p>Reading and Writing: Cohesion, Skimming, Coherence, Scanning; Reading and Annotation; Main ideas, Brainstorming and Taking notes; Comprehensions; Linking and Transitional words; Grammatical Knowledge: Parts of Speech, Punctuation, Subject Verb Agreement, Tense; WH Questions; Paraphrasing; Summarizing; News Report Writing; Creative Writing; Presentation.</p> <p>Speaking and Listening: Speaking and Listening strategies; Pronunciation and Intonation; Vocabulary, Educated guess from content; Linking words and Fillers; Introduction to Drama; Performing Play; Art of Questioning; Famous Speeches; Listening Activities; How to make and present a brochure; News Reporting; Impromptu Speaking; Group Presentation.</p>

Intensive English II

	Existing	Updated
Course Code	ENG 103	ENG 1207
Course Title	English II	Intensive English II
Prerequisite Course		
Course Contents	<p>A course to provide a solid foundation on perfecting skills in English reading, writing, listening comprehension and speaking. The course emphasizes the practice of pronunciation, speed-reading, and effective writing and listening. The course contents include the grammar parts of revision of tenses, use of idioms, prepositions, modals, conditional sentence, use of linking words, use of suffixes and prefixes, synonyms and antonyms, words with multi names, reading parts include the skills in skimming, scanning, selecting information, writing parts include planning, outlining, organizing ideas, topic sentences, paragraph writing, essay writing, job applications, writing reports, writing research report.</p>	<p>Reading and Writing:</p> <p>Writing process: Outlining, Drafting, Editing, Revising, Final Draft, Publishing; Prewriting Techniques: Free writing, Scratching out, Clustering, Questioning; Differences between a paragraph and an essay; Format of a paragraph; Adding details/ Body paragraphs: Ordering paragraphs, Time order, Emphatic order, Use of transitional words; Structure of a traditional essay; Types of Essays: Descriptive, Narrative, Cause-Effect, Argumentative, Compare and Contrast, Persuasive essay; Writing a good conclusion; Academic reading: Using index, choosing a book; Narrator's point of view; Preventing regression; Critical thinking; Expanding fixations; Return sweep.</p> <p>Speaking and Listening:</p> <p>Greetings and Expressions; Practice speaking; Role play (using modals and phrases); Handling situations; Listening tracks and speeches; Developing public speaking: Increasing confidents; Critical thinking and Vocabulary list; Newspaper project; Human rights discussion; Special occasion speech; Impromptu; Developing presentation skills; Developing argumentative skill: Argumentative presentation.</p> <p>Grammar Contents:</p> <p>Overview of verb tenses; Present and Past, Simple and Progressive; Perfect progressive tenses and Future time.</p>

General Education Courses

Society, Environment and Engineering Ethics

	Existing	Updated
Course Code	SOC 101	SOC 2101
Course Title	Society, Technology and Engineering Ethics	Society, Environment and Engineering Ethics
Prerequisite Course		
Course Contents	Historical Background for the emergence of Sociology as moral lessons for society. French Revolution, Industrial Revolution. Commonsense and Knowledge. Basics of Sociology. Culture, Elements of Culture, Cultural Lag, What is Ethics? Socialization, Agents of Socialization, Basic Institutions in society. Basic Association and Institutions in society, Type of Societies. Some recent social issues around us (poverty, rehabilitation, Gender discrimination, environment) Some social issues around us (Social Change, Urbanization, development, deviance and control). What is Engineering Ethics about? Moral reasoning. Engineering as Social Experimentation. The Engineer's Concern for safety. Professional Responsibility. Employer Authority. Rights of Engineers. Global Issues. Career Choice and Professional Outlook. Ethical Problems are like Design Problems.	Society: emergence of Sociology as moral lessons for society; Basic institutions in society, organization and institutions in society, Types of Society; Culture: basics of culture, elements of culture, cultural change, socialization, and social issues around us; Technology and society: interaction between technology and society; Engineering ethics: understanding ethics, engineering ethics; Moral reasoning and engineering as social experimentation; The engineers' concern for safety, professional responsibility; Employer authority; Rights of engineers; Global issues; Career choice and professional outlook; Ethical problems are like design problems; Genetically modified objects (GMO); Environment: environment and environmental issues– environmental degradation, waste management and renewable energy; Basic understanding of sustainable development, SDGs, climate change adaptation; Disability and Accessibility.

Project Management

	Existing	Updated
Course Code	CSE 469	PMG 4101
Course Title	Project Management	Project Management
Prerequisite Course	CSI 321	None
Course Contents	Software project management; software development team configuration and maintenance; software project documentation; communication in a software project (reporting and presentations); project management tools; advanced life cycle models; measurement, metrics and control; testing; systems integration; maintenance; systems development automation.	Triple Constraint in Project Management: Time, Scope and Cost; Process methodology, Requirement Collection, Plan, schedule a project including risk assessment with proper documentation and presentation. Cost Estimation, Optimization, and performance calculation, Change management, Quality improvement, Use of Modern tools in project planning, resource allocation and estimation.

Economics

	Existing	Updated
Course Code	ECO 213	ECO 4101
Course Title	Economics	Economics
Prerequisite Course		
Course Contents	<p>Definition of Economics; Economics and engineering; Principles of economics.</p> <p>Micro-Economics: Introduction to various economic systems – capitalist, command and mixed economy; Fundamental economic problems and the mechanism through which these problems are solved; Theory of demand and supply and their elasticities; Theory of consumer behavior; Cardinal and ordinal approaches of utility analysis; Price determination; Nature of an economic theory; Applicability of economic theories to the problems of developing countries; Indifference curve techniques; Theory of production, production function, types of productivity; Rational region of production of an engineering firm; Concepts of market and market structure; Cost analysis and cost function; Small scale production and large scale production; Optimization; Theory of distribution; Use of derivative in economics: maximization and minimization of economic functions, relationship among total, marginal and average concepts.</p> <p>Macro-Economics: Savings; investment, employment; national income analysis; Inflation; Monetary policy; Fiscal policy and trade policy with reference to Bangladesh; Economics of development and planning.</p>	<p>Definition of Economics; Economics and engineering; Principles of economics.</p> <p>Micro-Economics: Introduction to various economic systems – capitalist, command and mixed economy; Fundamental economic problems and the mechanism through which these problems are solved; Theory of demand and supply and their elasticities; Theory of consumer behavior; Cardinal and ordinal approaches of utility analysis; Price determination; Nature of an economic theory; Applicability of economic theories to the problems of developing countries; Indifference curve techniques; Theory of production, production function, types of productivity; Rational region of production of an engineering firm; Concepts of market and market structure; Cost analysis and cost function; Small scale production and large scale production; Optimization; Theory of distribution; Use of derivative in economics: maximization and minimization of economic functions, relationship among total, marginal and average concepts.</p> <p>Macro-Economics: Savings; investment, employment; national income analysis; Inflation; Monetary policy; Fiscal policy and trade policy with reference to Bangladesh; Economics of development and planning.</p>

Introduction to Sociology

	Existing	Updated
Course Code	SOC 103	SOC 4101
Course Title	Sociology	Introduction to Sociology
Prerequisite Course		
Course Contents	The objective of this course is to introduce students to key societal concepts, primary social institutions, social structure and stratification, religion and so on. They will also be familiar with the methods and different techniques of social research.	Concept and theory: major schools of sociology - functionalism, critical theory, gender, interactionism and postmodernism; Sociology of communications: the impacts of contemporary media institutions and communications technologies on the social construction of knowledge and the construction of socially significant identities and ideologies; Society: discussion on key concepts of society, social institutions, social structure and stratification, religion and so on; Sociology of development: technology, gender, business, globalization, and how do we formulate reasonable expectations? Global and social issues; Social research: importance of research, research methods and techniques.

Financial and Managerial Accounting

	Existing	Updated
Course Code	ACT 111	ACT 2111
Course Title	Financial and Managerial Accounting	Financial and Managerial Accounting
Prerequisite Course		
Course Contents	<p>Financial Accounting: Objectives and importance of accounting; Accounting as an information system; Computerized system and applications in accounting. Recording system: double entry mechanism; accounts and their classification; Accounting equation; Accounting cycle: journal, ledger, trial balance; Preparation of financial statements considering adjusting and closing entries; Accounting concepts (principles) and conventions.</p> <p>Financial statement analysis and interpretation: ratio analysis.</p> <p>Cost and Management Accounting: Cost concepts and classification; Overhead cost: meaning and classification; Distribution of overhead cost; Overhead recovery method/rate; Job order costing: preparation of job cost sheet and quotation price; Inventory valuation: absorption costing and marginal/variable costing techniques; Cost-Volume-Profit analysis: meaning breakeven analysis, contribution margin approach, sensitivity analysis.</p> <p>Short-term investment decisions: relevant and differential cost analysis. Long-term investment decisions: capital budgeting, various techniques of evaluation of capital investments.</p>	<p>Financial Accounting: Objectives and importance of accounting; Accounting as an information system; Computerized system and applications in accounting. Recording system: double entry mechanism; accounts and their classification; Accounting equation; Accounting cycle: journal, ledger, trial balance; Preparation of financial statements considering adjusting and closing entries; Accounting concepts (principles) and conventions.</p> <p>Financial statement analysis and interpretation: ratio analysis.</p> <p>Cost and Management Accounting: Cost concepts and classification; Overhead cost: meaning and classification; Distribution of overhead cost; Overhead recovery method/rate; Job order costing: preparation of job cost sheet and quotation price; Inventory valuation: absorption costing and marginal/variable costing techniques; Cost-Volume-Profit analysis: meaning breakeven analysis, contribution margin approach, sensitivity analysis.</p> <p>Short-term investment decisions: relevant and differential cost analysis. Long-term investment decisions: capital budgeting, various techniques of evaluation of capital investments.</p>

Industrial and Operational Management

	Existing	Updated
Course Code	IPE 401	IPE 3401
Course Title	Industrial Management	Industrial and Operational Management
Prerequisite Course		
Course Contents	<p>Introduction, evolution, management function, organization and environment.</p> <p>Organization: Theory and structure; Coordination; Span of control; Authority delegation; Groups; Committee and task force; Manpower planning.</p> <p>Personnel Management: Scope; Importance; Need hierarchy; Motivation; Job redesign; Leadership; Participative management; Training; Performance appraisal; Wages and incentives; Informal groups; Organizational change and conflict.</p> <p>Cost and Financial Management; Elements of costs of products depreciation; Break-even analysis; Investment analysis; Benefit cost analysis.</p> <p>Management Accounting: Cost planning and control; Budget and budgetary control; Development planning process.</p> <p>Marketing Management: Concepts; Strategy; Sales promotion; Patent laws.</p> <p>Technology Management: Management of innovation and changes; Technology life cycle; Case studies.</p>	<p>Introduction, evolution, management function, organization and environment.</p> <p>Organization: Theory and structure; Coordination; Span of control; Authority delegation; Groups; Committee and task force; Manpower planning.</p> <p>Personnel Management: Scope; Importance; Need hierarchy; Motivation; Job redesign; Leadership; Participative management; Training; Performance appraisal; Wages and incentives; Informal groups; Organizational change and conflict.</p> <p>Cost and Financial Management; Elements of costs of products depreciation; Break-even analysis; Investment analysis; Benefit cost analysis.</p> <p>Management Accounting: Cost planning and control; Budget and budgetary control; Development planning process.</p> <p>Marketing Management: Concepts; Strategy; Sales promotion; Patent laws.</p> <p>Technology Management: Management of innovation and changes; Technology life cycle; Case studies.</p>

Technology Entrepreneurship

	Existing	Updated
Course Code	CSE 499	TEC 2499
Course Title	Building a Tech Startup	Technology Entrepreneurship
Prerequisite Course		
Course Contents	<p>Defining the startup vision: Start: How and when to start a new venture, what one needs to start, forming a suitable team; Define: Defining the core idea of a new venture, technological feasibility, market feasibility; Learn: Get the basic business model canvas, value propositions, partners, and customers; Experiment: How to get a working prototype, what is a working prototype, how to evaluate a prototype</p> <p>Steering a new startup: Leap: Plunging in with your startup; Test: Test the prototype with potential customers, how to define customers, what to test, what questions to ask; Measure: How to interpret and evaluate the feedback, finding the early evangelists; Pivot (or Persevere): Do we change or keep the prototype based on the feedback? when to pivot, why pivoting is paramount, some of the successful companies that radically changed their business model;</p> <p>Accelerating towards success: Batch Production: Getting to mass production, mass producing software vs mass producing hardware, scaling in the cloud, scaling for connected devices; Grow: Evaluating and utilizing feedback from the bigger market audience, navigating legal and promotional problems; Adapt: Change with changing technology and market conditions, change due to size and scope; Innovate: How to keep being a leader, responding to competitors, intellectual property rights;</p>	<p>Defining the startup vision: Start: How and when to start a new venture, what one needs to start, forming a suitable team; Define: Defining the core idea of a new venture, technological feasibility, market feasibility; Learn: Get the basic business model canvas, value propositions, partners, and customers; Experiment: How to get a working prototype, what is a working prototype, how to evaluate a prototype.</p> <p>Steering a new startup: Leap: Plunging in with your startup; Test: Test the prototype with potential customers, how to define customers, what to test, what questions to ask; Measure: How to interpret and evaluate the feedback, finding the early evangelists; Pivot (or Persevere): Do we change or keep the prototype based on the feedback? when to pivot, why pivoting is paramount, some of the successful companies that radically changed their business model.</p> <p>Accelerating towards success: Batch Production: Getting to mass production, mass producing software vs mass producing hardware, scaling in the cloud, scaling for connected devices; Grow: Evaluating and utilizing feedback from the bigger market audience, navigating legal and promotional problems; Adapt: Change with changing technology and market conditions, change due to size and scope; Innovate: How to keep being a leader, responding to competitors, intellectual property rights.</p>

Psychology

	Existing	Updated
Course Code	PSY 101	PSY 2101
Course Title	Psychology	Psychology
Prerequisite Course		
Course Contents	The objective of this course is to provide knowledge about the basic concepts and principles of psychology pertaining to real-life problems. The course will familiarize students with the fundamental processes that occur within organism-biological basis of behavior, perception, motivation, emotion, learning, memory and forgetting and also to the social perspective-social perception and social forces that act upon the individual.	The objective of this course is to provide knowledge about the basic concepts and principles of psychology pertaining to real-life problems. The course will familiarize students with the fundamental processes that occur within organism-biological basis of behavior, perception, motivation, emotion, learning, memory and forgetting and also to the social perspective-social perception and social forces that act upon the individual.

Bangladesh Studies

	Existing	Updated
Course Code	None	BDS 2201
Course Title		Bangladesh Studies
Prerequisite Course		None
Course Contents		Ancient Bengal: Sasanka, Rise of the Palas, the Senas; Early Medieval Bengal; Coming of the Muslims; The Independent sultanate of Bengal: Ilyas Shahi and Hossein Shahi Bengal; Late medieval Bengal: The Establishment of Mughal Rule in Bengal; Bara Bhuiyans: Subedars and Nawabs; The European Style in Bengal Architecture; British rule in Bengal; Battles of Plassey and Buzas; The Dual government; permanent settlement (1793); Nineteenth century Bengali renaissance: social and religious reforms, Raja Rammohan Roy, Ishwar Chandra Vidyasagar, Titu Meer; Partition of Bengal (1905); Language Movement (1952); Movement for Autonomy; 6-point and 11-Point Programs; The 1970 Election-Military Action, Genocide in the East Pakistan; The Liberation War; The Emergence of Bangladesh as a Sovereign Independent State in 1971; Culture: Cultural diffusion and change, Bengali culture and problems of society; social problems of Bangladesh; Social change: theories of social change; social change in Bangladesh; urbanization process and its impact on Bangladesh society.

Bangla

	Existing	Updated
Course Code		BAN 2501
Course Title		Bangla
Prerequisite Course		
Course Contents		<p>(ক) বাহুল্য সহিত</p> <p>ক। নির্বাচিত প্রবন্ধ : (যে কোনো ৩টি): (১) হরপ্রসাদ শাস্ত্রী : তৈল, (২) বঙ্কিমচন্দ্র চট্টোপাধ্যায় : বাঙলা ভাষা, (৩) রবীন্দ্রনাথ ঠাকুর : সভ্যতার সংকট, (৪) প্রমথ চৌধুরী : বীরবলের হালখাতা (যে কোনো ১টি প্রবন্ধ), (৫) মোতাহের হোসেন চৌধুরী : শিক্ষা ও মনুষ্যত্ব, (৬) অন্যান্য প্রবন্ধ (সহায়ক গ্রন্থ হতে নির্বাচিত)</p> <p>খ। নির্বাচিত গল্প : (যে কোনো ৩টি): (১) রবীন্দ্রনাথ ঠাকুর : পোস্টমাস্টার / স্ত্রীর পত্র/ একরাহি, (২) বনফুল : নিমগাহ, (৩) বিভূতিভূষণ বন্দ্যোপাধ্যায় : পুঁই মাচা, (৪) বেগম রোকেয়া সাখাওয়াত হোসেন : অব্যবহার্যবাসিনী, (৫) সৈয়দ ওয়ালীউল্লাহ : মরনচারা, (৬) অন্যান্য গল্প (সহায়ক গ্রন্থ হতে নির্বাচিত)</p> <p>গ। নির্বাচিত কবিতা : (যে কোনো ৩টি): (১) রবীন্দ্রনাথ ঠাকুর : নির্বাকের স্বপ্নভঙ্গ, (২) কাজী নজরুল ইসলাম : আজ সৃষ্টি সুখের উল্লাসে, (৩) জীবনানন্দ দাশ : বনলতা সেন, (৪) শামসুর রাহমান : তোমাকে পাওয়ার জন্য হে স্বাধীনতা, (৫) নিমিলেন্দু গুণ : হুলিয়া (প্রেমাত্মক রক্ত চাই), (৬) অন্যান্য কবিতা (সহায়ক গ্রন্থ হতে নির্বাচিত)</p> <p>ঘ। উপন্যাস (যে কোনো ১টি): বিভূতিভূষণ বন্দ্যোপাধ্যায় : আরণ্যক, অমৈত মল্লবর্মণ : তিতাস একটি নদীর নাম, মানিক বন্দ্যোপাধ্যায় : দিবারাহের কান</p> <p>(খ) প্রায়োগিক বাংলা</p> <p>(ক) বাংলা ভাষার লিখন-সম্পদ : (১) বাংলা ধ্বনিতত্ত্ব (ধ্বনি, বর্ণ, ধ্বনি পরিবর্তন, যুক্তবর্ণ), (২) বাংলা বানান : বাংলা একাডেমির বাংলা বানানের নিয়ম, শব্দের অপভ্রংশ, শব্দের বানান ও অর্থ, (৩) বাক্যের গঠন-অর্থ : বাক্যের গঠনগত গঠন-অর্থ, বিরাম চিহ্ন, (৪) বাংলা লিখন কৌশল : রেজুলেশন লিখন, অনুষ্ঠান সংকলন পাণ্ডুলিপি প্রস্তুত, বিজ্ঞাপন লিখন, প্রচ্ছদ সংশোধন।</p> <p>(খ) বাংলা ভাষার শ্রবণ ও কথন-সম্পদ : (১) বাংলা উচ্চারণের নিয়ম : স্বরবর্ণ ও ব্যঞ্জনবর্ণের উচ্চারণের স্থান, উচ্চারণপদ্ধতি, (২) বাংলা উচ্চারণ-সূত্র ও তার প্রয়োগ সহায়ক গ্রন্থ :</p> <p>(১) প্রবন্ধ সংগ্রহ, ঢাকা বিশ্ববিদ্যালয় প্রকাশনা সংস্থা (২) গল্প সংগ্রহ, ঢাকা বিশ্ববিদ্যালয় প্রকাশনা সংস্থা (৩) কবিতা সংগ্রহ, ঢাকা বিশ্ববিদ্যালয় প্রকাশনা সংস্থা (৪) বাংলা ভাষার ব্যাকরণ, মাহবুবুল আলম</p>

Basic Sciences Courses

Physics

	Existing	Updated
Course Code	PHY 105	PHY 2105
Course Title	Physics	Physics
Prerequisite Course		
Course Contents	<p>Heat and Thermodynamics THERMOMETRY: Heat, Temperature, Thermometers, Principle of temperature measurement, Scales of thermometers. Platinum resistance thermometer, Thermo-electric thermometer. Examples KINETIC THEORY OF GASES: Kinetic theory of gases, Maxwell's distribution of molecular speed, mean free path, Equipartition of energy, Brownian motion, Equation of State: 1. Ideal gas, 2. Real gas(van der Waals's equation). LAWS OF THERMODYNAMICS: First law of thermodynamics and its application Second law of thermodynamics, Carnot Cycle, Efficiency of heat engine, Carnot theorem. THERMODYNAMIC FUNCTIONS: Entropy and disorder, thermodynamic functions, Maxwell relations, Clausius-Clapeyron equation, Gibbs phase rule, Third law of thermodynamics .</p> <p>Physical Optics</p> <p>INTERFERENCE: Theories of light, Huygen's Principle, Superposition, Interference of Light, Young's double slit experiment, Energy Distribution in double slit experiment, Coherent sources, Condition for Interference, Displacement of fringes and its uses, Fresnel's Bi-prism, Interference at wedge shaped films, Newton's rings, Michelson Interferometer, Review. DIFFRACTION: Diffraction of Light, Fresnel & Fraunhofer diffraction, Diffraction by single slit, Resolving power of optical instruments, Diffraction by double slit, Diffraction by N-slits, Diffraction grating, Review. POLARIZATION: Polarization of light, Polarization by reflection, Brewster's law, Malus's law, Double refraction, Nicol prism, Retardation plates, Optical activity, Polarimeter, Uses of Polaroid, Review. Modern Physics ATOMIC PHYSICS: Rutherford's atom model and its limitations, Bohr's atom model and the postulates, Particle Properties of Wave: The Photoelectric Effect, Compton Effect, De Broglie Hypothesis, Wave-Particle Duality, Heisenberg's Uncertainty Principle. X-rays. Production, properties, application, Origin of characteristic X-ray lines, Auger effect LASER: Spontaneous emission, stimulated emission, absorption, Population inversion, Properties, Application, Ruby laser, He-Ne laser. NUCLEAR PHYSICS: Properties of nucleus, Binding energy, Radioactivity, Properties of α, β, γ rays, Decay law and equation, Half-life, Mean life, Chain reaction, Nuclear applications, Artificial radioactivity, Radioisotopes & their applications, Nuclear Fission & Fusion, Example of Fission: Reactors and A-bomb, Example of Fusion: Stellar energy and H-bomb RELATIVITY: Frame of Reference, Galilean Transformation, Michelson-Morley experiment, Einstein's postulates, Lorentz Transformation, Length contraction, Time dilation.</p>	<p>Waves and Oscillations Periodic motion: periodic waves, elastic restoring force, simple harmonic motion (SHM), differential equation of SHM and its solutions, examples of SHM, energy calculation of SHM, time period, velocity, acceleration, frequency calculation with graph, Lissajou's figure design, spring mass system and torsional pendulum, DHM, characteristic graph, differential equations for spring mass system with damping mechanism and RLC circuit-series and parallel analysis, resonant frequency, reactance, impedance, FHM; Mechanical Waves; Vibrating bodies and acoustic phenomena: progressive wave and its differential equation, EM wave, group velocity, phase velocity, standing waves, node and antinode; The Doppler effects, application of acoustic Phenomena.</p> <p>Electricity magnetism</p> <p>Electrostatic Force and Electric Field; Concept of charge, Coulomb's law, concept of electric field and its calculation, electric dipole; Gauss's law in electrostatic and its application, electric field due to dipole, torque on a dipole in uniform e-field, electric flux, flux density, Gauss's law and Coulomb's law; Electric Potential: electric potential and its calculation, electric potential energy, relationship between field and potential, potential due to a point charge, dipole, continuous charge distribution, electric field calculation from electric potential, equipotential surface, potential gradient; Capacitance and Dielectric : capacitors, capacitors in series and parallel, energy of charged capacitors, electrical energy density in terms of electric field, electron volt, dielectric media, polarization vector and displacement vector, Laplace's and Poisson's equations, capacitor with a dielectric material, Gauss's law with dielectric; Current, Resistance and Electromotive Force: current and current density, resistance and resistivity, Ohm's law, EMF, power, resistance in series and parallel, Kirchhoff's Rules, RC circuit; Magnetic Field: magnetic field, magnetic flux and flux density, Lorentz force, Gauss's law for magnetism, motion of a charged particles in magnetic field : Hall effect; Magnetic field intensity, magnetic dipole moment, Biot-Savart Law, Ampere's law and its applications; Magnetic properties of material, magnetization, hysteresis; Inductions and Inductance: induced emf and Faraday's law of induction; Lenz's law; Mutual inductance ; Self inductance; Energy in an inductor; Inductance in series, in parallel, and their combination, MMF, leakage and fringing flux, Transformers.</p> <p>Quantum Physics Quantum theory: quantum theory of radiation, energy of photons, photo-electric Effect, work function, threshold frequency, threshold voltage, Compton effect, X-rays production, properties and application, Bragg Diffraction, De Broglie wave length, Heisenberg's Uncertainty Principle, correspondence principle, pair production, pair annihilation; Schrodinger equation: wave function, Schrodinger equation-time dependent and time independent form, expectation value, quantum operator, tunneling effect, quantum numbers, energy of trapped electron, quantum dots and corrals, quantization of Bohr orbital energy.</p>

Physics Laboratory

	Existing	Updated
Course Code	PHY 106	PHY 2106
Course Title	Physics Laboratory	Physics Laboratory
Prerequisite Course		
Course Contents	Experiments based on PHY 105	Experiments based on PHY 105

Biology for Engineers

	Existing	Updated
Course Code		BIO 3105
Course Title		Biology for Engineers
Prerequisite Course		
Course Contents		Introduction; The Basics of Life: Chemistry; Organic Molecules: The Molecules of Life; Cell Structure and Function; Enzymes, Coenzymes, and Energy; Biochemical Pathways: Cellular Respiration, Photosynthesis; DNA and RNA: The Molecular Basis of Heredity; Cell Division; Patterns of Inheritance; Applications of Biotechnology; Diversity within Species and Population Genetics; Evolution and Natural Selection; The Formation of Species and Evolutionary Change; Ecosystem Dynamics: The Flow of Energy and Matter; Community Interactions; Population Ecology; Evolutionary and Ecological Aspects of Behavior; The Origin of Life and Evolution of Cells; The Classification and Evolution of Organisms; The Nature of Microorganisms; The Plant Kingdom; The Animal Kingdom Materials Exchange in the Body; Nutrition: Food and Diet; The Body's Control Mechanisms and Immunity; Human Reproduction, Sex, and Sexuality.

Mathematics Courses

Fundamental Calculus

	Existing	Updated
Course Code	MATH 003	MATH 1151
Course Title	Elementary Calculus	Fundamentals of Calculus
Prerequisite Course		None
Course Contents	Function, Domain and Range of a Function, Translation, reflection, compression and stretches of a function. Even and Odd functions, Inverse functions, One to One and many to one function, Family of Exponential, logarithmic, sine and cosine function, Limit, continuity and differentiability, Tangent line, Derivative and Chain rule, An overview of area problem, Newton's anti-derivative method in finding area, Indefinite integral, fundamental theorem of calculus, Definite integral, Area between two curves, arc length.	Function: domain and range of a function, Translation, reflection, compression and stretches of a function; Even and odd functions; Inverse functions; One to One and many to one functions; Family of exponential, logarithmic, sine and cosine functions; Limit, continuity and differentiability; Tangent line; Derivative and chain rule; An overview of area problem; Newton's anti-derivative method in finding area; Indefinite integral, fundamental theorem of calculus; Definite integral; Area between two curves, arc length.

Calculus and Linear Algebra

	Existing	Updated
Course Code	MATH 183	MATH 2183
Course Title	Differential & Integral Calculus, Linear Algebra	Calculus and Linear Algebra
Prerequisite Course	MATH 003	MATH 151
Course Contents	<p>Calculus: Implicit Differentiation, L'Hopital Rule, Analysis of Function I: Slope and Concavity, Analysis of function II: Relative Extrema and Polynomials, Rolle's theorem, Mean Value Theorem, Taylor's series & Maclaurin series, Partial Derivatives, The Chain Rule, Different types of Integration (Principles of Integral evaluation, Integration by parts, Trigonometric Substitution, Integrating rational functions by partial fractions), Improper Integral, Gamma & Beta functions, Multiple integrals.</p> <p>Linear Algebra: System of linear equations. Definitions, equality, addition, subtraction, multiplication, transposition, inversion, rank of matrices. Solution of system of equations by matrix method. Vector space, Eigen values and Eigen vectors.</p>	<p>Calculus: Implicit Differentiation, L'Hopital Rule, Analysis of Function I: Slope and Concavity, Analysis of function II: Relative Extrema and Polynomials, Taylor's series & Maclaurin series, Partial Derivatives, The Chain Rule, Different types of Integration (Principles of Integral evaluation, Integration by parts, Trigonometric Substitution, Integrating rational functions by partial fractions), Multiple integrals.</p> <p>Linear Algebra: System of linear equations. Definitions, equality, addition, subtraction, multiplication, transposition, inversion, rank of matrices. Solution of system of equations by matrix method. Eigen values and Eigen vectors.</p>

Coordinate Geometry and Vector Analysis

	Existing	Updated
Course Code	MATH 201	MATH 2201
Course Title	Coordinate Geometry and Vector Analysis	Coordinate Geometry and Vector Analysis
Prerequisite Course	MATH 003, MATH 151	MATH 151
Course Contents	Conic sections, rotation of axes, Rectangular coordinate in 3-space, cross and dot product of vectors, parametric equation of straight lines, Plane in 3-space, quadratic surfaces, Differentiation and integration of vector valued function, tangent and normal vectors, directional derivative and gradient of scalar fields, Tangent planes and normal vectors, vector fields, line integrals, conservative vector field, Green's theorem. Triple integral in cylindrical and spherical coordinate systems, Surface integral, flux, divergence theorem, Stokes' theorem.	Conic sections, rotation of axes; Rectangular coordinate in 3-space, cross and dot product of vectors, parametric equation of straight lines; Plane in 3-space, quadratic surfaces; Differentiation and integration of vector valued function, tangent and normal vectors, directional derivative and gradient of scalar fields; Tangent planes and normal vectors, vector fields, line integrals, conservative vector field; Green's theorem; Triple integral in cylindrical and spherical coordinate systems; Surface integral, flux, divergence theorem; Stokes' theorem; Multiple integrals.

Probability and Statistics

	Existing	Updated
Course Code	STAT 205	MATH 2205
Course Title	Probability and Statistics	Probability and Statistics
Prerequisite Course	MATH 003, MATH 151	MATH 151
Course Contents	Probability & Statistics: Frequency distribution. Mean, median, mode and other measures of central tendency. Standard deviation and other measures of dispersion. Moments, skewness and kurtosis, correlation and regression analysis. Elementary probability theory and discontinuous probability distribution, e.g., binomial, Poisson and negative binomial. Continuous probability distributions, e.g. normal and exponential. Characteristics of distributions. Elementary sampling theory. Estimation of parameter, Hypothesis testing.	Frequency distribution; Mean, median, mode and other measures of central tendency; Standard deviation and other measures of dispersion; Moments, skewness and kurtosis, correlation and regression analysis; Elementary probability theory and discontinuous probability distribution, e.g., binomial, Poisson and negative binomial; Continuous probability distributions, e.g. normal and exponential; Characteristics of distributions; Elementary sampling theory; Estimation of parameter, Hypothesis testing.

Other Engineering Courses

Electrical Circuits

	Existing	Updated
Course Code	CSE 113	EEE 2113
Course Title	Electrical Circuits	Electrical Circuits
Prerequisite Course		
Course Contents	Fundamental electrical concepts and measuring units, D.C. voltages, current, resistance and power, laws of electrical circuits and methods of network analysis, principles of D.C. measuring apparatus, laws of magnetic fields and methods of solving simple magnetic circuits. Alternating current, Instantaneous and RMS current, voltage and power, average power combinations of R, L & C circuits, Phasor, representation of sinusoidal quantities.	Fundamental electrical concepts and measuring units, DC voltages, current, resistance and power, laws of electrical circuits and methods of network analysis, principles of DC measuring apparatus, laws of magnetic fields and methods of solving simple magnetic circuits; Alternating current: instantaneous and RMS current, voltage and power, average power combinations of R, L & C circuits, phasor, representation of sinusoidal quantities.

Electronics

	Existing	Updated
Course Code	CSE 123	EEE 2123
Course Title	Electronics	Electronics
Prerequisite Course	CSE 113	EEE 113
Course Contents	Semiconductors, junction diode characteristics, Bipolar transistors: characteristics, small signal low frequency h-parameter model, hybrid-pi model, amplifiers, voltage and current amplifiers, oscillators, differential amplifiers, operational amplifiers, linear application of operational amplifiers, gain input and output impedance.	Semiconductor diode: materials, energy band, n-type and p-type materials, p-n junction diode, ideal vs practical diode, zener diode, light emitting diode; Diode applications: load-line Analysis, series-parallel dc circuits, AND/OR logic gates, full-wave and half-wave rectification, clipper and clamper circuits; Bipolar junction transistors: device structure and physical operation, current-voltage characteristics, BJT Circuits at DC, BJT as an amplifier and as a switch; MOS field-effect transistors (MOSFETs): device structure and physical operation, current-voltage characteristics, MOSFET circuits at DC, MOSFET as an amplifier and as a switch; CMOS combinational logic circuit design.

Electronics Laboratory

	Existing	Updated
Course Code	CSE 124	EEE 2124
Course Title	Electronics Laboratory	Electronics Laboratory
Prerequisite Course		
Course Contents	Laboratory work based on CSE 123	Laboratory work based on EEE 161

Green Computing

	Existing	Updated
Course Code		EEE 4261
Course Title		Green Computing
Prerequisite Course		
Course Contents		Cloud computing: Definition, Concept, service model and their clarification, deployment model, security and privacy; Edge Computing: Definition, Concept, Advantages and challenges; Telecomputing: Definition, advantages and challenges; Power and energy management: IEEE rules and codes in power and energy management, Microsoft, IBM and others definition in energy management; E-waste: Definition of e-waste and its recycle process. Cost benefit analysis of e-waste recycle. And environmental impact analysis of e-waste.

Core Courses

Introduction to Computer Systems

	Existing	Updated
Course Code		CSE 1110
Course Title		Introduction to Computer Systems
Prerequisite Course		
Course Contents		Introduction to computations; Early history of computing devices; Computers; Major components of a computer; Hardware: processor, memory, I/O devices; Software: Operating system, application software; Basic architecture of a computer; Basic Information Technology; The Internet; Number system: binary, octal, hexadecimal, binary arithmetic; Basic programming concepts; Program development stages: flow charts; Programming constructs: data types, operators, expressions, statements, control statements, functions, array.

Structured Programming Language

	Existing	Updated
Course Code	CSI 121	CSE 1111
Course Title	Structured Programming Language	Structured Programming Language
Prerequisite Course		CSE 110
Course Contents	Overview, Structure of C program, Data Types, I/O Functions, Identifiers, Expressions, Statement and Symbolic Constants, Arithmetic operators, Relational Operators and Logical Operators, Bit-wise Operators, Precedence and Associativity, Control statements, Storage class, Functions, Command Line Parameters and Library Functions, Arrays, Strings, Structure, Union and Bit-fields, Pointer, Memory Allocation and Release, Pointer and Multi-Dimensional Arrays, File Handling, Video Adapter, Modes and Graphics Initialization, Graphics Functions.	Basic understanding of problem solving; Structured programming language: data types, operators, expressions, control structures (If-else, Switch-case, Loop); Functions and program structure: parameter passing conventions, scope rules and storage classes, recursion; Header files; Pointers and arrays; Strings; Multidimensional array; User defined data types: structures, unions, enumerations; Input and Output: standard input and output, formatted input and output, file access; Variable length argument list; Command line parameters; Error Handling; Graphics; Linking; Library functions.

Structured Programming Language Laboratory

	Existing	Updated
Course Code	CSI 122	CSE 1112
Course Title	Structured Programming Language Laboratory	Structured Programming Language Laboratory
Prerequisite Course		CSE 110
Course Contents	Laboratory work based on CSI 121	Laboratory work based on CSE 111 with a project work.

Object Oriented Programming

	Existing	Updated
Course Code	CSI 211	CSE 1115
Course Title	Object Oriented Programming	Object Oriented Programming
Prerequisite Course	CSI 121	CSE 111
Course Contents	Object oriented fundamentals, Java Application, Java applets, Methods, Arrays, String & characters, Graphics & java2D, Basic graphical user interface components, Multithreading, Multimedia, Files & streams, JDBC, Servlets, RMI, Networking, Java beans.	Philosophy of Object Oriented Programming (OOP); Advantages of OOP over structured programming; Abstraction and Encapsulation, classes and objects, access specifiers, static and non-static members; Constructors, destructors and copy constructors; Array of objects, object pointers, and object references; Inheritance: single and multiple inheritance; Polymorphism:overloading, abstract classes, virtual functions and overriding; Exceptions; Object Oriented I/O; Template functions and classes; Multithreaded Programming.

Object Oriented Programming Laboratory

	Existing	Updated
Course Code	CSI 212	CSE 1116
Course Title	Object Oriented Programming Laboratory	Object Oriented Programming Laboratory
Prerequisite Course	CSI 122	CSE 112
Course Contents	Laboratory work based on CSI 211	Laboratory work based on CSE 115

Advanced Object Oriented Programming Laboratory

	Existing	Updated
Course Code		CSE 2118
Course Title		Advanced Object Oriented Programming Laboratory
Prerequisite Course		CSE 116
Course Contents		Laboratory work based on advanced topics in Object Oriented Programming with a project work.

Web Programming

	Existing	Updated
Course Code	CSE 465	CSE 4165
Course Title	Web Programming	Web Programming
Prerequisite Course	CSI 211, CSI 212	CSE 118
Course Contents	Web architecture and HTTP: History and architecture of the World Wide Web, overview of the Hyper Text Transfer Protocol, other related protocols; Hyper Text Markup Language: The concept of markup, overview of HTML (table, form, frame, window, link etc.); Client side scripting: Variables, data types, control structure, functions, Document Object Model (DOM), event handlers, properties, methods, cookies; Server side scripting: Concepts, variables, data types, control structure, functions, objects; Database: Content generation, data exchange; Regular expressions, mails, cookies, sessions.	Web architecture and HTTP: History and architecture of the World Wide Web, overview of the Hyper Text Transfer Protocol, other related protocols; Hyper Text Markup Language: The concept of markup, overview of HTML (table, form, frame, window, link etc.); Cascading Style Sheets: Overview of CSS (selectors, different CSS properties and values); Client side scripting: Variables, data types, control structure, functions, Document Object Model (DOM), event handlers, properties, methods, cookies; Server side scripting: Concepts, variables, data types, control structure, functions, objects, regular expressions, mails, cookies, sessions and a related web framework; Database: Content generation, data exchange; Layered or Multi-tier Architecture for Web Applications; MVC; Content Management System.

Mobile Application Development

	Existing	Updated
Course Code	CSE 481	CSE 4181
Course Title	Mobile Application Development	Mobile Application Development
Prerequisite Course	CSI 211,CSI 212	CSE 118
Course Contents	Introduction to mobile applications and Java overview. Software Overview: API levels, installation, ADT and IDE. App stores: Google Play, iTunes, Amazons etc. Basic Building Blocks of a Mobile Application: Application framework, components, MVC architecture. User Interfaces: Basic user interfaces, advanced user interface, widgets and layouts. Activity and Activity Lifecycle: Passing data between activities, intents, advanced system components. Database (SQLite), Networking, Multimedia and Content Providers: importing images, email/sms, call Mapping and Location Based Services Sensors: Accelerometer, light sensor, microphone, etc.	Introduction to Mobile Programming; Mobile Programming Languages; Mobile Application Development Framework; MVC architecture; UI Architecture: activities and intents, activity life cycle, supporting multiple screen sizes; Working with data storage: storing and retrieving data, data persistence, SQLite database; User interface widgets: text controls, button controls, toggle buttons, images ; UI controllers: different types of dialog like alert, custom dialog, notification, showing Menu; Design patterns for handling synchronous/asynchronous tasks, processes and threads; View Animation; Network Communication: web services, handling HTTP requests and response, data parsing (JSON, XML); Mapping and location based services; Sensors: accelerometer, light sensor, microphone; Game development; Marketing; Distribution of Apps; Cross platform App development framework; Auto-Layout design.

Digital Logic Design

	Existing	Updated
Course Code	CSE 225	CSE 2325
Course Title	Digital Logic Design	Digital Logic Design
Prerequisite Course		
Course Contents	Digital logic, Boolean algebra, De-Morgan's law, logic gates and their truth tables, canonical forms, Combinational logic circuits, minimization techniques, Arithmetic and data handling logic circuits, decoders and encoders, Multiplexers and demultiplexers, Combinational Circuit design, Flip-flops, race around problems, Counters and their applications, PLA design, Synchronous and asynchronous logic design: state diagram, Mealy and Moore machines, State minimizations and assignments, Pulse mode logic, Fundamental mode design. Diode logic gates, transistor switches, transistor transistor gates, MOS gates, Logic families: TTL, ECL, IIL and CMOS logic with operation details, Propagation delay, product and noise immunity, Open collector and High impedance gates, memory systems, A/D and D/A converters with applications	Number systems: Introduction, digital number systems, arithmetic operations; Function minimization techniques: Boolean algebra (identities, functions and manipulation), Canonical and standard forms, minimization techniques; Combinational logic circuits design procedure; Combinational and Arithmetic functions: Arithmetic (adders) and other popular (encoders, decoders, multiplexers, demultiplexers) modules; Sequential circuits and Registers: Sequential logic design procedure, state diagrams, state table, input and output equations, latches, flip-flops, race around problems, design problems, registers, register transfers, counters and their applications.

Digital Logic Design Laboratory

	Existing	Updated
Course Code	CSE 226	CSE 2326
Course Title	Digital Logic Design Laboratory	Digital Logic Design Laboratory
Prerequisite Course		
Course Contents	Laboratory work based on CSE 225	Laboratory work based on CSE 225

Computer Architecture

	Existing	Updated
Course Code	CSE 313	CSE 3313
Course Title	Computer Architecture	Computer Architecture
Prerequisite Course	CSE 225, CSE 226	CSE 225
Course Contents	Information representation and transfer, instruction and data access methods, the control unit: hardwired and microprogrammed, memory organization, I/O systems, channels, interrupts, DMA, Von Neumann SISD organization, RISC and CISC machines. Pipelined machines, interleaved memory system, caches, Hardware and architectural issues of parallel machines, Array processors, associative processors, multiprocessors, systolic processors, data flow computers and interconnection networks, High level language concept of computer architecture.	Information representation; Measuring performance; Instructions and data access methods: operations and operands of computer hardware, representing instruction, addressing styles; Arithmetic Logic Unit (ALU) operations, floating point operations, designing ALU; Processor design: datapath - single cycle and multicycle implementations; Control Unit design - hardwired and microprogrammed; Pipeline: pipelined datapath and control, hazards; Exceptions; Memory organization: Cache, Concepts of DMA and Interrupts; Buses: overview of computer BUS standards; Multiprocessors: types of multiprocessors, performance, single bus multiprocessors, multiprocessors connected by network, clusters.

Microprocessors and Microcontrollers

	Existing	Updated
Course Code	CSE 425	CSE 4325
Course Title	Microprocessor, Microcontroller and Interfacing	Microprocessors and Microcontrollers
Prerequisite Course	CSE 236	
Course Contents	Introduction to 8-bit, 16-bit, and 32-bit microprocessors: architecture, addressing modes, instruction set, interrupts, multi-tasking and virtual memory; Memory interface; Bus interface; Arithmetic coprocessor; interfacing: programmable peripheral interface, programmable timer, serial communication interface, programmable interrupt controller, direct memory access, keyboard and display interface, Integrating microprocessor with interfacing chips; Microcontroller: Introduction to microcontrollers (i.e. 8051), How to Program an 8-bit Microcontroller using C and assembly language, Introduction to Embedded System, Embedded Systems programming.	Introduction to 16-bit and 32-bit microprocessors: architecture, addressing modes, instruction set (e.g. x86), interrupts, multitasking and virtual memory, paging, cache memory; Interfacing: programmable peripheral interface, direct memory access (DMA), keyboard and display interface, memory chips (e.g. ROM, RAM), clock generator, bus arbiter; Architecture of modern microprocessors: multi processors vs multi-core architecture, hyperthreading technology, turbo boost technology; Introduction to micro-controllers (e.g. ATmega32): architecture, digital interfacing: LEDs, switches, sensors and motors, analog interfacing: introduction to the analog-to-digital converter (ADC) module, serial communication protocols (e.g. SPI, I2C, CAN-BUS) for embedded system.

Microprocessors and Microcontrollers Laboratory

	Existing	Updated
Course Code	CSE 426	CSE 4326
Course Title	Microprocessor, Microcontroller and Interfacing Laboratory	Microprocessors and Microcontrollers Laboratory
Prerequisite Course	CSE 236	
Course Contents	Students will design simple systems using the principles learned in CSE 425.	Students will design simple systems using the principles learned in CSE 425. An introduction to assembly language will be included in this course at the beginning.

Discrete Mathematics

	Existing	Updated
Course Code	CSI 219	CSE 2213
Course Title	Discrete Mathematics	Discrete Mathematics
Prerequisite Course		
Course Contents	Set theory, Elementary number theory, Graph theory, Paths and trees, Generating functions, Algebraic structures, Semi graph, Permutation groups, Binary relation, Mathematical logic, Propositional calculus and predicate calculus	Set theory: sets, relations, functions; Mathematical Logic: propositional calculus and predicate calculus; Mathematical reasoning and proof techniques; Counting: permutations, combinations, Discrete Probability principles of inclusion and exclusion; Recurrence relations; Graph Theory: graphs, paths, and trees

Data Structure and Algorithms - I

	Existing	Updated
Course Code	CSI 217	CSE 2215
Course Title	Data Structures	Data Structure and Algorithms - I
Prerequisite Course	CSI 121	CSE 111
Course Contents	Concepts and examples, elementary data objects, elementary data structures, arrays, lists, stacks, queues, graphs, trees, Memory management, Sorting and searching, hash techniques.	Internal data representation; Abstract data types; Introduction to algorithms; Asymptotic analysis: growth of functions, O , Ω and Θ notations; Correctness proof and techniques for analysis of algorithms; Master Theorem; Elementary data structures: arrays, linked lists, stacks, queues, trees and tree traversals, graphs and graph representations, heaps, binary search trees; Graph Traversals: DFS, BFS, Applications of DFS and BFS; Sorting: heap sort, merge sort, quick sort, linear-time sorting; Data structures for set operations.

Data Structure and Algorithms - I Laboratory

	Existing	Updated
Course Code	CSI 218	CSE 2216
Course Title	Data Structure Laboratory	Data Structure and Algorithms - I Laboratory
Prerequisite Course		
Course Contents	Laboratory work based on Data Structure	Laboratory work based on Data Structures and Algorithms I

Data Structure and Algorithms - II

	Existing	Updated
Course Code	CSI 227	CSE 2217
Course Title	Algorithms	Data Structure and Algorithms - II
Prerequisite Course	CSI 217, CSI 219	CSE 215,CSE 213
Course Contents	Techniques for analysis of algorithms, Methods for the design of efficient algorithms: divide and conquer, greedy method, dynamic programming, back tracking, branch and bound, Basic search and traversal techniques, graph algorithms, Algebraic simplification and transformations, lower bound theory, NP-hard and NP-complete problems.	Methods for the design of efficient algorithms: divide and conquer, greedy methods, dynamic programming; Graph algorithms: MST algorithms, shortest path algorithms, maximum flow and maximum bipartite matching; Advanced data Structures: balanced binary search trees (AVL trees, red-black trees, splay trees), skip lists, advanced heaps (Fibonacci heaps, binomial heaps); Hashing; String matching algorithms; NP-completeness; NP-hard and NP-complete problems; Coping with hardness: backtracking, branch and bound, approximation algorithms.

Data Structure and Algorithms - II Laboratory

	Existing	Updated
Course Code	CSI 228	CSE 2218
Course Title	Algorithms	Data Structure and Algorithms - II Laboratory
Prerequisite Course		
Course Contents	Laboratory work based on Algorithms	Laboratory work based on Data Structures and Algorithms II

Theory of Computation

	Existing	Updated
Course Code	CSI 233	CSE 2233
Course Title	Theory of Computing	Theory of Computation
Prerequisite Course		
Course Contents	Finite Automata: Deterministic finite automata, Non-deterministic finite automata, equivalence and conversion of deterministic and non-deterministic finite automata, pushdown automata. Context free language, context free grammar. Turing machines: basic machines, configuration, computing with Turing machine, combining Turing machines.	Finite Automata: Deterministic finite automata, Non-deterministic finite automata, equivalence and conversion of deterministic and non-deterministic finite automata, pushdown automata. Context free language, context free grammar. Turing machines: basic machines, configuration, computing with Turing machine, combining Turing machines.

System Analysis and Design

	Existing	Updated
Course Code	CSI 311	CSE 3411
Course Title	System Analysis and Design	System Analysis and Design
Prerequisite Course		
Course Contents	Information, general concepts of formal information systems, analysis of information requirements for modern organizations, modern data processing technology and its application, information systems structures, designing information outputs, classifying and coding data, physical storage media considerations, logical data organization, systems analysis, general systems design, detail system design, Project management and documentation, Group development of an information system project: includes all phases of software life cycles from requirement analysis to the completion of a fully implemented system.	System Study: concept of system and system study, system organogram, system development life cycle, different types of system, skills of system analyst; Information Gathering: types of information, sources of information, information gathering tools and their competitive analysis; Guidelines to conduct information gathering tools; Feasibility Study: statement of constraints, types of feasibility for IT products, determining best candidate system, SWOT analysis, cash flow and NPV analysis, feasibility Report; System Design: structured and object oriented design using UML; DFD, use case, sequence diagram, state diagram, class diagram, etc using UML tools; Effective designing of input, output and UI; Software Requirement Specifications (SRS); Project deployment: study on project management and tools; Scheduling by Gantt chart, PERT/CPM method, etc; System security, risk management, data migration, training, art of negotiation, etc.

System Analysis and Design Laboratory

	Existing	Updated
Course Code	CSI 312	CSE 3412
Course Title	System Analysis and Design Laboratory	System Analysis and Design Laboratory
Prerequisite Course		
Course Contents	Laboratory work based on CSI 311	Laboratory work based on System Analysis and Design

Software Engineering

	Existing	Updated
Course Code	CSI 321	CSE 3421
Course Title	Software Engineering	Software Engineering
Prerequisite Course	CSI 311	CSE 311
Course Contents	Concepts of software engineering: requirements definition, modularity, structured design, data specifications, functional specifications, verification, documentation, software maintenance, Software support tools, Software project organization, quality assurance, management and communication skills.	Basic Concepts: software, software engineering, recent trends and challenges; Process Models: waterfall, incremental, iterative; Requirements Engineering: software requirements specification, system requirements specification, stakeholder requirements specification; Architecture: monolithic architecture, service-oriented architecture, micro-service architecture, model-view-controller pattern and variants, system design; Services Computing: application programming interface, web services, cloud services, representational state transfer, JavaScript object notation, simple object access protocol; User Interface Design: web and mobile platform, wireframe model, methods and tools; Software Testing: manual and automated test, black box and white box test, unit test, integration test, regression test, acceptance test, non-functional test, test planning, test documentation; Version Control and Repository: version numbering, version control software, code repository systems; Documentation: requirements, architecture, technical, end user, marketing; Legal and Ethical Aspects: terms and conditions, end-user license agreement, software engineering code of ethics, privacy engineering; Business Case Study: case study on local and international popular software products.

Software Engineering Laboratory

	Existing	Updated
Course Code	CSI 322	CSE 3422
Course Title	Software Engineering Laboratory	Software Engineering Laboratory
Prerequisite Course		
Course Contents	Laboratory work based on CSI 321	Laboratory work based on Software Engineering

Computer Security

	Existing	Updated
Course Code		CSE 4531
Course Title		Computer security
Prerequisite Course		CSE 323
Course Contents		Fundamental concepts: confidentiality, integrity and availability, assurance, authenticity and anonymity; threats and attacks, security principles; Encryption, symmetric and asymmetric key encryption; Security: OS access control, Web and mobile application security, software security, hardware security, memory protection, data base security; Security Attacks: malware, DDos, Trojan and backdoors, buffer overflow, social engineering.

Database Management Systems

	Existing	Updated
Course Code	CSI 221	CSE 3521
Course Title	Database Management Systems	Database Management Systems
Prerequisite Course		
Course Contents	Concepts and methods in database system, File organization and retrieval, Data manipulation, Query formulation and language, Database models, Data description languages, database integrity and security, Data dictionary/directory systems, database administration, Database design, Survey of some existing database management systems, Some applications using commercial languages.	Concepts of database systems; Data Models: Entity-Relationship model, Relational model; Query Languages: SQL, Relational algebra, Constraints, View; Security and Integrity Management; Functional dependencies and normalization; Indexing: primary and secondary indexes, B+ trees; Hashing: Static and Dynamic hashing, Collision Problem in Hashing; Transaction management; Recovery: RAID Different levels; File storage management.

Database Management Systems Laboratory

	Existing	Updated
Course Code	CSI 222	CSE 3522
Course Title	Database Management Systems Laboratory	Database Management Systems Laboratory
Prerequisite Course		
Course Contents	Laboratory work based on CSI 221	Laboratory work based on CSE 221 A project work will be included

Operating Systems Concepts

	Existing	Updated
Course Code	CSI 309	CSE 3509
Course Title	Operating System Concepts	Operating System Concepts
Prerequisite Course		
Course Contents	Principles of operating systems, design objectives, sequential processes, concurrent processes, concurrency, functional mutual exclusion, processor cooperation and deadlocks, processor management, Control and scheduling of large information processing systems, Resource allocation, dispatching, processor access methods, job control languages, Memory management, memory addressing, paging and store multiplexing, Multiprocessing and time sharing, batch processing, Scheduling algorithms, file systems, protection and security, design and implementation methodology, performance evaluation and case studies.	Operating system: its role in computer systems; multitasking, multiuser, multiprocessing OS; Operating system structures; Process: process concept and scheduling, inter-process communication, communication in client-server systems; CPU scheduling: scheduling criteria and algorithms, thread scheduling, multiple-processor scheduling; Process synchronization: critical-section problem, semaphores, monitors; Deadlock: resource allocation and deadlock, deadlock detection, prevention and recovery; Memory management: swapping, paging, segmentation, virtual memory; File Systems: files, directories, security, protection; Case study of some operating systems.

Operating Systems Concepts Laboratory

	Existing	Updated
Course Code	CSI 310	CSE 3510
Course Title	Operating System Concepts Laboratory	Operating System Concepts Laboratory
Prerequisite Course		
Course Contents	Laboratory work based on CSI 309	Laboratory work based on Operating System Concepts

Computer Networks

	Existing	Updated
Course Code	CSE 323	CSE 3711
Course Title	Computer Networks	Computer Networks
Prerequisite Course	CSE 315	
Course Contents	Network architectures- layered architectures and ISO reference model: data link protocols, error control, HDLC, X.25, flow and congestion control, virtual terminal protocol, data security, Local area networks, satellite networks, packet radio networks, Introduction to ARPANET, SNA and DECNET, Topological design and queuing models for network and distributed computing systems.	Introduction to Computer Networks; Network Edge, Network Core ; Layering architecture: TCP/IP and OSI Reference Models; Circuit Switching and Packet Switching; Hubs, Routers, and Switches; Application layer services: Web, HTTP, FTP, SMTP, DNS architecture; Introduction to transport layer: UDP,TCP; Principles of Reliable data transfer; TCP Congestion and Flow control; Routing and forwarding, DHCP, NAT, Fragmentation; Routing algorithms; Autonomous Systems; Link layer services; MAC Protocols; Link layer addressing; Ethernet; ARP; Wireless links and network characteristics; Wi-Fi: IEEE 802.11 Wireless LANs.

Computer Networks Laboratory

	Existing	Updated
Course Code	CSE 324	CSE 3712
Course Title	Computer Networks Laboratory	Computer Networks Laboratory
Prerequisite Course		
Course Contents	Laboratory work based on CSE 323	Laboratory work based on CSE 323

Artificial Intelligence

	Existing	Updated
Course Code	CSI 341	CSE 3841
Course Title	Artificial Intelligence	Artificial Intelligence
Prerequisite Course		
Course Contents	Survey and concepts in Artificial Intelligence, Problem solving agents, Uninformed and Informed search techniques, Game playing, Knowledge representation, Inference in Propositional and First Order logic, Theorem Proving, Decision tree learning, Neural Network, Bayesian learning, planning.	Survey and concepts in Artificial Intelligence; Problem solving agents; Uninformed and Informed search techniques; Local Search Techniques; Game playing; Constraint Satisfaction Problems; Bayesian learning; Supervised Learning: Classification, Perceptrons; Stationary processes and Markov assumptions; Hidden Markov Models; Human Aware AI Systems.

Artificial Intelligence Laboratory

	Existing	Updated
Course Code	CSI 342	CSE 3842
Course Title	Artificial Intelligence Laboratory	Artificial Intelligence Laboratory
Prerequisite Course		
Course Contents	Laboratory work based on CSI 341	Laboratory work based on CSE 341

Elective Courses**Mathematical Analysis for Computer Science**

	Existing	Updated
Course Code		CSE 4601
Course Title		Mathematical Analysis for Computer Science
Prerequisite Course		MATH 205, CSE 213
Course Contents		Recurrent problems; Manipulation of sums; Integer functions; Number theory; Binomial coefficient; Special numbers; Generating functions; Combinatorial game theory; Introduction to probability theory, expectation; Random variables; Conditional Probability and Conditional Expectation; Stochastic process; Markov chains: discrete parameter, continuous parameter, birth-death process; Queuing models: birth-death model, Markovian model, open and closed queuing network; Application of queuing models.

Basic Graph Theory

	Existing	Updated
Course Code		CSE 4633
Course Title		Basic Graph Theory
Prerequisite Course		CSE 213, CSE 217
Course Contents		Graphs and their applications; Basic graph terminologies; Basic operations on graphs; Graph representations; Degree sequence and graphic sequence; Paths, cycles and connectivity; Trees and counting of trees; Distance in graphs and trees; Spanning trees in graphs; Euler tours; Hamiltonian cycles; Ear decomposition; Graph labeling; Matching and Covering: Vertex and Edge Covering; Line graphs, Perfect graphs and Planar graphs; Graph coloring: Vertex coloring and Edge coloring; Special classes of graphs.

Algorithm Engineering

	Existing	Updated
Course Code	CSE 455	CSE 4655
Course Title	Advanced Algorithms	Algorithm Engineering
Prerequisite Course	CSI 227	CSE 217
Course Contents	Randomized Algorithms and Probabilistic Analysis; Randomized Data Structures: Skip Lists; Amortized Analysis; Order Statistics; Advanced Data Structures; Advanced Dynamic Programming; Advanced Greedy Algorithms; Number Theoretic Algorithms; Linear Programming; Multi-threaded Programming; Approximation Algorithms; NP and Computational Tractability; Online Algorithms.	Computational complexity; Exact Algorithms; Parameterized complexity; Practical computing and heuristics; Approximation algorithms; LP based approximation algorithms; Randomized algorithms; On-line algorithms; Experimental algorithmics; Contemporary and state-of-the-art algorithms.

Compiler Design

	Existing	Updated
Course Code	CSI 411	CSE 4611
Course Title	Compiler	Compiler Design
Prerequisite Course		CSE 213
Course Contents	Compiler modules; lexical analysis; parsing theory; symbol tables; type systems; scope; semantic analysis; intermediate representations; run-time environments; code generation; code optimization.	Compiler modules; Lexical analysis; Parsing theory; Symbol tables; Type systems; Scope; Semantic analysis; Intermediate representations; Run-time environments; Code generation; Code optimization.

Computational Geometry

	Existing	Updated
Course Code		CSE 4613
Course Title		Computational Geometry
Prerequisite Course		CSE 213
Course Contents		Searching and Geometric Data Structures: Balanced binary search trees, Priority-search trees, Range searching, Interval trees, Segment trees; Algorithms and complexity of fundamental geometric objects: Polygon triangulation and art gallery theorem, Polygon partitioning, Convex-hulls in 2-dimension and 3-dimension, Dynamic convex-hulls; Geometric intersection: Line segment intersection and the plane-sweep algorithm, Intersection of polygons; Proximity: Voronoi diagrams, Delunay triangulations, Closest and furthest pair; Visualization: Hidden surface removal and binary space partition (BSP) trees; Graph Drawings: Drawings of rooted trees (Layering, Radial drawings, HV-Drawings, Recursive winding), Drawings of planar graphs (Straight-line drawings, Orthogonal drawings, Visibility drawings).

Computer Graphics

	Existing	Updated
Course Code	CSI 421	CSE 4621
Course Title	Computer Graphics	Computer Graphics
Prerequisite Course	MATH 201, CSI 227	MATH 183, MATH 201
Course Contents	Introduction to Graphical data processing, Fundamentals of interactive graphics programming, Architecture of display devices and connectivity to a computer, Implementation of graphics concepts of two-dimensional and three-dimensional viewing, clipping and transformations, Hidden line algorithms, Raster graphics concepts: Architecture, algorithms and other image synthesis methods, Design of interactive graphic conversations	Basics of computer graphics and its applications; Raster graphics: 3D rasterization pipeline; Transformation: modelling, viewing and projection transformation in both 2D and 3D spaces; homogeneous coordinate system; Visible surface detection and hidden surface removal: e.g. z-buffer (or, depth buffer), depth-sorting, BSP-tree algorithms; Scan conversion and clipping algorithms: e.g. Cohen-Sutherland, Cyrus-Beck, Sutherland-Hodgman algorithms; Fractals: e.g. Koch curve, Snowflakes, Dragon curve; Ray tracing: ray casting methods, direct illumination, global illumination, shadows, shading and textures.

Data Communication

	Existing	Updated
Course Code	CSE 315	CSE 3715
Course Title	Data Communication	Data Communication
Prerequisite Course	MATH 187	
Course Contents	Introduction to modulation techniques: Pulse modulation, pulse amplitude modulation, pulse width modulation and pulse position modulation, Pulse code modulation, quantization, Delta modulation, TDM, FDM, OOK, FSK, PSK, QPSK, Representation of noise, threshold effects in PCM and FM, Probability of error for pulse systems, concept of channel coding and capacity, Asynchronous and synchronous communications, Hardware interfaces, multiplexers, concentrators and buffers, Communication medium, Fiber optics.	Introduction of layered network architecture; Introduction of data communication: physical point to point communication, signal, signal representation and processing, signal to noise ratio; Framing techniques; Frequency response of signals: Fourier integrals, Fourier transforms, time domain and frequency domain concept; representation of noise; Introduction to information theory: entropy, information capacity; Modulation and demodulation: amplitude modulation, frequency and phase Modulation; From analog to digital communication: sampling, Nyquist theorem, quantization, digitization of analog signals; Line coding; Techniques of modulation: pulse modulation, pulse amplitude modulation, pulse width modulation, pulse position modulation, pulse code modulation; Multiplexing techniques: time division multiplexing, frequency division multiplexing techniques.

Wireless and Cellular Communication

	Existing	Updated
Course Code	CSE 457,CSE 461	CSE 4759
Course Title	Mobile Cellular Communication,Wireless Communication	
Prerequisite Course	CSE 323	CSE 315,CSE 323
Course Contents	<p>Introduction: Concept, evolution and fundamentals. Analog and digital .cellular systems. Cellular Radio System: Frequency reuse, co-channel interference, cell splitting and components. Mobile radio propagation: Propagation characteristics, models for radio propagation, antenna at cell site and mobile antenna. Frequency Management and Channel Assignment: Fundamentals, spectrum utilization, fundamentals of channel assignment, fixed channel assignment, non-fixed channel assignment, traffic and channel assignment. Handoffs and Dropped Calls: Reasons and types, forced handoffs, mobile assisted handoffs and dropped call rate. Diversity Techniques: Concept of diversity branch and signal paths, carrier to noise and carrier to interference ratio performance. Digital cellular systems: Global system for mobile, time division multiple access and code division multiple access.</p> <p>Basics of Antenna; gain and effective area, radiation pattern. Propagation of radio waves – broadcast and line of sight, transmission and reception of radio waves, effect of earth’s curvature; long, medium and short wave propagation, ionospheric propagation. RADAR and its principle; communication systems for ships and aircrafts. Scattering in radio links. Overview of satellite communication; location of geo-stationary satellites and orbit calculation. Lasers and optical detectors; line of sight laser communication.</p>	<p>Cellular concepts: frequency reuse, handoff strategies, interference and system capacity, grade of service, improving capacity and coverage, call blocking probability; Propagation effects: outdoor propagation models, indoor propagation models, power control, Doppler’s effect, small and large scale fades; Wireless LAN Technology; IEEE 802.11: standard, protocol architecture, physical layer and media access control; Mobile IP;Wireless Application Protocol; IEEE 802.16 Broadband Wireless Access; Brief review of 2nd and 3rd generation wireless: GSM, GPRS, CDMA; LTE, LTE-Advanced, and 5G. Vehicular wireless networks, white spaces, IEEE 802.22 regional area networks, Bluetooth and Bluetooth Smart, wireless personal area networks, wireless protocols for Internet of Things, ZigBee.</p>

Advanced Network Serviced and Management

	Existing	Updated
Course Code	CSE 473	CSE 4773
Course Title	Advanced Network Services and Management	Advanced Network Services and Management
Prerequisite Course	CSE 323	CSE 315,CSE 323
Course Contents	Application specific protocols: Domain Name Services, Electronics mail, World Wide Web and Web caching, Network Management (SNMP), Error Reporting Mechanism (ICMP), Socket Interfaces, File Transfer and Remote File Access, Multimedia application: RTP, Session Control; Network security: Cryptographic algorithm, security mechanism, authentication protocol, firewall.	Application specific protocols: domain name services, electronics mail; World Wide Web and Web caching; Network Management (SNMP), error Reporting Mechanism (ICMP), socket Interfaces, file transfer and remote file access; Multimedia application: RTP, session control; Intra- and Inter-AS routing: IGP, EGP, BGP; Network security: cryptography, firewalls, access control lists (ACLs); VPN, IPSec, IPv6.

Cryptography

	Existing	Updated
Course Code		CSE 4749
Course Title		Cryptography
Prerequisite Course		CSE 213
Course Contents		Cryptography, history of cryptography; Perfect ciphers, Stream ciphers, attacks on stream ciphers, block ciphers, how to use block ciphers with one time key and many time key; Symmetric encryption, , DES, TDES, AES, Feistel block structure;Asymmetric key: public key protocols, basic key exchange, RSA (cryptosystem); Quantum -cryptography, one time pad exchange using qbits; Message integrity (MAC), HMAC, Secure hash functions. Digital signatures.

Networks Security

	Existing	Updated
Course Code	CSE 477	CSE 4777
Course Title	Networks Security	Networks Security
Prerequisite Course	CSE 323	CSE 315,CSE 323
Course Contents	<p>Computer Security Concepts: OSI security architecture, security attacks, security services, security mechanisms, network security model.</p> <p>Classical Encryption Techniques: symmetric cipher model, cryptanalysis, substitution techniques (Ceaser, Monoalphabetic, Playfair, Hill cipher), transposition techniques, rotor machines, steganography.</p> <p>Block Ciphers and the Data Encryption Standard (DES): block cipher principles, Data Encryption Standard (DES), strength of DES, differential and linear cryptanalysis. Public-Key Cryptography and RSA: principles of public-key cryptosystems, RSA algorithm. Diffie-Hellman Key Exchange: Discrete logarithm, key exchange and generation algorithm, attacks on Diffie-Hellman protocol.</p> <p>Cryptographic Hash Functions: applications of cryptographic hash functions, requirements and security, hash functions based on Cipher Block Chaining (CBC), Secure Hash Algorithm (SHA).</p> <p>Digital Signatures: essential elements, limitations of symmetric key, Digital Signature Standard (DSS). Distribution of public keys and X.509.</p> <p>Network Security Protocols: Authentication, key exchange and key distribution protocols. Network Security Standards: IP security (IPsec), Secure Sockets Layer (SSL), Transport Layer Security (TLS), Hypertext Transfer Protocol Secure (HTTPS). Security analysis: Use of formal tools, e.g., Automated Validation of Internet Security Protocols and Applications (AVISPA).</p>	<p>Introduction to computer security, CIA TRIAD, Threats and Attacks, Passive and Active attacks and examples of passive as well as active attacks, security mechanisms, network security model; Hashing, Cryptography, Introduction to Symmetric key and Asymmetric key encryption; One way authentication protocols, Needham Schroeder protocol, Needham-Schroeder Symmetric key protocol Anomaly in Needham Schroeder Symmetric key protocol, Needham-Schroeder Asymmetric key protocol (Kerberos); IP Sec, Intrusion Detection System (IDS) (Fire-wall), TLS, HTTPS, TELNET, SSH, Wire-shark; Wireless network security: WEP, WPA, WPA2; Secure Hash Algorithm (SHA), Digital Signature Standard (DSS); Advanced network security topics.</p>

Electronic Business

	Existing	Updated
Course Code	CSE 463	CSE 4763
Course Title	E-Commerce	Electric Business
Prerequisite Course	CSE 323	CSE 323
Course Contents	History, business models; Ecommerce channels: Portals, auctions, communities, marketplace; Managing the marketplace: Demographics and advertising; Customer relationship management, web services for B2B and B2C ecommerce, electronic payment systems; Network security, cryptography, digital certificates; Markup for ecommerce: XML, M-commerce, wireless and U-commerce, digital money and electronic banking; Ethical, legal, and regulatory environment: Intellectual property, copyright, trademark, patents.	The E-Business Framework: difference between electronic business and electronic commerce, electronic markets, disintermediation, horizontal and vertical market places; E-Products and E-Services; Classification of business webs: agora, aggregation, value chain, alliance, supply chain net; business model for e-products and e-services, branding and pricing; E-Procurement: difference between purchase and procurement, market solutions: sell-side, buy-side, and market place; Integration of product catalogue, procurement service providing; Online Marketing: comparison of online media, usage of Internet and websites, stages of a customer development model: surfer, consumer, prosumer, buyer, and key customer; E-Contracting: generic services, information, negotiation, archiving, enforcement, reconciliation, structure of a contract, digital signature, legal affairs; Online Distribution: components of a distribution system, characterisation of online distribution, hybrid distribution networks, model for electronic software distribution; E-Payment: electronic means of payment, micro and macro payment, classification of payment systems, credit cards, customer accounts, digital money; secure transactions; Electronic customer relationship management: objectives of CRM, customer acquisition and liaison, customer buying cycle, architecture of CRM systems, customer satisfaction survey; E-Business environment: information society, building process for communities, multi-option society, ethics in electronic business.

Multimedia Systems Design

	Existing	Updated
Course Code	CSI 447	CSE 4547
Course Title	Multimedia Systems Design	Multimedia Systems Design
Prerequisite Course	CSE 323	
Course Contents	Overview to multimedia systems, multimedia storage. Data compression techniques for audio and video. Synchronization. Multimedia networking and protocols, QOS principles. Video streams on ATM. Mobile multimedia computations. Operating system support for multimedia. Hypermedia system. Standard for multimedia. Multimedia database and multimedia applications	Organization and structure of modern multimedia systems; text, audio and video encoding; Data compression: lossless and lossy techniques; Multimedia networking: Quality of Service management and multimedia protocols; Streaming multimedia: peer-to-peer, video-on-demand, live streaming; Multimedia storage: data placement and scheduling, caching, and data retrieval; Scheduling algorithms for multimedia within OS; Synchronization schemes: in-band and out-band, synchronization skews and specification; Design of real-world multimedia solution.

Distributed Systems

	Existing	Updated
Course Code		CSE 4519
Course Title		Distributed Systems
Prerequisite Course		
Course Contents		Remote invocation and indirect communication; Time and coordination; Overlay networks and P2P; Distributed storage and file systems; Name services; Global state and transactions; Replication and consistency; Consensus; Fault tolerance; Security and privacy; Emerging topics in distributed systems.

Simulation and Modeling

	Existing	Updated
Course Code	CSI 423	CSE 4523
Course Title	Simulation and Modeling	Simulation and Modeling
Prerequisite Course	MATH 205	MATH 205
Course Contents	Simulation methods, model building, random number generator, statistical analysis of results, validation and verification techniques, Digital simulation of continuous system, Simulation and analytical methods for analysis of computer systems and practical problems in business and practice, introduction to simulation packages.	Simulation methods, model building, random number generator, statistical analysis of results, validation and verification techniques; Digital simulation of continuous system; Simulation and analytical methods for analysis of computer systems and practical problems in business and practice; Introduction to simulation packages.

Cloud Computing

	Existing	Updated
Course Code	CSE 487	CSE 4587
Course Title	Cloud Computing	Cloud Computing
Prerequisite Course		
Course Contents	Overview of Distributed Computing: Trends of computing, introduction to distributed computing, next big thing: Cloud computing. Introduction to Cloud Computing: Cloud computing properties and characteristics, service models, deployment models. Attributes of Cloud computing: Multi-tenancy – a single instance of software or other computing resource serving several clients, massive scalability – ability to support hundreds of thousands of clients at the same time, elasticity – ability to grow or contract on demand, on-demand self-provisioning of resources. Infrastructure-as-a-Service (IaaS): Introduction to IaaS, resource (i.e., server, storage and network) virtualization, case studies. Platform-as-a-Service (PaaS): Introduction to PaaS. Cloud platform, management of computation and storage, case studies. Software-as-a-Service (SaaS): Introduction to SaaS, Web services, Web 2.0, Web OS, case studies. Cloud issues and challenges: Cloud provider lock-in or vendor lock-in, security of Cloud computing	Basic Concepts: cloud computing and applications, assessing the value proposition, issues and challenges, cloud architecture, service models, deployment models; Cloud Platforms: abstraction and virtualization, capacity planning, platform as a service, Amazon web services , Microsoft Azure, Google cloud platform; Cloud Infrastructure: managing the cloud, cloud security; Services and Applications: service-oriented architecture, moving applications to the cloud, cloud-based storage, media and streaming, cloud based mobile apps and web services.

Advanced Database Management Systems

	Existing	Updated
Course Code	CSE 467	CSE 4567
Course Title	Advanced DBMSs	Advanced Database Management Systems
Prerequisite Course	CSI 221	CSE 221
Course Contents	Database system architecture; managing primary and secondary storage; query processing; meta-data and catalog management; language processing; query optimization and plan generation; concurrency; failures and recovery; extensibility; client-server interactions. Object-oriented database systems, XML, database and the web, data management in distributed mobile computing environment, data broadcasting, text database, digital library design and implementation, multimedia database: Basic concept, design and optimization of access strategies; parallel database, spatial database, temporal database.	Database system architecture; Managing primary and secondary storage; Query processing; Meta-data and catalog management; Language processing; Query optimization and plan generation; Concurrency; Failures and recovery; Extensibility; Client-server interactions; Object-oriented database systems, XML, database and the web, data management in distributed mobile computing environment, data broadcasting, text database, digital library design and implementation; Multimedia database: basic concepts, design and optimization of access strategies; Parallel database, spatial database, temporal database; Parallel and distributed database systems; NoSQL; New database architectures and query operators.

Machine Learning

	Existing	Updated
Course Code	CSE 489	CSE 4889
Course Title	Machine Learning	Machine Learning
Prerequisite Course	CSI 341	CSE 341
Course Contents	Introduction to machine learning; Regression analysis: Logistic regression, linear regression; Classification techniques: Classification trees; Support vector machines; Statistical performance evaluation: Bias-variance tradeoff; VC dimension; Ensemble learning; Reinforcement learning; Neural networks; EM Algorithm; Unsupervised Learning: K - means clustering; Principal Component Analysis; Deep Learning; Practical applications of machine learning.	Introduction to Machine Learning; Regression analysis: linear regression; Classification techniques: classification trees, support vector machines; Statistical performance evaluation: bias-variance tradeoff; VC dimension; Reinforcement Learning; Neural networks; EM Algorithm; Unsupervised Learning: k-means clustering; Principal component analysis; Deep Learning; Practical applications of machine learning.

Data Mining

	Existing	Updated
Course Code	CSE 491	CSE 4891
Course Title	Data Mining	Data Mining
Prerequisite Course	CSI 341	CSE 341
Course Contents	Data Mining Task & Applications; Association Analysis; Data Preprocessing; Frequent Itemset Mining; Pattern Mining; Decision Tree Induction; Rule-Based Classification; Naïve Bayes classifier; Naïve Bayesian Tree; K-Nearest Neighbor Classifier; Model Evaluation and Selection; Ensemble Learning; Bagging; Boosting & AdaBoost; Random Forests; Isolated Forests; Data Balancing Methods; Feature Selection; Active Learning; Transfer Learning; K -Means Clustering; Similarity- Based Clustering; Nearest Neighbor Clustering; Density-Based Clustering; Evaluation of Clustering; Clustering High-Dimensional Data; Outlier Detection; Novel Class Classification;	Introduction to data mining: data mining task and applications, data preprocessing, feature selection, association analysis, frequent item-set mining; Single model classifier: k-nearest neighbor, naïve Bayes classifier, decision tree induction, naïve Bayesian tree, rule-based classifiers; Model evaluation and selection; Ensemble learning: random Forests, bagging, boosting, isolated forests; Clustering: k-means clustering, similarity-based clustering, nearest-neighbor clustering, density-based clustering, ensemble clustering, evaluation of clustering methods, clustering high-dimensional data; Data balancing methods; Active learning; Transfer learning; Outlier detection; Concept drift.

Introduction to Bioinformatics

	Existing	Updated
Course Code	CSE 493	CSE 4893
Course Title	Introduction to Bioinformatics	Introduction to Bioinformatics
Prerequisite Course		
Course Contents	Introduction; Molecular biology basics: DNA, RNA, genes, and proteins; Graph algorithms: DNA sequencing, DNA fragment assembly, Spectrum graphs; Sequence similarity; Suffix Tree and variants with applications; Genome Alignment: maximum unique match, LCS, mutation sensitive alignments; Database search: Smith-Waterman algorithm, FASTA, BLAST and its variations; Locality sensitive hashing; Multiple sequence alignment; Phylogeny reconstruction; Phylogeny comparison: similarity and dissimilarity measurements, consensus tree problem; Genome rearrangement: types of genome rearrangements, sorting by reversal and other operations; Motif finding; RNA secondary structure prediction; Peptide sequencing; Population genetics; Recent Trends in Bioinformatics.	Introduction; Molecular biology basics: DNA, RNA, genes, and proteins; Graph algorithms: DNA sequencing, DNA fragment assembly, Spectrum graphs; Sequence similarity; Suffix Tree and variants with applications; Genome Alignment: maximum unique match, LCS, mutation sensitive alignments; Database search: Smith-Waterman algorithm, FASTA, BLAST and its variations; Locality sensitive hashing; Multiple sequence alignment; Phylogeny reconstruction; Phylogeny comparison: similarity and dissimilarity measurements, consensus tree problem; Genome rearrangement: types of genome rearrangements, sorting by reversal and other operations; Motif finding; RNA secondary structure prediction; Peptide sequencing; Population genetics; Recent Trends in Bioinformatics.

Digital Image Processing

	Existing	Updated
Course Code	CSE 483	CSE 4883
Course Title	Digital Image Processing	Digital Image Processing
Prerequisite Course	CSI 341	CSE 341
Course Contents	Digital image fundamentals: Visual perception, sensing, acquisition, sampling, quantization. Intensity transformation and spatial filtering: Different transformations, histogram, correlation and convolution, smoothing and sharpening filters. Filtering in frequency domain: Discrete-Fourier-Transformation (DFT) of image, smoothing and sharpening in frequency domain, selective filtering. Image restoration and reconstruction: Noise models, spatial filtering for noise, frequency filtering for noise, reconstruction from projections. Color image processing: Color models, color transformation and segmentation Morphological image processing: Erosion, dilation, opening, closing, morphological algorithms. Image compression: Redundancy, fidelity criteria, some basic compression techniques. Image segmentation: Point, line and edge detection, thresholding, region based segmentation. Object recognition: Matching, statistical classifier, neural networks Analysis, design and visualization tools: MATLAB, IP toolbox, CV toolbox.	Digital Image Fundamentals: visual perception, sensing, acquisition, sampling, quantization; Intensity Transformation and Spatial Filtering: different transformations, histogram, correlation and convolution, smoothing and sharpening filters; Filtering in Frequency Domain: discrete-fourier-transformation (DFT) of image, smoothing and sharpening in frequency domain, selective filtering; Image Restoration and Reconstruction: noise models, spatial filtering for noise, frequency filtering for noise, reconstruction from projections; Color Image Processing: color models, color transformation and segmentation; Morphological Image Processing: erosion, dilation, opening, closing, morphological algorithms; Image Compression: redundancy, fidelity criteria, some basic compression techniques; Image Segmentation: point, line and edge detection, thresholding, region based segmentation; Object Recognition: matching, statistical classifier, neural networks.

Big Data Analytics

	Existing	Updated
Course Code		CSE 4817
Course Title		Big Data Analytics
Prerequisite Course		CSE 341
Course Contents		Introduction to Big Data: characteristics of Big Data and dimensions of scalability; Data Science: getting value out of Big Data, foundations for Big Data systems and programming, getting started with Hadoop; Big Data Modelling and Management Systems: Big Data modelling, Big Data management, designing a Big Data management system; Big Data Integration and Processing: retrieving Big Data, Big Data integration, processing Big Data, Big Data analytics using Spark; Machine Learning with Big Data: introduction to machine learning with Big Data, data exploration, classification, evaluation of machine learning models, regression, cluster analysis, and association analysis; Graph Analytics for Big Data: introduction to graphs, graph Analytics, graph analytics techniques, computing platforms for graph analytics.

Human Computer Interaction

	Existing	Updated
Course Code	CSE 451	CSE 4451
Course Title	Human Computer Interaction	Human Computer Interaction
Prerequisite Course		
Course Contents	Foundations of Human-Computer Interaction: Understanding and Conceptualizing Interaction; Understanding users: Human Perception, Ergonomics, Cognition, Psychology; Task Analysis, User Interface Design, Interface Programming, Graphical User Interfaces, Mobile Devices, Multimodal Interfaces and Ubiquitous Computing, User-centered System Development and Evaluation, User-centered Software Development and Evaluation, Prototyping, Interaction Design for New Environments, Affective and Social Computing, Assistive and augmentative communication, Assistive technology and Rehabilitation, Human Machine Interface, Brain computer Interface, Experimental Research ethics.	Foundations of human computer interaction: understanding and conceptualizing interaction; Understanding users: human perception, ergonomics, cognition, psychology; Task Analysis; User Interface Design, interface programming, graphical user interfaces, user survey, user journey and experience, mobile devices, multimodal interfaces and ubiquitous computing, user-centered system development and evaluation, user-centered software development and evaluation; Prototyping; Interaction design for new environments; Affective and social computing; Assistive and augmentative communication, assistive technology and rehabilitation; Human machine interface, brain computer interface; Experimental research ethics.

Software Architecture

	Existing	Updated
Course Code		CSE 4435
Course Title		Software Architecture
Prerequisite Course		
Course Contents		Introduction; Design vs Architecture; Enterprise Architecture; Architectural drivers; Software Architecture role; Skills and knowledge of software architect; Software architecture in the delivery process; Visualizing Software Architecture; Managing risks; Architectural recovery, architectural styles, domain specific software architectures coupled with programming/implementation effort, design and implement a real-world software system, the state-of-the-art in software architecture research and future trends.

Software Testing and Quality Assurance

	Existing	Updated
Course Code	CSE 495	CSE 4495
Course Title	Software Testing and Quality Assurance	Software Testing and Quality Assurance
Prerequisite Course	CSI 321	CSE 321
Course Contents	Testing strategies: SDLC vs STLC; Testing Levels; Testing methods; Testing types: Specification-based vs. code-based, black-box vs. white-box, functional vs. structural testing; unit, integration, system, acceptance, and regression testing; Load, Performance, Stress, Unit Testing; Verification vs. validation; Test planning: scenario, case, traceability matrix; ISO Standards; Agile testing; Testing Estimation techniques; Introduction to software reliability, quality control and quality assurance; Formal verification methods; static and dynamic program verification.	Testing strategies: SDLC vs STLC; Testing Levels; Testing methods; Testing types: Specification-based vs. code-based, black-box vs. white-box, functional vs. structural testing; unit, integration, system, acceptance, and regression testing; Load, Performance, Stress, Unit Testing; Verification vs. validation; Test planning: scenario, case, traceability matrix; ISO Standards; Agile testing; Testing Estimation techniques; Introduction to software reliability, quality control and quality assurance; Formal verification methods; static and dynamic program verification.

Game Design and Development

	Existing	Updated
Course Code	CSE 485	CSE 4485
Course Title	Game Design and Development	Game Design and Development
Prerequisite Course		
Course Contents	<p>Introduction to Game: Game Design Concepts, Character Modeling, Animation, Story-line, Graphics Programming using basic languages(C/C++/C#/Java), overview of Game Development tools, concepts of 3d virtual world</p> <p>Introduction to Game Engine Pipeline: 3d mesh and 3d object modeling primer, compile time loading of game objects, real-time graphics rendering (animation), real-life physics simulation and collision detection, game state saving techniques and memory management</p> <p>Introduction to Advanced Topics: Advanced data structures (Scene graph management using Quad Trees, Texturing using BumpMap, Random Terrain Generators with custom tweaking), Artificial Intelligence inside games etc.</p> <p>Development of a Customize Game: Implementation of a game using industry standard tools.Implementing all the previously mentioned features for this game.</p> <p>Optimization for Game and Graphics Rendering: Pre-Rendered optimization using state removal techniques, Compile-time optimization using advanced compiler techniques, Fluid Simulation using Shaders 3.0, Aerodynamic simulation usingNvidia Physics, Introduction to Ray Tracing for Lighting techniques.</p> <p>Game Concepts in other Fields: Discussion on game development concepts in other fields – virtual reality, animated movies, physics simulation (Fluid/Aerodynamics simulation), simulation of A.I driven objects, particles collision detection etc.</p>	<p>Introduction to games: history, games and society; Game design: design concepts, teams and processes character modelling, animation, story-line, programming fundamentals, concepts of 3D virtual world; Game Engines: 3D mesh and object modelling, simulation and collision detection, etc; Debugging games; Game Architecture; Memory and I/O systems; Development of a customized game; Advanced Topics: data structures , AI, etc in Games; Networks and multiplayer mode; Application of Games: simulation, animation movies and others.</p>

Digital System Design

	Existing	Updated
Course Code	CSE 429	CSE 4329
Course Title	Digital System Design	Digital System Design
Prerequisite Course	CSE 425	CSE 313
Course Contents	Design using MSI and LSI components; Programmable logic devices; Basic components of a computer system; Design of processing unit: ALU, Comparator, Accumulator, Shifter, Multiplier; Hardware multiplication: Booth and Modified Booth algorithm; Design of control unit: hardwired and microprogrammed; Simple-As-Possible (SAP) computer: SAP-1, selected concepts from SAP-2 and SAP-3 (jump, call, return, stack, push and pop); Designing microprocessor based system; Hardware Interfacing with Intel 8086 microprocessor: programmable peripheral interface, programmable interrupt controller, programmable timer, keyboard and display interface.	Design using MSI and LSI components; Programmable logic devices; Basic components of a computer system; Design of processing unit: ALU, Comparator, Accumulator, Shifter, Multiplier; Hardware multiplication: Booth and Modified Booth algorithm; Design of control unit: hardwired and microprogrammed; Simple-As-Possible (SAP) computer: SAP-1, selected concepts from SAP-2 and SAP-3 (jump, call, return, stack, push and pop); Designing microprocessor based system; Hardware Interfacing with Intel 8086 microprocessor: programmable peripheral interface, programmable interrupt controller, programmable timer, keyboard and display interface.

Real-time Embedded Systems

	Existing	Updated
Course Code	CSE 479	CSE 4379
Course Title	Embedded Systems	Real-time Embedded Systems
Prerequisite Course	CSE 425	CSE 425
Course Contents	<p>Introduction to embedded systems: Background, history, classifications, programming languages for embedded systems. Embedded System Processors: Combinational logic and transistors, RT-level combinational and sequential components, customized single purpose processor design. Microcontroller Organization: Structure of microcontrollers, CPU, memory and I/O structure, various microcontrollers, PIC, Rabbit and ARM. CPU and Bus Systems: I/O and memory mapping, addressing modes, interrupts and traps, bus protocols, DMA, system bus configurations, the AMBA and AHB buses, memory devices: RAM, ROM, SDRAM, flash, basic I/O interfaces. Interfacing: Parallel ports, LEDs, push-button, keypad, 7-segment display, LCD display, touchscreen, timers and counters, serial Interface, networked embedded systems. Embedded Programming Techniques: C-language primer, state machines, streams, circular buffers. Development and Debugging: Development environment, hardware/software debugging techniques, performance analysis, use of hardware debugging modules. Multiprocessor Embedded Systems: CPU and hardware acceleration, mutiprocessor performance analysis. System Design Techniques: Design methodologies and flows, requirement analysis, specifications description, system analysis and architecture design, quality assurance.</p>	<p>Embedded architectures: 16/32/64-bit embedded processors; Interaction with devices: buses, memory architectures, memory management, device drivers; Concurrency: software and hardware interrupts, timers; Real-time principles: synchronization, scheduling, multi-tasking; Real-time task scheduling: scheduleablity analysis, rate and deadline monotonic scheduling, fixed and dynamic priority scheduling; Feed-back control theory and application; Profiling and code optimization; Embedded software systems: exception handling, loading, mode-switching, programming embedded systems.</p>

VLSI Design

	Existing	Updated
Course Code	CSI 427	CSE 4327
Course Title	VLSI Design	VLSI Design
Prerequisite Course		
Course Contents	VLSI technology: Top down design approach, technology trends and design styles. Review of MOS transistor theory: Threshold voltage, body effect, I-V equations and characteristics, latch-up problems, NMOS inverter, CMOS inverter, pass-transistor and transmission gates. CMOS circuit characteristics and performance estimation: Resistance, capacitance, rise and fall times, delay, gate transistor sizing and power consumption. CMOS circuit and logic design: Layout design rules and physical design of simple logic gates. CMOS subsystem design: Adders, multiplier and memory system, arithmetic logic unit. Programmable logic arrays. I/O systems. VLSI testing.	VLSI technology: Top down design approach, technology trends and design styles. Review of MOS transistor theory: Threshold voltage, body effect, I-V equations and characteristics, latch-up problems, NMOS inverter, CMOS inverter, pass-transistor and transmission gates. CMOS circuit characteristics and performance estimation: Resistance, capacitance, rise and fall times, delay, gate transistor sizing and power consumption. CMOS circuit and logic design: Layout design rules and physical design of simple logic gates. CMOS subsystem design: Adders, multiplier and memory system, arithmetic logic unit. Programmable logic arrays. I/O systems. VLSI testing.

Robotics

	Existing	Updated
Course Code		CSE 4337
Course Title		Robotics
Prerequisite Course		CSE 425,CSE 341
Course Contents		Introduce the basic concepts of robotics, types of robots, robotics and AI; Automation & autonomy architectures; Robot hardware: sensors, actuators; Robotic mapping: localization, Monte Carlo localization, multi-object localization; Robotic navigation and locomotion: motion planning, dynamics and control; Human-robot interaction: Natural language learning; Multi-agents: tasks and teams.

Interfacing

	Existing	Updated
Course Code		CSE 4397
Course Title		Interfacing
Prerequisite Course		CSE 425
Course Contents		Definition of interface, types of interfaces; Interface levels; Typical interface mechanisms; Example interfaces; Input/output ports: I/O port structure, status and control data registers, bidirectional pin operation, bus connection; Three-state output, Z state; Technological considerations; Connections to external loads; Input device connections; Signal multiplexing; Analog Interfaces; Timing and frequency aspects of analogue signals; Nyquist-Shannon sampling theorem; Analog-digital converters; Digital-analog converters; Example application; Serial communication interfaces; Types and characteristics of communication interfaces; Synchronous serial interface (SSI). Real examples (RS232, SPI); Common computer Interfaces; Universal Serial Bus (USB), USB3, Thunderbolt PCI express (PCIe), Storage interfaces – SATA, NVMe, eMMC; Display interfaces – VGA, DVI, Display Port; Microcontroller interfacing – Arduino, Raspberry pi GPIO,; Buses and DMA; Design and operation of interface between computer and the outside world; Human computer interaction, brain Computer interfaces.

Enterprise Systems: Concepts and Practice

	Existing	Updated
Course Code		CSE 4941
Course Title		Enterprise Systems: Concepts and Practice
Prerequisite Course		
Course Contents		<p>Materials management (MM); Supply chain management (SCM); Customer relationship management (CRM); Financials, mobile and cloud enterprise systems; Internet-of-Things (IoT) and enterprise BIG data;</p> <p>The course will incorporate a hands-on component using SAP, Oracle ES software. The course will also incorporate modelling techniques and tools, assess an organisation's readiness for ES implementation.</p>

Web Application Security

	Existing	Updated
Course Code		CSE 4943
Course Title		Web Application Security
Prerequisite Course		CSE 323
Course Contents		Client-side (browser) security: vulnerabilities associated with browsing the web, system penetration, information breach and identity threat; Securing the communication channel: encrypting data stream using SSL, confidentiality and integrity of data using third party transaction protocols e.g. SET, PCI DSS standard, the latest evolutions for HTTPS deployments; Securing untrusted data: server-side and client-side injection attacks, defending common injection attacks; Session management and access control: relationship between authentication, authorization and session management, prevent authorization bypasses and harden session management mechanisms; Server-side security: CGI security, server configuration, access control, operating system security, malicious e-mails, web scripts, cookies, web bugs spyware, rogue AV etc.

UI: Concepts and Design

	Existing	Updated
Course Code		CSE 4945
Course Title		
Prerequisite Course		
Course Contents		Design principles: color, emphasis, usability, hierarchy, etc; Low fidelity wireframes: beginning to design using low fidelity wireframes and storyboards; Introduction to Sketch software, rapid prototyping using Sketch, high fidelity mobile, application, and website wireframes; Creating a style guide with Sketch; Design research and personas: UX fundamentals; find, build, verify, patterns, personas, situations, buy-in, knowledge, scenarios; Using sketch to prototype using material design; Prototype employee time clock; Prototype tablet ordering interface; Prototype iOS todo app; Core principles of design: good, bad and ugly web search; Introduction to Illustrator, introduction to value: understanding Illustrator and designing in Illustrator, refactor and embellish, introduction to color with value, add hue to value; Introduction to PhotoShop, unity in design, PhotoShop and a UI tool, freeform of painting; Introduction to HTML and Visual Studio Code, learn markup language, tags and structure; Introduction to CSS, design guidelines, and styling; Styling with CSS. Complete content from CSS from scratch; Create new CSS on existing HTML; Basic site and app development in Bootstrap, develop a responsive site that will work on PCs tables and Phones; Basic site and App design in Bootstrap; Design graphics for the responsive site in the previous website.

IT Audit: Concepts and Practice

	Existing	Updated
Course Code		CSE 4949
Course Title		IT Audit: Concepts and Practice
Prerequisite Course		
Course Contents		IT audit concepts and frameworks; General phases of IT audit; Internal IT audit control framework: the committee of sponsoring organizations (COSO); The impact of information technology audit process on internal controls: general controls, application controls, tests of controls; Referring case study; IT-Audit methodologies and frameworks: COBIT, ITIL, ISO 17799 etc; Practical IT-Audit methodologies development steps for enterprises completing the audit: reporting, types of auditors' opinions, audit documentation and resources; Referring case study.

University Required Courses

Life Skills for Success

	Existing	Updated
Course Code		URC 1101
Course Title		Life Success Skills
Prerequisite Course		
Course Contents		<p>Introduction: Why this course, Evaluation rubric, Student involvement, Importance of character, Deviation from right path & consequences, Understanding right path, Lives of famous persons; Essence of Life: Who am I, Self-esteem, Vigil, Essence of creation, Animal Vs Human Being, Human values, Ethical Living, Professional ethics, Mind Mapping, Goal Setting, Transforming Failure into Success, Integration of soft skills, Human qualities/habits for success in life; Parents & Life: Why are parents so important in life, Can we ignore the contribution of parents in our lives, Mother and father-degree of importance, Should we respect our parents, How to respect of parents, Should we send our parents to old-age home, Living with parents, Weight of parents in religion, Success of lives on parents care; Personality Trait Analysis: Personality traits concept, Personality traits test, Personality theory, Personality test score interpretation, Personality traits chart, Personality traits in the workplace, What is MBTI, Four dichotomies of MBTI, 16 types of personalities under MBTI, Advantage of MBTI; Etiquette and Manner: Types of etiquette, Etiquette and manners, Importance of etiquette, Social etiquette, Respect to elders, Morality & ethics, Learning of etiquette, Etiquette rules, Corporate culture & etiquette, Best examples of etiquettes and manners; Study Skills: What are study skills? Why is it important? 10 habits of successful students, Types of study skills, Fine tuning your study room, Organization and scheduling tasks, How to take lecture notes, How to read textbooks, Memorization techniques, Exam preparation techniques; Health & Happiness: The importance of Exercise, Relationship between health and happiness, The role of health diet, The key to a healthy mind, Sleep is the best medicine, Tips and ways to be a happier person, Balanced life; Stress Management: What is stress, Strategies for stress management strategies, Techniques, for stress management, Tools for managing stress, Managing stress in the workplaces, Tips for managing stress for the learners Social Responsibility: Meaning of social responsibility, Responsibilities to stakeholders, responsibilities to neighbors, child, women, co-workers, senior citizens, Personal Social Responsibility (PSR) Vs Corporate Social Responsibility, Importance of social media connectivity, Positive mind set in social media connectivity, How to post in Facebook and other social media. Effective Communication: Concept of effective communication, Essence of effective communication, Effective communication in the workplace, Examples of effective communication skills, Effective communication techniques, Communication through effective presentation, Types of presentation, Importance of fluency, Body language, Presentation skills, Development of effective PP slides Time Management: Time management definition, Why time management, Time management skills, Tools for managing times, Time management for students, Tips for effective time management Legal Compliance & UIU Life: Why law, Why should we obey Rules and Regulations, UIU Core Values, Rules & Regulations, Effective dressing, Wearing ID Card, Classroom Discipline, UIU IT Services & Library Facilities.</p>

Final Year Design Project

Final Year Design Project (FYDP) is a senior design project work that takes place during the final year of 4 years engineering curriculum of B.Sc. in Computer Science Engineering.

Final Year Design Project - I

	Existing	Updated
Course Code	CSE 400	CSE 4000A
Course Title	Thesis/Project	Final Year Design Project - I
Prerequisite Course		
Course Contents	All candidates are required to undertake supervised study and research culminating in a Thesis/Project in their field of specialization.	This course introduce different soft skill-sets that are necessary for the successful completion of FYDP. The skill-sets include, but not limited to, mastering effective communications, individual and team development, ethical leadership, project management, the steps in the design process, environment and sustainability, etc. These skill sets would be developed by a series of seminars and workshops. The outcomes relevant to POs would be measured based on the student performance in different tests designed to assess those specific skills. The standard rubrics will be used to assess the performance. At the end of the trimester the students will submit an interim report of their FYDP and give a presentation.

Final Year Design Project - II

	Existing	Updated
Course Code	CSE 400	CSE 4000B
Course Title	Thesis/Project	Final Year Design Project - II
Prerequisite Course		CSE 402
Course Contents	All candidates are required to undertake supervised study and research culminating in a Thesis/Project in their field of specialization.	In this course the students will implement the proposal that is accepted in the course CSE 402.