UNITED INTERNATIONAL UNIVERSITY

DEPARTMENT of COMPUTER SCIENCE AND ENGINeERING

BSCSE Curriculum

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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 (6 credits)

1	ENG 1011	English I	3.0
2	ENG 1013	English II	3.0

(B) General Education (14 credits)

Compulsory (8 credits)

1	SOC 2101	Society, Environment and Engineering Ethics	3.0
2	PMG 4101	Project Management	3.0
3	BDS 1201	History of the Emergence of Bangladesh	2.0

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)

i.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

ii.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

iii.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

iv.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

v.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

vi.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

vii.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 (2 credits)

1	URC 1103	Life Skills for Success	2.0

(I) Final Year Design Project (6 credits)

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

Summary of Courses

#	Group	Theory	Laboratory	Final Year Design Project	Total
1	Language	6.0	–	–	6.0
2	General Education	14.0	–	–	14.0
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	–	2.0
9	Final Year Design Project	–	–	6.0	6.0
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 1011	English I	3.0
ENG 103	English II	3.0	ENG 1013	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 DifferentialEquations	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 Systems	3.0
CSI 310	Operating System Concepts Laboratory	1.0	CSE 4510	Operating Systems 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 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 1011	English - I	3.0
2	CSE 1110	Introduction to Computer Systems	1.0
3	URC 1101	Life Skills for Success	2.0
4	CSE 2213	Discrete Mathematics	3.0
		Subtotal	9.0

Trimester 2

Sl. No.	Course Code	Course Title	Credit Hr.
1	ENG 1013	English - II	3.0
2	CSE 1111	Structured Programming Language	3.0
3	CSE 1112	Structured Programming Language Laboratory	1.0
4	BDS 1201	History of the Emergence of Bangladesh	2.0
		Subtotal	9.0

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
3	EEE 2113	Electrical Circuits	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	CSE 2233	Theory of Computation	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
		Subtotal	11.0

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
1	PMG 4101	Project Management	3.0
		Subtotal	13.0

Trimester 10

Sl. No.	Course Code	Course Title	Credit Hr.
1	GED OPT I	General Education Optional	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
5	CSE 4513	Computer Security	3.0
		Subtotal	14.0

Trimester 12

Sl. No.	Course Code	Course Title	Credit Hr.
1	CSE 4000C	Final Year Design Project - III	2.0
2	EEE 4261	Green Computing	3.0
3	CSE ***	Elective - IV	3.0
4	CSE ***	Elective - V	3.0
		Subtotal	11.0

Credit hours distribution in twelve trimesters

Trimester	Theory Credits	Laboratory Credits	Total Credits
Trimester 1	8.0	1.0	9.0
Trimester 2	8.0	1.0	9.0
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	9.0	2.0	11.0
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	14.0	0.0	14.0
Trimester 12	12.0	0.0	11.0
Total	121.0	16.0	137.0

Course Contents

Language Courses

ENG 1011: English I

Reading and Writing Cohesion, Skimming, Coherence, Scanning; Main ideas, Brainstorming and Taking notes, [illegible]
Speaking and Listening Speaking and listening strategies, Pronunciation and Intonation, Vocabulary: Educated guess from [illegible]
Activities, How to make and present a brochure, Impromptu Speaking, Group Presentation

ENG 1013: English II

Prerequisite Course: ENG 1011

Writing Free Writing; Guided Writing; Paragraph writing with guidelines (based on hints, Wh questions); Process of [illegible] making practice on Academic word list (1-10); Compare and Contrast essay, Argumentative essay); Vocabulary: Sentence [illegible]
Reading Practice on Reading Comprehension; **Speaking** [illegible] **Listening**
Listening practice from various sources

General Education Courses

SOC 2101: Society, Environment and Engineering Ethics

Society: emergence of Sociology as moral lessons for society; Basic institutions in society, organization and insti- tutions in [illegible] sustainable development, SDGs, climate change adaptation, Disability and Accessibility.

PMG 4101: Project Management

Prerequisite Course: CSE 3411

Triple Constraint in Project Management: Time, Scope and Cost; Process methodology, Requirement Col- lection, Plan, [illegible] resource allocation and estimation.

BDS 1201: History of the Emergence of Bangladesh

Partition of Bengal (1947); Language Movement (1952); Movement for Autonomy; 6-point and 11-Point Programs; The 1970 [illegible] theories of social change; social change in Bangladesh; urbanization process and its impact on Bangladesh society.

ECO 4101: Economics

Definition of Economics; Economics and engineering; Principles of economics.

Micro-Economics: Introduction to various economic systems - capitalist, command and mixed economy; Fun- damental [illegible] relationship among total, marginal and average concepts.

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.

SOC 4101: Introduction to Sociology

Concept and theory: major schools of sociology - functionalism, critical theory, gender, interactionism and post- [illegible] Global and social issues; Social research: importance of research, research methods and techniques.

ACT 2111: Financial and Managerial Accounting

Financial Accounting: Objectives and importance of accounting; Accounting as an information system; Comput- erized [illegible] adjusting and closing entries; Accounting concepts (principles) and conventions.

Financial statement analysis and interpretation: ratio analysis.

Cost and Management Accounting: Cost concepts and classification; Overhead cost: meaning and classification; [illegible] budgeting, various techniques of evaluation of capital investments.

IPE 3401: Industrial and Operational Management

Introduction, evolution, management function, organization and environment.

Organization: Theory and structure; Coordination; Span of control; Authority delegation; Groups; Committee and task force; Manpower planning.

Personnel Management: Scope; Importance; Need hierarchy; Motivation; Job redesign; Leadership; Participative management; Training; Performance appraisal; Wages and incentives; Informal groups; Organizational change and conflict.

Cost and Financial Management: Elements of costs of products depreciation; Break-even analysis; Investment analysis; Benefit cost analysis.

Management Accounting: Cost planning and control; Budget and budgetary control; Development planning process.

Marketing Management: Concepts; Strategy; Sales promotion; Patent laws.

Technology Management: Management of innovation and changes; Technology life cycle; Case studies.

TEC 2499: Technology Entrepreneurship

Defining the startup vision; Start: How and when to start a new venture, what one needs to start, forming a suitable team; Ideate: Defining the core ideas; 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.

Starting a new startup: Lean - 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: Whether to pivot 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.

Accelerating towards success: Batch Production: Getting to mass production, mass producing software vs mass producing hardware; Scale: Scaling, navigating legal and promotional problems; Grow: Evaluating the feedback from the bigger market audience, going for continued growth; Adapt: Changing 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.

PSY 2101: Psychology

The objective of this course is to provide knowledge about the basic concepts and principles of psychology pertain- ing 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.

BDS 2201: Bangladesh Studies

Ancient Bengal; Sasanka, Rise of the Palas, the Senas; Early Medieval Bengal: Coming of the Muslims; The In- dependent 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 Buxar; The Dual government; Permanent Settlement (1793); Nine- teenth 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 [illegible] change: theories of social change; social change in Bangladesh; urbanization process and its impact on Bangladesh society.

BAN 2501: Bangla

(অ) বাংলা সাহিত্য

ক। নির্বাচিত প্রবন্ধ : (যে কোনো ৩টি)

(১) হরপ্রসাদ শাস্ত্রী : তৈল, (২) বঙ্কিমচন্দ্র চট্টোপাধ্যায় : বাঙালা 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)

খ। নির্বাচিত গল্প : (যে কোনো ৩টি)

(১) রবীন্দ্রনাথ ঠাকুর : পোস্টমাস্টার / স্ত্রীর পত্র/ একরাত্রি (২) বনফুল : নিমগাছ (৩) বিভূতিভূষণ বন্দ্যোপাধ্যায় : পুঁই মাচা (৪) বেগম রোকেয়া সাখাওয়াত হোসেন : অবোরোধবাসিনী (৫) সৈয়দ ওয়ালীউল্লাহ : নয়নচারা (৬) অন্যান্য গল্প (সহায়ক গ্রন্থ হতে নির্বাচিত)

গ। নির্বাচিত কবিতা : (যে কোনো ৩টি)

(১) রবীন্দ্রনাথ ঠাকুর : নির্ঝরের স্বপ্নভঙ্গ, (২) কাজী নজরুল ইসলাম : আজ সৃষ্টি সুখের উল্লাসে (৩) জীবনানন্দ দাশ : বনলতা সেন (৪) শামসুর রাহ্‌মান : তোমাকে পাওয়ার জন্য হে স্বাধীনতা (৫) নির্মলেন্দু গুণ : হুলিয়া (প্রেমাংশুর রক্ত চাই) (৬) অন্যান্য কবিতা (সহায়ক গ্রন্থ হতে নির্বাচিত)

ঘ। উপন্যাস (যে কোনো ১টি)

বিভূতিভূষণ বন্দ্যোপাধ্যায় : আরণ্যক, অদ্বৈত মল্লবর্মণ : তিতাস একটি নদীর নাম, মানিক বন্দ্যোপাধ্যায় : দিবারাত্রির কাব্য

(আ) প্রায়োগিক বাংলা

(ক) বাংলা ভাষায় লিখন-দক্ষতা

(১) বাংলা ধ্বনিতত্ত্ব (ধ্বনি, বর্ণ, ধ্বনি পরিবর্তন, যুক্তবর্ণ), (২) বাংলা বানান : বাংলা একাডেমির বাংলা বানানের নিয়ম, শব্দের অপপ্রয়োগ, শব্দের বানান ও অশুদ্ধি, (৩) বাক্যের শুদ্ধি-অশুদ্ধি : বাক্যের গঠনগত শুদ্ধি-অশুদ্ধি, বিরাম চিহ্ন, (৪) বাংলা লিখন কৌশল : রেজুলেশন লিখন, অনুষ্ঠান সঞ্চালন পাণ্ডুলিপি প্রস্তুত, বিজ্ঞাপন লিখন, প্রুফ সংশোধন।

(খ) বাংলা ভাষায় শ্রবণ ও কথন-দক্ষতা

(১) বাংলা উচ্চারণের নিয়ম : স্বরবর্ণ ও ব্যঞ্জনবর্ণের উচ্চারণের স্থান, উচ্চারণরীতি, (২) বাংলা উচ্চারণ-সূত্র ও তার প্রয়োগ

সহায়ক গ্রন্থ :

(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

Basic Sciences Courses

PHY 2105: Physics

Waves and Oscillations: Periodic motion; periodic waves, elastic restoring force, simple harmonic motion (SHM), differential [illegible] effects, application of acoustic Phenomena.

Electricity magnetism: Electrostatic Force and Electric Field: Concept of charge, Coulomb's law, concept of electric [illegible] leakage and fringing flux, Transformers.

Quantum Physics: Quantum theory: quantum theory of radiation, energy of photons, photo-electric Effect, work [illegible] corrals, quantization of Bohr orbital energy.

PHY 2106: Physics Laboratory

Experiments based on PHY 2105

BIO 3105: Biology for Engineers

Introduction: The Basics of Life; Chemistry: Organic Molecules: The Molecules of Life; Cell Structure and Function; [illegible] The Nature of Microorganisms, The Plant Kingdom, The Animal Kingdom, Mate-

rials Exchange in the Body; Nutrition: Food and Diet; The Body's Control Mechanisms and Immunity; Human Reproduction, Sex, and Sexuality.

Mathematics Courses

MATH 1151: Fundamental Calculus

Function, Domain and Range of a Function, Translation and reflection of a function, Even and Odd functions, Inverse functions, One to one and many to one function, Limit, continuity and differentiability, Tangent line, Differentiation of different types of functions, An overview of Optimization problems, Newton's method, Indefinite integral, Fundamental theorem of calculus, Definite integral, Area between two curves. Different types of integration (Principles of integral evaluation, Integration by parts, Trigonometric Substitution).

MATH 2183: Calculus and Linear Algebra

Prerequisite Course: MATH 1151

Calculus: Analysis of Function I: Slope and Concavity, Analysis of function II: Relative Extrema and Polyno- mials, Partial Derivatives, The Chain Rule.

Differential Equation: Solution of the differential equations of 1st and 2nd order.

Linear Algebra: Solution of different types of system of linear equations. Operations of matrix algebra, trans- position, inversion, rank of matrices. Solution of system of equations by matrix method. Eigen values and Eigen vectors.

MATH 2201: Coordinate Geometry and Vector Analysis

Prerequisite Course: MATH 1151

Conic sections, rotation of axes, Rectangular co-ordinate in 3-space, cross and dot product of vectors, parametric equation of straight lines and planes in space, Cylindrical and Spherical coordinate systems, integrals of multivariable functions (double and triple integrals including polar coordinates), Gradient of scalar fields, divergence and curl of vector fields. Line integrals, conservative vector field and Green's theorem, surface integral, flux, divergence theorem, Stokes' theorem.

MATH 2205: Probability and Statistics

Prerequisite Course: MATH 1151

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

EEE 2113: Electrical Circuits

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.

EEE 2123:Electronics

Prerequisite Course: EEE 2113

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, [illegible] physical operation, current-voltage characteristics, BJT circuits at DC, [illegible] effect transistor (MOSFET): 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.

EEE 2124: Electronics Laboratory

Laboratory work based on EEE 2123.

EEE 4261: Green Computing

Cloud computing: Definition, Concept, service model and their clarification, deployment model, security and privacy; [illegible] Definition, Concept, Advantages and challenges; [illegible] Definition of e-waste and its recycle process. Cost benefit analysis of e-waste recycle. And environmental impact analysis of e-waste.

Core Courses

CSE 1110: Introduction to Computer Systems

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 [illegible] Information Technology; the Internet; Number systems: binary, octal, hexadecimal, Binary arithmetic; Basic programming concepts; Program development stages: flow charts; Programming constructs: data types, operators, expressions, statements, control statements, functions, array.

CSE 1111: Structured Programming Language

Prerequisite Course: CSE 110

Basic understanding of problem solving; Structured programming language: data types, operators, expressions, control structures (if-else, switch-case, Loops); 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.

CSE 1112: Structured Programming Language Laboratory
Prerequisite Course: CSE 1110

Laboratory work based on CSE 1111 with a project work.

CSE 1115: Object Oriented Programming
Prerequisite Course: CSE 1111

Philosophy of Object Oriented Programming (OOP); Advantages of OOP over structured programming; Ab- straction 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; Multi-threaded Programming.

CSE 116: Object Oriented Programming Laboratory
Prerequisite Course: CSE 1112

Laboratory work based on CSE 1115.

CSE 2118: Advanced Object Oriented Programming Laboratory
Prerequisite Course: CSE 1116

Laboratory work based on advanced topics in Object Oriented Programming with a project work.

CSE 4165: Web Programming
Prerequisite Course: CSE 2118

Web architecture and HTTP: History and architecture of the World Wide Web; overview of the Hyper Text Transfer Protocol; [illegible] Content generation, data exchange; Layered or Multi-tier Architecture for Web Applications; MVC; Content Management System.

CSE 4181: Mobile Application Development
Prerequisite Course: CSE 2118

Introduction to Mobile Programming; Mobile Programming Languages; Mobile Application Development Frame- work; [illegible] Game development, Marketing, Distribution of Apps; Cross platform App development framework, Auto-Layout design.

CSE 1325: Digital Logic Design

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 functions: decoders, multiplexers, demultiplexers, encoders; 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.

CSE 1326: Digital Logic Design Laboratory

Laboratory work based on CSE 1325.

CSE 3313: Computer Architecture

Prerequisite Course: CSE 1325

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, virtual memory; Buses; Concepts of DMA and Interrupts; Multiprocessors: types of multiprocessors, performance, single bus multiprocessors, multiprocessors connected by network, clusters.

CSE 4325: Microprocessors and Microcontrollers

Introduction to 16-bit and 32-bit microprocessors: architecture, addressing modes, instruction set (e.g. x86), interrupts, multitasking and virtual memory; Memory interface; bus interface; programmable peripheral interface, direct memory access (DMA), keyboard and display interface; Introduction to microcontrollers (e.g. ATMega32): architecture, clock generator, timers, LEDs, switches, sensors and analog interfacing; Introduction to the analog-to-digital converter (ADC) module, serial communication protocols (e.g. SPI, I2C, CANBUS) for embedded system.

CSE 4326: Microprocessors and Microcontrollers Laboratory

Students will design simple systems using the principles learned in CSE 4325. An introduction to assembly language will be included in this course at the beginning.

CSE 2213: Discrete Mathematics

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.

CSE 2215: Data Structure and Algorithms - I

Prerequisite Course: CSI 1115

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.

CSE 2216: Data Structure and Algorithms - I Laboratory

Laboratory work based on Data Structures and Algorithms I

CSE 2217: Data Structure and Algorithms - II

Prerequisite Course: CSE 2215

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.

CSE 2218: Data Structure and Algorithms - II Laboratory

Laboratory work based on Data Structures and Algorithms II.

CSE 2233: Theory of Computation

Finite Automata: Deterministic finite automata, Non-deterministic finite automata, equivalence and conversion of deterministic and non-deterministic finite automata, pushdown automata; Context free languages, context frees grammar; Turing machines: basic machines, configuration, computing with turing machine, combining turing machines.

CSE 3411: System Analysis and Design

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 comparative analysis; Feasibility Study: constraints, types of feasibility, 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 case; Software Requirement Specification (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.

CSE 3412: System Analysis and Design Laboratory

Laboratory work based on System Analysis and Design.

CSE 3421: Software Engineering

Prerequisite Course: CSE 3411

Basic Concepts: software, software engineering, recent trends and challenges; Process Models: waterfall, incre- mental, [illegible] code of ethics, privacy engineering, Business Case Study: case study on local and international popular software products.

CSE 3422: Software Engineering Laboratory

Laboratory work based on Software Engineering.

CSE 4531: Computer Security

Prerequisite Course: CSE 3711

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.

CSE 3521: Database Management Systems

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.

CSE 3522: Database Management Systems Laboratory

Laboratory work based on CSE 3521. A project work will be included.

CSE 4509: Operating Systems

Operating system: its role in computer systems; multitasking, multiuser, multiprocessing OS; Operating system structures; Process: process concept and scheduling, interprocess communication, communication in client-server systems; CPU scheduling: scheduling criteria and algorithms, thread scheduling, multiprocessor 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.

CSE 4510: Operating Systems Laboratory

Laboratory work based on Operating System Concepts.

CSE 3711: Computer Networks

Introduction to Computer Networks; Network Edge, Network Core ; Layering architecture; TCP/IP and OSI Reference [illegible] Link layer addressing, Ethernet, ARP, Wireless links and network characteristics, Wi-Fi: IEEE 802.11 Wireless LANs.

CSE 3712: Computer Networks Laboratory

Laboratory work based on CSE 3711.

CSE 3841: Artificial Intelligence

Prerequisite Course: MATH 2205

Survey and concepts in Artificial Intelligence; Problem solving agents; Uninformed and Informed search tech- niques; Local Search Techniques; Game playing; Constraint Satisfaction Problems; Bayesian learning; Supervised Learning; Classification, Perceptrons, Stationary processes and Markov assumptions, Hidden Markov Models, Hu- man Aware AI Systems.

CSE 3842: Artificial Intelligence Laboratory

Laboratory work based on CSE 341.

Elective Courses

CSE 4601: Mathematical Analysis for Computer Science

Prerequisite Course: MATH 2205, CSE 2213

Recurrent problems; Manipulation of sums; Integer functions; Number theory; Binomial coefficient; Special numbers; Generating functions; [illegible] Conditional probability and conditional expectation; [illegible] parameter, birth-death process; Queuing models: birth-death model, Markovian model, open and closed queuing network; Application of queuing models.

CSE 4633: Basic Graph Theory

Prerequisite Course: CSE 2213, CSE 2217

Graphs and their applications; Basic graph terminologies; Basic operations on graphs; Graph representations; Degree sequence and graphic sequence; [illegible] Vertex and Edge Connectivity; Line graphs, Perfect graphs and Planar graphs; Graph coloring: Vertex coloring and Edge coloring; Special classes of graphs.

CSE 4655: Algorithm Engineering

Prerequisite Course: CSI 2217

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.

CSE 4611: Compiler Design

Prerequisite Course: CSE 2233

Compiler modules; Lexical analysis; Parsing theory; Symbol tables; Type systems; Scope; Semantic analysis; Intermediate representations; Runtime environments; Code generation; Code optimization.

CSE 4613: Computational Geometry

Prerequisite Course: MATH 2201, CSE 2213

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, the Plane-sweep algorithm, Intersection of polygons; Proximity: Voronoi diagrams, Delaunay 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).

CSE 4621: Computer Graphics

Prerequisite Course: MATH 2183,MATH 2201

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: z-buffer (or depth buffer), depth sorting, BSP tree algorithms; Scan conversion and clipping algorithms: e.g. Cohen-Sutherland, Cyrus-Beck, Sutherland-Hodgeman algorithms; Fractals: e.g. Koch curve, snowflakes, Dragon curve; Ray tracing: ray casting methods, direct illumi- nation, global illumination, shadows, shading and textures.

CSE 3715: Data Communication

Introduction of layered network architecture; Introduction of data communication; physical point to point commu- nication, signal representation and processing; signal to noise ratio; Framing techniques; Frequency response of signals; Fourier integrals; Fourier transforms; time domain and frequency domain concepts; 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; Pulse coding techniques of modulation: pulse amplitude modulation, pulse width modulation, pulse position modulation, pulse code modulation; Multi- plexing techniques: time division multiplexing, frequency division multiplexing techniques.

CSE 4759: Wireless and Cellular Communication

Prerequisite Course: CSE 3715, CSE 3711

Cellular concepts: frequency reuse, handoff strategies, interference and system capacity, grade of service, im- proving [illegible] wireless personal area networks, wireless protocols for Internet of Things, ZigBee.

4773: Advanced Network Serviced and Management

Prerequisite Course: CSE 3711

Application specific protocols: domain name services, electronics mail; World Wide Web and Web caching; Network [illegible] cryptography, firewalls, access control lists (ACLs), VPN, IP Sec, IPv6.

CSE 4749: Cryptography

Prerequisite Course: CSE 2213

Cryptography, history of cryptography; Perfect ciphers, Stream ciphers, attacks on stream ciphers, block ciphers, how to use [illegible] cryptography, one time pad exchange using qbits, Message integrity (MAC), HMAC, Secure hash functions. Digital signatures.

CSE 4777: Networks Security

Prerequisite Course: CSE 3711

Introduction to computer security, CIA TRIAD, Threats and Attacks, Passive and Active attacks and examples of passive [illegible] Advanced network security topics.

CSE 4763: Electronic Business

Prerequisite Course: CSE 3711

The E-Business Framework, difference between electronic business and electronic commerce, electronic mar- kets, [illegible] 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, con- sumer, prosumer, buyer and key customer; E-Contracting: generic services, information, negotiation, archiving, enforcement; legal validity, structure of a contract, digital signature, legal services; Online Distribution: components of a distribution system, characteristics 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.

CSE 4547: Multimedia Systems Design
Prerequisite Course: CSE 3711

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; 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.

CSE 4519: Distributed Systems

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.

CSE 4523: Simulation and Modeling
Prerequisite Course: MATH 2205

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.

CSE 4587: 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.

CSE 4567: Advanced Database Management Systems
Prerequisite Course:CSE 3521

Database system architecture; Managing primary and secondary storage; Query processing; Metadata and catalog management; Language processing; Query optimization and query generation; Concurrency; Failures and recovery in transactions; Extensibility; Client-server interactions; Object-oriented database systems; XML database and the web data management; 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.

CSE 4889: Machine Learning

Prerequisite Course: CSE 3841

Introduction to Machine Learning; Regression analysis; linear regression; Classification techniques; classifi- cation 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.

CSE 4891: Data Mining

Prerequisite Course: CSE 3841

Introduction to data mining; data mining task and applications, data preprocessing, feature selection, as- sociation analysis: frequent itemset mining; Single model classifier: k-nearest neighbor, naive Bayes classifier, decision tree induction, naive 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, cluster- ing high-dimensional data; Data balancing methods; Active learning; Transfer learning; Outlier detection; Concept drift.

CSE 4893: Introduction to 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, 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.

CSE 4883: Digital Image Processing

Prerequisite Course: CSE 4883

Digital Image Fundamentals: visual perception, sensing, acquisition, sampling, quantization; Intensity Trans- formation and Spatial Filtering: different transformations, histogram correction and convolution, smoothing and sharpening filters; Filtering in Frequency Domain: discrete fourier transformation (DFT) of images, 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 detec- tion, thresholding, region based segmentation; Object Recognition: matching, statistical classifier, neural networks.

CSE 4817: Big Data Analytics

Prerequisite Course: CSE 4883

Introduction to Big Data: characteristics of Big Data and dimensions of scalability; Data Science: getting value out of [illegible] introduction to graphs, graph Analytics, graph analytics techniques, computing platforms for graph analytics.

CSE 4451: Human Computer Interaction

Foundations of human computer interaction; understanding and conceptualizing interaction; Understanding users; human [illegible] technology and rehabilitation; Human machine interface, brain computer interface; Experimental research ethics.

CSE 4435: Software Architecture

Introduction; Design vs Architecture; Enterprise Architecture; Architectural drivers; Software Architecture role; Skills and [illegible] architecture research and future trends.

CSE 4495: Software Testing and Quality Assurance

Prerequisite Course: CSE 3421

Testing strategies; SDLC vs STLC; Testing Levels; Testing methods; Testing types; Specification-based vs. code-based, [illegible] verification methods, static and dynamic program verification.

CSE 4485: Game Design and Development

Introduction to games: history, games and society; Game design: design concepts, teams and processes; character modelling, [illegible] Application of Games: simulation, animation movies and others.

CSE 4329: Digital System Design

Prerequisite Course: 3313

Design using MSI and LSI components; Programmable logic devices; Basic components of a computer system; Design [illegible] controller, programmable timer, keyboard and display interface.

CSE 4379: Real-time Embedded Systems

Prerequisite Course: CSE 4325

Embedded architectures: 16/32/64-bit embedded processors; Interaction with devices: buses, memory archi- tectures, [illegible] optimization; Embedded software systems: exception handling, loading, mode-switching, programming embedded systems.

CSE 4327: VLSI Design

VLSI technology: Top down design approach, technology trends and design styles. Review of MOS transistor theory: [illegible] unit. Programmable logic arrays. I/O systems. VLSI testing.

CSE 4337: Robotics

Prerequisite Course: CSE 4325, CSE 3841

Introduce the basic concepts of robotics, types of robots, robotics and AI; Automation & autonomy architec- tures; [illegible] learning; Multi-agents: tasks and teams.

CSE 4397: Interfacing

Prerequisite Course: CSE 4325

Definition of interface, types of interfaces; Interface levels; Typical interface mechanisms; Example interfaces: In- [illegible] computer interfaces.

CSE 4941: Enterprise Systems: Concepts and Practice

Materials management (MM); Supply chain management (SCM); Customer relationship management (CRM); Fi- nancials, [illegible] mobile and cloud enterprise systems; Internet of Things (IoT) and enterprise Big data. The course will also incor- porate [illegible] The course will incorporate a hands-on component using SAP, Oracle ES software. [illegible] modelling techniques and tools, assess an organisation's readiness for ES implementation.

CSE 4943: Web Application Security

Client-side (browser) security; vulnerabilities associated with browsing the web, system penetration, information breach and identity theft; Securing the communication channel: encrypting data stream using SSL, confidentiality and integrity of data [illegible] using third-party transaction protocols e.g. SET, PCI DSS standard [illegible] server-side and client-side injection attacks, defending common injection attacks; Session management [illegible] access control [illegible] authentication, authorization and session management [illegible] operating system security, malicious e-mails, web scripts, cookies, web bugs spyware, rogue AV etc.

CSE 4945: UI: Concepts and Design

Design principles: color, emphasis, usability, hierarchy, etc; Low fidelity wireframes: beginning to design using low fidelity wireframes and storyboards, introduction to Sketch software [illegible] application and website wireframes [illegible] design [illegible] in the previous website.

CSE 4949: IT Audit: Concepts and Practice

IT audit concepts and frameworks; General phases of IT audit; Internal IT audit control framework: the committee of sponsoring organizations (COSO) [illegible] enterprises completing the audit: reporting, types of auditors' opinions, audit documentation and resources; Referring case study.

University Required Courses

URC 1103: Life Skills for Success

The course is intended for fresh entrants at the first trimester who need to be oriented and adapted to university survival skills, as well as achieving soft skills for success as a responsible citizen in the society. Complementary

to this core object, students need to be motivated and inspired to study attentively with a sense of integrity and ethical orientation. In addition, this course will create students' awareness to build a successful career as well as becoming a successful individual in the society. The course will cover lectures on rules and regulations of the university, the importance of student life, contribution of family, building professional ethics and personal integrity, time management, study skills, etiquettes and manners, social responsibility including environmental concerns, effective communication, dealing with health and psychological issues, etc. The course is expected to take care of this broad gamut of soft skills that would immensely inspire towards developing a quality person.

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 and Engineering.

CSE 4000A: Final Year Design Project - I

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, steps in the design process, environmental and sustainability etc. These skill-sets would be developed by a series of seminars and workshops. These specific skills and their 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.

CSE 4000B: Final Year Design Project - II

In this course, the students will implement the proposal that is accepted in the course CSE 4000A.

CSE 4000C: Final Year Design Project - III

In this course, the students will implement the proposal that is accepted in the course CSE 4000A.