Department of Computer Science and Engineering

Undergraduate Course Syllabus

Rabindra Maitree University, Kushtia
97/71, Ram Chandra Roy Chowdhury Street Court-para, Kushtia

01. Name of the Rules

The rules shall be called "Rules for 4 Year BSc Engineering in Computer Science".

02. Degree And Department

The name of the degree is 'Bachelor of Science (BSc) Engineering in Computer Science. It is a composite program of learning, examination and evaluation. A student completing the degree under the Department of Computer Science and Engineering of Rabindra Maitree University shall obtain the degree of BSc Engineering in Computer Science.

03. Admission

(i) Students passed HSC or equivalent examination from science group are allowed to apply for BSc Engineering in Computer Science program. Students must have GPA 2.50 in both SSC or equivalent and HSC or equivalent separately and total GPA should be 6.00. In case of freedom fighter, students having total GPA 5.00 may apply.

(ii) Students of English Medium, must have 05 (five) subjects in O-Level and 2(two) subjects in A-Level with minimum 'B' grade or GPA 4.00 in four subjects and minimum 'C' grade or GPA 3.50 in rest three subjects. In case of GED courses (five), students must earn 410 out of 800 in each course and 450 in averages.

(iii) Appeared students may apply in the condition that they will earn minimum requirements of admission.

(iv) The requirements may be changed as per the direction of UGC.

04. Medium of Instruction and Answer

The medium of instruction and answer in the examinations shall be English. But GED Bengali course/s will be taught in Bengali. In other cases, GED courses may be taught in English or Bengali decided by the academic committee.

05. Duration of the Program and Examination

The duration of the BSc Engineering in Computer Science program shall be 8 (eight) semesters in 4 (four) academic years. There shall be 2 (two) semester in each academic year. Each semester will be 6 (six) months consisting of 18 (eighteen) weeks of which 15 (fifteen) weeks for class teaching, at least 1 (one) week as break and 2 (two) weeks for holding the semester final examination. For each course there will be 1 (one) lecture of 60 minutes for each credit in every week & minimum 04 (four) tutorial/open academic discussions in every semester. In case of practical course two class hours in a week will be considered as one credit.

Students shall sit for the comprehensive viva-voce at the end of semester final examination.

06. Distribution of Courses, Marks and Credit Hours

The BSc Engineering in Computer Science program shall consist of 165 credits. The number of courses including marks and credits of each course will be determined by the academic committee of the concerned department and approved by the university and UGC authority.

07. Evaluation System

a) Performance of students in a theoretical course will be evaluated as follows:

Internal Evaluation:

Midterm test	: 1 × 20 = 20
Class Performance / Participation/ Class Study/ Quiz/ Assignment/ Class test without notice	= 10
Class Attendance	= 10
Year-end Final Examination	= 60

Performance of students in a practical course will be evaluated as follows:

Continuous Assessment (Quiz 5, class test 5, assignment 5 lab report and term paper 15, lab attendance 10)	= 40
Project (work 10, report 5, presentation 5)	= 20
Lab Examination (script 15, experiment 15, viva 10)	= 40

b) Three copies of the total mark obtained by the students in internal evaluation, class attendance, assignments etc. shall be prepared and two copies shall be submitted to the Chairman of the Examination Committee and 1 copy shall be published and hung on the notice board before the semester final examination starts. The marks for class attendance will be as follows:

Attendance	**Marks**
90% and above	10%
80% to 89%	80%
70% to 79%	60%
60% to 69%	40%
50% to 59%	20%
Less than 50 %	0

A student will not be allowed to appear at the examination of a course if his/ her class attendance in that course is less than 50%.

c) There will be a semester final examination. The duration of the final examination of each course shall be of 3 (three) hours. Number and formation of question shall be determined by the department.

d) Two evaluators considered as 1st and 2nd examiners will evaluate the scripts of semester final/grade improvement/special examinations. Course teacher will be appointed as the first examiner and second examiner will be appointed by the concern examination committee. The examiners will act as question-setters & script evaluators.

e) If a course is conducted by more than one teacher, the examination committee will select any one of them as first examiner who will set question paper and give internal

evaluation marks.

f) The arithmetic mean of the marks given by two examiners shall be taken. If the marks given by two examiners differ by 20% or more, the Examination Committee shall appoint 3rd examiner to examine the script. In this case the arithmetic mean of two nearest marks shall be taken. In the event of equal difference of marks among the three examiners, the average of the two higher marks shall be considered. The third examiner would be appointed by the concerned Examination Committee who would be other than a member of the Examination Committee or a tabulator, provided that he/ she was not an examiner of this course.

g) Total marks of a student in each course (final examination and internal evaluation) should be rounded up.

h) Total marks obtained in each course shall be converted into LG (Letter Grade) and GP (Grade Point) as under:

Numerical Grade	Letter Grade		Grade Point	Interpretation
80% and above	A+	(A plus)	4·00	Outstanding
75% to less than 80%	A	(A regular)	3·75	Excellent
70% to less than 75%	A−	(A minus)	3·50	Very Good
65% to less than 70%	B+	(B plus)	3·25	Good
60% to less than 65%	B	(B regular)	3·00	Satisfactory
55% to less than 60%	B−	(B minus)	2·75	Below Satisfactory
50% to less than 55%	C+	(C plus)	2·50	Average
45% to less than 50%	C	(C regular)	2·25	Below Average
40% to less than 45%	D	--	2·00	Poor
Less than 40%	F	--	0	Fail

i) The 1st, 2nd and 3rd (if any) examiners shall prepare 3 copies of mark sheets (1 copy in detail and 2 copies in integrated form) and submit to the Chairman of the Examination Committee.

08. Examination Committee:

a. The Academic Committee of the Department shall constitute an Examination Committee for each year (for 2 semesters). The Examination Committee shall consist of three members selected by the Academic Committee. One will act as chairman of the committee. In case of 4th year exam committee one additional member should be nominated from same or relevant department/discipline of other university not below the rank of associate Professor.

b. The Examination Committee will moderate and shall make arrangement for writing

and/or printing of question papers, fix dates for conducting viva-voce examination and prepare the results.

c. On receipt of question papers the Chairman of the Examination Committee shall convene the meeting of the Examination Committee for moderation of question papers. If the question paper of any course is not received either from first or second examiners the moderation work shall not be invalidated.

d. After preparing of results the Chairman of the Examination Committee will hand over the course-wise mark sheets, average sheets and all other relevant documents to the Controller of Examinations for publication.

09. **Exam and Result Publication**:

a) The Controller of Examinations shall be responsible for safe custody of answer scripts and will distribute these to the 1st, 2nd or 3rd (if necessary) examiners along with the supporting things (such as: questions, top sheet, detailed & integrated blank mark sheet, envelops, etc.).

b) The following information shall be shown in the tabulation sheet:
Internal evaluation, written & total marks, viva-voce, individual LG & GP, points secured, GPA, AGPA, CGPA LG of GPA and EC.

[The elaborations of the abbreviations are LG = Letter Grade; GP = Grade Point; GPA = Grade Point Average; AGPA = Accumulated Grade Point Average; CGPA = Cumulative Grade Point Average; EC = Earned Credit]

c) The members of the Examination Committee shall ordinarily act as tabulators. If necessary, the concern exam committee shall appoint tabulators other than the members of the Examination Committee. The tabulators will prepare 3 (three) sets of result sheets and will send to the Controller of Examinations for publication. Provided that the transcript/grade sheet showing course-wise LG and the corresponding grade points (the numerical marks will not be shown), the CGPA, EC, LG and the interpretation of the CGPA of the candidates for the BSc Engineering in Computer Science degree. Final grade must be spelled out clearly in the certificate/ transcript [Example: C+ = 'C+' (C plus); A- = 'A-' (A minus); B = 'B' (B regular)].

d) The result of an examination shall be published within one month (in case of final result of BSc Engineering in Computer Science program within one and a half months) from the date of last course final examination.

10. **Promotion**

A student failing to clear up dues shall not be promoted to the next semester. If a student fails to attend or to earn D grade of maximum two courses in a semester, he or she may be promoted to the next semester. But he/she must attend or earn credit by next semester.

11. Degree Requirements

For the BSc Engineering in Computer Science degree each student shall require to:

a. Earn 165 credits successfully;

b. Earn a minimum CGPA of 2.50;

c. Obtain a minimum Letter Grade of C+ (GP 2.50) in the Viva-Voce examination; and

d. Complete the program in minimum four academic years from the first admission year into the program but not more than seven years.

A student of BSc Engineering in Computer Science degree will be awarded with distinction if his/her CGPA is 3.90 or above and he/she does not have any 'F' grade in the total program.

12. Examination Entry Requirements

a. A student shall have to attend at least 75% of classes held in a course. The Academic Committee of the Department may recommend a shortage of attendance (not below 50%) for consideration. A candidate taking his / her examination under the benefit of this provision (from 50% to 74%) shall have to pay prescribed fees for each course as non-collegiate fee.

b. Each course teacher shall submit the class attendance report along with the register/documents to the Chairman of the Department at least 10 days before the processing of the examination entry form.

c. Student failing to clear up dues of the program shall not be permitted to appear at that semester final examination.

d. A student is required to fill-up the examination entry form and pay University dues within the time specified by the authority for taking each semester final examination

13. Retaking Examination and Improving Grades

a. Students obtaining the below letter grade 'B-' (less than GP 2.75) in any course in any semester shall be allowed to improve the grade in the subsequent examination

b. For improving the grade and appearing at the examination a student is required to pay necessary fees for each course as examination fee and send application to the authority within 20 days from the date of publication of the result of BSc Engineering in Computer Science program. If a student fails to improve his/her CGPA his/her previous GPA will remain valid.

c. No improvement shall be allowed in internal evaluation (in-course/assignment /practical/case study/term paper/quiz test etc.) and viva-voce examination.

14. Re-Admission

a. If a student fails to appear at the semester final Examination, fails to appear at the examinations due to shortage of required percentage of attendance or fails to pay the dues for some unavoidable circumstances or is expelled from the University for any reason, as the case may be, he/she shall have to get himself/herself re-admitted to the subsequent Batch.

b. If a student fails to get the requisite grade points for promotion form one semester to the next semester he/she may seek re-admission with the subsequent Batch. For re-admission a student shall have to apply immediately (within 15 days) after announcement of the result of the concerned Semester.

c. On re-admission grades earlier earned by a student in any semester shall be cancelled automatically and the student shall have to retake all the course-works (such as: internal evaluation, thesis, viva-voce and examination).
d. Re-admission in any year shall be allowed only once and a student will not get chance for re-admission more than once during the entire program. A student must complete the BSc Engineering in Computer Science program during the entire program. A student must complete the BSc Engineering in Computer Science program within a maximum period of six academic years from the original admission year.

15. Drop Out

a. After taking readmission in any semester if a student fails to earn the GPA for promotion from one semester to the next semester he/she shall be dropped out of the program.
b. If a student fails to earn the CGPA 2.50 or to earn 165 credits successfully in grade improvement examination/F grade improvement examination (he/she shall be dropped out of the BSc Engineering in Computer Science program.

16. Credit Transfer

Credit transfer from any other program/University/Institutions is allowed for BSc Engineering in Computer Science program.

17. Academic Administration

a. The academic calendar showing dates for beginning and ending classes, commencement of examinations and probable date for publication of the results shall be published by the university authority before commencement of each semester.
b. Re-examination of any script shall not be allowed.
c. The Examination Committee will start tabulation work after receiving all the marks of the examinations. Modification of submitted marks shall not be accepted.
d. Within the framework of these rules and the rules of the University the Departmental Academic Committee may adopt policies for strengthening the academic and extra-academic activities of the Department.

18. Award of Degree

The university will award the degree of BSc Engineering in Computer Science on recommendation of the academic council.

19. Addition, Alteration, Change or Modification of the Rule

In order to make any addition, alteration to or change or modification of this rule (if required) it must be placed to the Academic Council for approval.

Marks and Credits at a glance

Semester	Marks	Credits
1st Year 1st Semester	650	17.5
1st Year 2nd Semester	750	20.5
2nd Year 1st Semester	800	21.5
2nd Year 2nd Semester	700	21.0
3rd Year 1st Semester	750	21.0
3rd Year 2nd Semester	850	23.0
4th Year 1st Semester	700	19.5
4th Year 2nd Semester	600	18.0
Viva Voce	200	3.0
Total	**6000**	**165.0**

First Year First Semester

Code	Course Title	Marks	Credits
CSE 1101	Introduction to Computer Systems	100	2.0
CSE 1102	Programming Fundamentals	100	3.0
CSE 1103	Programming Fundamentals Lab I	50	1.5
CHEM 1101	Chemistry	100	2.0
MATH 1101	Differential Calculus and Co-ordinate Geometry	100	3.0
GED 01	বাংলা ভাষা	100	3.0
GED 02	English I : Basic Communicative Skills	100	3.0
	Total	**650**	**17.5**

First Year Second Semester

Code	Course Title	Marks	Credits
CSE 1201	Discrete Mathematics	100	2.0
CSE 1202	Object Oriented Programming using C++	100	3.0
CSE 1203	Object Oriented Programming using C++ Lab	50	1.5
PHY 1201	Physics	100	2.0
EEE 1201	Introduction to Electrical Engineering	100	3.0
EEE 1202	Introduction to Electrical Engineering Lab.	50	1.5
EEE 1203	Engineering Drawing	50	1.5
MATH 1201	Integral Calculus, Ordinary and Partial Differential Equations, and Series Solutions	100	3.0
GED 03	English –II: Advanced Reading and Writing	100	3.0
	Total	**750**	**20.5**

Second Year First Semester

Code	Course Title	Marks	Credits
CSE 2101	Data Structures	100	2.0
CSE 2102	Data Structures Lab.	50	1.0
CSE 2103	Digital Logic Design	100	3.0
CSE 2104	Digital Logic Design Lab.	50	1.5
EEE 2101	Electronic Devices and Circuits	100	3.0
EEE 2102	Electronic Devices and Circuits Lab.	50	1.5

EEE 2103	Basic Mechanical Engineering	100	2.0
MATH 2101	Complex Variables and Matrices	100	3.0
CSE 2105	Object Oriented Programming using Java	100	3.0
CSE 2106	Object Oriented Programming using Java Lab	50	1.5
	Total	**800**	**21.5**

Second Year Second Semester

Code	Course Title	Marks	Credits
CSE 2201	Algorithms	100	3.0
CSE 2202	Algorithms Lab.	50	1.5
CSE 2203	Database Management System	100	3.0
CSE 2204	Database Management System Lab.	50	1.5
CSE 2205	Computer Architecture	100	3.0
CSE 2206	Data Communication	100	3.0
STAT 2201	Statistics and Probability	100	3.0
MATH 2201	Vectors, Fourier Analysis, and Laplace Transforms	100	3.0
	Total	**700**	**21.0**

Third Year First Semester

Code	Course Title	Marks	Credits
CSE 3101	Peripherals and Interfacing	100	3.0
CSE 3102	Peripherals and Interfacing Lab.	50	1.5
CSE 3103	Software Engineering and Information System Design	100	3.0
CSE 3104	Software Engineering and Information System Design Lab.	50	1.5
CSE 3105	Operating System	100	3.0
CSE 3106	Numerical Methods	100	3.0
CSE 3107	Technical Writing and Presentation	50	1.0
GED 04	History of Emergence of Independent Bangladesh	100	3.0
BUS 3101	Financial and Managerial Accounting	100	2.0
	Total	**750**	**21.0**

Third Year Second Semester

Code	Course Title	Marks	Credits
CSE 3201	Mathematical Analysis for Computer Science	100	3.0
CSE 3202	Theory of Computation	100	3.0
CSE 3203	Computer Networks	100	3.0
CSE 3204	Computer Networks Lab.	50	1.5
CSE 3205	Microprocessors and Microcontrollers	100	3.0
CSE 3206	Assembly Language, Microprocessors and Microcontrollers Lab	50	1.5
CSE 3207	Web Engineering	100	2.0
CSE 3208	Web Engineering Lab	50	1.0
GED 08	Socio-economic and Political Studies of Bangladesh	100	3.0
BUS 3201	Professional Ethics and Industrial Management	100	2.0
	Total	**850**	**23.0**

Fourth Year First Semester

Course Code	Course Title	Marks	Credits
CSE 4101	Artificial Intelligence	100	3.0
CSE 4102	Artificial Intelligence Lab.	50	1.5
CSE 4103	Compiler Design and Construction	100	3.0
CSE 4104	Compiler Design and Construction Lab.	50	1.5
CSE 4105	Cryptography and Network Security	100	3.0
CSE 4106	Cryptography and Network Security Lab	50	1.5
CSE 4107	Simulation and Modeling	100	3.0
CSE 4108	Computer Graphics	100	2.0
CSE 4109	Computer Graphics Lab.	50	1.0
	Total	**700**	**19.5**

Fourth Year Second Semester

Course Code	Course Title	Marks	Credits
CSE 4201	Digital Signal and Image Processing	100	3.0
CSE 4201	Project and Thesis	200	6.0
CSE-****	Optional Course 1	100	3.0
CSE-****	Optional Course 1 Lab.	50	1.5
CSE-****	Optional Course 2	100	3.0
CSE-****	Optional Course 2 Lab.	50	1.5
	Total	**600**	**18.0**

Optional Courses:

Course Code	Course Title	Credits
CSE 4203	Distributed Systems	3.0
CSE 4204	Distributed Systems Lab	1.5
CSE 4205	System Programming	3.0
CSE 4206	System Programming Lab.	1.5
CSE 4207	Basic Multimedia Theory	3.0
CSE 4208	Multimedia Lab	1.5
CSE 4209	Algorithm Engineering	3.0
CSE 4210	Algorithm Engineering Lab.	1.5
CSE 4211	Computational Geometry	3.0
CSE 4212	Computational Geometry Lab.	1.5
CSE 4213	Machine Learning and Data Mining	3.0
CSE 4214	Machine Learning and Data Mining Lab.	1.5
CSE 4215	Pattern Recognition	3.0
CSE 4216	Pattern Recognition Lab.	1.5
CSE 4217	VLSI Design	3.0
CSE 4218	VLSI Design Lab.	1.5
CSE 4219	Wireless Networks	3.0
CSE 4220	Wireless Networks Lab.	1.5
CSE 4221	Optical Fiber Communication	3.0
CSE 4222	Optical Fiber Communication Lab	1.5
CSE 4223	Human Computer Interaction	3.0
CSE 4224	Human Computer Interaction Lab	1.5

CSE 4225	Mobile Computing	3.0
CSE 4226	Mobile Computing Lab	1.5

First Year First Semester

CSE 1101: Introduction to Computer Systems

Computer Generations and Classification: Definition, functions and characteristics of computers, Block diagram, Computer Generations, Moore's Law, Classification of Computers, Hardware, Software and Firmware, Computers' impact on society.
Data representation: The decimal, binary, octal and hexadecimal number systems, Binary arithmetic in computers, Conversion Algorithms. Binary Codes, Weighted binary codes, Non-weighted binary code, Error detecting and correcting codes, Representation of characters, integers, and fractions in computers; Alphanumeric codes.
Hardware Components: Input/output units, Memory units, CPU, Logic Circuits; Machine architecture; Distributed Computer system, Parallel Computer System,
Software Components: Programming languages and their classifications, Assembler, Compiler and Interpreter, Structured and blocked structured languages, procedural and non-procedural programming, Types of software: Systems software, Application packages.
Operating Systems: Need for an Operating System (OS), Types of OS, Example of Operating Systems: DOS, Windows and Linux.
Computers and Communications: Types of Communications with and among computers; Need for Computer Communication Networks; Internet and the World Wide Web; Introduction to HyperText Markup Language (HTML) and Web page.
Application Software: MS Word, MS Excel, MS Access etc.

Books Recommended:

1. P. K. Sinha : Fundamentals of Computer
2. V. Rajaraman : Fundamentals of Computers
3. Jain, Satish : Introduction to Computer Science Vol. I & II

CSE 1102: Programming Fundamentals

Problem solving techniques: Problem Analysis, Algorithm, Flowchart, Debugging, Coding and Documentation.
Programming in C: An overview of C; variables, constants, operators and expressions; program control statements; functions, arrays, pointers, Structures, unions and user-defined types and enumeration; Storage Management and Dynamic Data Structures; Input output and disk files; Pre-processors, Bit field operators, Libraries, Linking libraries and header files, Graphics programming.

Books Recommended

1. Balagurusamy E : Programming in ANSI C
2. H Schildt : Turbo C/C++: The Complete Reference
3. Cochan S G : Programming in C
4. Gottfried : Programming with C

CSE 1103: Programming Fundamentals Lab I

Laboratory works based on CSE 1102

CHEM 1101: Chemistry

Atomic structure, quantum numbers, electronic configuration, periodic table; Properties and uses of noble gases; Different types of chemical bonds and their properties; Molecular structure of compounds; Selective organic reactions; Different types of solutions and their compositions; Phase rule, phase diagram of monocomponent system; Properties of dilute solutions; Thermochemistry, chemical kinetics, chemical equilibria; Ionization of water and pH concept; Electrical properties of Solution.

MATH 1101: Differential Calculus and Co-ordinate Geometry

Differential Calculus: Limits, continuity, and differentiation of real-valued functions. Successive differentiation. Expansion of functions. Maxima and Minima. Partial differentiation. Tangent and Normal.
Co-ordinate Geometry: Transformation of co-ordinates axes and its uses; Equation of conics and its reduction to standard forms; Pair of straight lines; Homogeneous equations of second degree; Angle between a pair of straight lines; Pair of lines joining the origin to the point of intersection of two given curves, circles; System of circles; Orthogonal circles; Radical axis, radical center, properties of radical axes; Coaxial circles and limiting points; Equations of parabola, ellipse and hyperbola in cartesian and polar co-ordinates; Tangents and normals, pair of tangents; Chord of contact; Chord in terms of its middle points; Pole and polar parametric co-ordinates; Diameters; Conjugate diameters and their properties; Director circles and asymptotes.

GED 01: বাংলা ভাষা

ক. ভাষার পরিচয়, বাংলা ভাষার উদ্ভব ও ক্রমবিকাশ, বাংলা লিপির সাধারণ পরিচিতি

খ. ধ্বনি ও বর্ণ প্রকরণ, ধ্বণি পরিবর্তন, অক্ষর, উচচারণ।

গ. বাংলা শব্দগঠন প্রক্রিয়া, শব্দের উৎস-পরিচয়, শব্দের অপপ্রয়োগ ও বিশিষ্টার্থক প্রয়োগ, প্রায় সমোচ্চারিত ভিন্নার্থক শব্দ।

ঘ. বাংলা বানান : ণ-ত্ব ও ষ-ত্ব বিধান, বাংলা বানান সংস্কারের ইতিহাস, বানান ভুলের কারণ ও প্রতিকার, বাংলা একাডেমি প্রণীত প্রমিত বাংলা বানানের নিয়মাবলী।

ঙ. ভাষার রীতি : সাধু, চলিত, আঞ্চলিক ও প্রমিত ভাষা। বিরাম চিহ্নের ব্যবহার।

চ. অভিধান : ব্যবহার পদ্ধতি ও গুরুত্ব।

ছ. পদ প্রকরণ, বাক্য প্রকরণ, উপসর্গ-অনুসর্গ, প্রকৃতি-প্রত্যয়, কারক-বিভক্তি, সমাস, বাগধারা, প্রবাদ-প্রবচন।

জ. বাংলা লিখনকৌশল : প্রতিবেদন, স্মারকলিপি, জীবন বৃত্তান্ত, আবেদন পত্র ইত্যাদি।

সহায়ক গ্রন্থাবলি:

বাংলা একাডেমি : প্রমিত বাংলা ভাষার ব্যাকরণ

GED 02: English-I Basic Communicative Skills

Introduction to Language, Grammar items i.e., use of articles, parts of speech, number, tense, subject-verb-agreement, modals, punctuation, Sentence construction, transformation of sentences, simple passive voice construction and conditionals etc. Oral and Writing Skills, Essential Elements of Good Writing, Developing a Good Writing Style, Spoken Word Skills, Developing Good Speaking Style and Listening.

Books Recommended

Ahmed, Sadruddin : *English Learning: The Easy Way*
McCarthy and O'Dell : *English Grammar in Use for Intermediate Level*
Murphy, Remond : *English Vocabulary in Use for Advance Level*
Wren and Martin : *High School Grammar and Composition*

First Year Second Semester

CSE 1201: Discrete Mathematics

Mathematical Logic: Statements and Notation, Connectives: Negation, Conjunction, Disjunction, Statement Formulas and Truth Tables; Conditional and Biconditional; Tautologies; Equivalence of Formulas; Duality Law; Tautological Implications; Functionally Complete Sets of Connectives; Normal Forms; Ordering and Uniqueness of Normal Forms; Rules of Inference; Methods of Proof.
Predicate Calculus: Predicates; Statement Function; Variables; and Quantifiers; Predicate Formulas; Free and Bound Variables; The Universe of Discourse.
Rules of Inference: Universal Specification; Existential Specification; Existential Generalization; and Universal Generalization. Mathematical Induction.
Elements of Number Theory: Modular Arithmetic and The Euclidean Algorithm.
Relations and Functions: Properties of Binary Relations, Composition of Binary relations, Relation matrix and Graph of a Relation. Functions: Characteristic function, Floor function, Ceiling function and Hashing functions.
Groups, Semigroups and Monoids: Definition of Groups and examples, Homomorphism, Product and Quotients of groups Homomorphism of semigroups and monoids, Grammars and languages, Formal definition of a language.

Books Recommended

1. Rosen, K. H. : Discrete Mathematics and its Applications
2. Koleman & Busby : Discrete Mathematical Structures for Computer Science

CSE 1202: Object Oriented Programming using C++

Principle of Object-oriented programming: Software evolution; A look at Procedure-oriented programming; Object-oriented programming paradigm; Basic concepts of Object-Oriented Programming (OOP); Benefits of OOP. Object-Oriented Programming languages.
Object-Oriented Programming with C++: Tokens, Expressions Control Structures, and Functions in C++; Classes and Objects, Constructors and Destructors, Parameterized Constructors, Friend Functions, Function and Operator overloading and Type Conversions. Inheritance: Single, Multilevel, Multiple, Hierarchical, and Hybrid inheritance; Virtual base classes, Constructor in derived classes; Nesting of classes. Virtual Functions: Pointers to Objects, **this** pointer, Pointer to derived classes, Virtual Functions, Pure Virtual Functions, Early versus late binding. C++ I/O operations: C++ streams, C++ stream classes, Unformatted console I/O operations, Formatting I/O, Creating manipulator functions, Classes for file stream operations, Opening and Closing a File, Detecting EOF, File pointers and their manipulations, Sequential and Random I/O operations, Error handling during file operations. Templates; Exception handling; Introduction to the Standard Template Library; Manipulating Strings. Object-Oriented System Development concepts.

Books recommended

1. Balagurusamy, E : Object Oriented Programming with C++
2. Schildt, H : Turbo C/C++: The Complete Reference
3. D Ravichandran : Programming with C++

CSE 1203: Object Oriented Programming using C++ Lab

Laboratory works based on **CSE 1203**.

PHY 1201: Physics

Electricity and Magnetism: Static electricity: Charge, Electric field, Electric dipole, Dipole in an electric field, Calculation of electric field from electric dipole. Gauss's theorem and its application. Current: Current and current density, Drift speed, EMF, RC circuit. Electromagnetism: Ampere's law, Faraday's law, Biot-Savart law, Inductance, Calculation of inductance (LR circuit). Magnetism: Intensity of magnetism, Permeability, Susceptibility, Paramagnetic, Diamagnetic and Ferromagnetic substances. States of Matter: Solid, Liquid and Gas, different types of bonds, Inter-atomic force, Conductor, Insulator and semiconductor, Properties of semiconductor, Bands in semiconductor, Energy band description of semiconductor, Effect of temperature on semiconductor, P-type and N-type semiconductor, P-N junction.
Waves and Oscillations: Oscillations: Simple harmonic motion (SHM), Damped harmonic motion, Forced oscillation, Combination and composition of simple harmonic motions, Lissajous figures. Transverse and Longitudinal nature of waves, Travelling and standing waves, Intensity of waves, Energy calculation of travelling and standing waves, Phase velocity and group velocity. Sound waves: Velocity of longitudinal wave in a gaseous medium, Doppler Effect.
Physical Optics: Theories of light: Different theories of light, Huygen's principles and constructions. Interference of light: Coherent source, Relation between path difference and phase difference, Definition of interference, Young's double slit experiment, Interference in thin film, Newton's ring. Diffraction of light: Fresnel and Fraunhoffer diffraction, Diffraction by single slit, Diffraction by double slit. Polarization of light: Brewster's law, Malus law.

EEE 1201: Introduction to Electrical Engineering

Electrical Circuit: Concepts of Electrical Networks; Nodal analysis with voltage and current sources; Thevenin's and Norton's Theorems; Superposition Theorem; Maximum Power Transfer Theorem; Star and Delta Conversions;
The Magnetic Field: Definition of B, Effect of magnetic force on current, Torque on a current Loop, Hall effect; Ampere's Law: B near a long wire, Magnetic lines of induction, Two parallel conductors, B for a solenoid, The Biot-Savart's Law.
Electromagnetic: Maxwell's Equation, Electromagnetic wave equation and propagation, Pointing vector, Faraday's laws of electromagnetic induction, Lenz's Law, Motional e.m.f, Eddy current. Self and Mutual Inductance.
Transient: Transients in RC, RL, RLC Circuits; Energy in magnetic field.
Filters: Different types of Filters; T and π networks, K-Type Low-Pass, High Pass, Band-Pass and Band-Elimination Filters;
AC Theory and Circuits: General AC Theory; AC Power; Average & RMS Value of AC Voltage & Current, Series and Parallel Resonant circuits, Q Value & Bandwidth, Phasor Algebra;

Books Recommended

1. D.R. Resnick and D. Halliday : Physics, Part-II
2. B. L. Theraza : Electrical Technology
3. A.R. Rafiqullah , A. K Roy & M.S Huq : Concepts of Electricity and Magnetism
4. B. Grobe : Basic Electronics.
5. Cochan S G : Fundamentals of Electricity and Magnetism.
6. J. D. Ryder Networks, Lines and Fields
7. Corson and Lorrain : Introduction to Electromagnetic Field and Waves

EEE 1202: Introduction to Electrical Engineering Lab

Laboratory works based on EEE 1201

EEE 1203: Engineering Drawing

Introduction; Instruments and their uses; First and third angle projections; Orthographic drawings; Isometric views; Missing lines and views; Sectional views and conventional practices; Auxiliary views.

MATH 1201: Integral Calculus, Ordinary and Partial Differential Equations, and Series Solutions

Integral Calculus: Methods of substitution. Integration by parts. Integration of special trigonometric and rational functions. Fundamental Theorem Calculus. General properties of definite integrals. Simple definite integrals and reduction formula. Length and areas of plane curves. Volumes and surface-areas of solids of revolution.
Differential Equations: Exact Solution of First-Order Ordinary Differential Equations: Exact Differential Equations and Integrating Factors, Separable Equations and Equations reducible to this form, Linear Equations and Bernoulli Equations.
Explicit Solution of Higher-Order Linear Differential Equations: Basic Theory, Homogeneous Linear Equation with Constant Coefficients, Method of Undetermined Coefficients, Variation of Parameters, Cauchy-Euler Equation.
Series Solutions of Linear Differential Equations: Power Series Solutions about an Ordinary Point, Solutions about Singular Points; The Method of Frobenius.

Books Recommended

1.	Das and Mukherjee	**:**	Differential Calculus
2.	Das and Mukherjee	**:**	Integral Calculus
3.	Ayres, F	**:**	Calculus
4.	Edwards	**:**	Differential Calculus
5.	Sapely L Ross	**:**	Differential Equations

GED 03: English-II Advanced Reading and Writing

Reading: The purpose of reading skills is to provide students with the necessary tools to become competent and avid readers. **Reading strategies** (skimming, scanning, predicting, inferencing, intensive & extensive reading etc.). **Active reading** (highlighting, getting information from text, noting key words, following main arguments, summarizing) **Reading** to improve linguistic skills and expand vocabulary **Reading** journal articles and literary criticism

Writing: Writing with purpose and for specific audience, Writing the first draft, Revising and editing, Writing the final draft, Supporting details and conclusion Effective writing: Creating emphasis and variety.

Paragraph: Paragraph structure – topic sentence, transitional devices, unity, order, coherence, conclusion
Essay: Essay structure – beginning, middle, end Essay forms – narrative, descriptive, expository, critical

Letter Writing: Formal and informal letter etc.

Books Recommended
1. Professor Dr. M. Maniruzzaman. Advanced Reading and Writing Skills, Friends Book Corner, Dhaka.

2. Kristina Browne, Susan Hood, 1989: Writing Matters. Writing Skills and Strategic for Students of English, CUP.
3. J. Karl Nicholas, James R. Nichol, 1981: Rhetorical Models for Effective Writing. Winthrop Publishes, Inc, Cambridge, Massachusetts.
4. Moris Imhoof and Hurman Hudson, From Paragraph to Essay, Oxford University Press
5. Simon Greenwell and Michael Swan, 1986: Effective Reading. Reading Skills for Advanced Students. CUP

Second Year First Semester

CSE 2101: Data Structures

Introduction: Basic Terminology, Elementary Data Organization, Data Structures, Algorithms, and Complexity of Algorithms
Stacks, Queues and Recursion: Fundamentals, Different types of stacks and queues: Circular, deques etc.; Evaluation of expressions, Multiple stacks and queues; Recursion, Direct and indirect recursion, Depth of recursion, Simulation of Recursion, Removal of Recursion; Towers of Hanoi.
Graphs: Introduction, definition and terminology, graph representations, traversals, connected components and spanning trees, shortest path and transitive closure, activity networks, topological sort and critical paths, enumerating all paths.
Trees: Basic terminology, Binary trees, binary tree representations, binary tree traversal; Binary search tree, tree search, Insert into a search tree, tree sort algorithm, deletion from a search tree, Building a binary search tree, Inserting a node, AVL trees, Forming a heap;
Linked Lists: Single linked lists, Linked stacks and queues, the storage pool, polynomial addition, equivalence relations, sparse matrices, doubly linked lists and dynamic storage management, generalized lists, garbage collection and compaction.
Extended binary trees: 2-trees, internal and external path lengths, Huffman codes/algorithm; Threaded binary trees, binary tree representation of trees; Application of Trees: Set representation, decision trees, game trees; Counting binary trees.
Sorting: Searching, bubble sort, shell sort, insertion sort, selection sort, quick sort, heap sort, 2-way merge sort, sorting on several keys, practical considerations of internal sorting.

Books Recommended

1.	Lipschutz	**:**	Data Structures, Schaum's Outline
2.	Reingold and Hansen	**:**	Data Structure
3.	Taunenbaum, Langsam	**:**	Data Structure Using C
4.	Robert L. Kruse	**:**	Data Structure and Program Design

CSE 2102: Data Structures Lab
Laboratory works based on CSE 2101

CSE 2103: Digital Logic Design

Introduction to Logic Gates: Different types of logic gates and their truth table, Boolean Algebra. Combinational logic circuits, Minimization of switching functions: Karnaugh map, and Quine-McClusky methods.

Digital Arithmetic Circuits: Half adder; Full adder; Parallel adders; 2's complement system; Look ahead carry adder; The BCD adder.
Combinational Logic Circuits: Decoder, Encoder, 7-segment Decoder, Multiplexer and Demultiplexers.
Flip Flop and related devices: Latches, Clocked SR, JK, D & T flip-flops, FF timing considerations, Master-slave flip-flops, FF applications; Frequency division & counting.
Counters and Registers: Asynchronous and Synchronous counter, n-mod counters, propagation delay, Parallel up, down and up/down counters, presettable counters, cascading counters, Shift-register counters, Frequency counters, Digital clock.
D/A and A/D conversion: D/A-converter circuitry, DAC specification, and DAC applications. Analog-to-Digital conversion: Digital-ramp, Successive approximation, Flash and tristate ADCs. Digital Voltmeter.
Semiconductor terminology: Semiconductor memory terminology; Read-Only Memories, ROM architecture, ROM timing, types of ROMs, Flash Memory, ROM applications, Programmable Logic Devices. RAM architecture, Static RAM and Dynamic RAM, Dynamic RAM structure and operation, DRAM read/write cycles, DRAM refreshing, DRAM technology, Expanding word size and capacity, Magnetic bubble and CCD memory.

Books Recommended

1. Tocci, R.J. : Digital systems
2. Mano, M : Computer System Architecture
3. Malvino & Leach : Digital principles and Applications
4. Jain R. P. : Modern Digital Electronics

CSE 2104: Digital Logic Design Lab
Laboratory works based on CSE 2103.

EEE 2101: Electronic Devices and Circuits
Energy Bands in Solids: The nature of the Atom, Atomic energy levels, Valence and conduction bands, Conductors, Semiconductors and Insulators.
Semiconductor Diode and Rectifiers: Semiconductors' characteristics and their types, P-N Junction Diodes and their V-I Characteristics; Zener Diode, Ideal Rectifier Concept, P-N Junction Diode as a Rectifier; Half-wave and Full-wave Rectifiers; Rectifier Filters and Ripple Factor, Voltage Regulator Using Zener Diode, Clipper, Clamper.
Transistor: PNP and NPN Junction Transistors; CB, CE and CC Configurations and their V_c-I_c Characteristics; Transistor Action; Different Types and Biasing; Bias Stabilisation; Operating Point; DC and AC Load Lines; Dynamic Transfer Curve, Current, Voltage and Power Gains. Transistor as a Circuit Element, Transistor Hybrid Parameters.
Transistor Amplifiers: Transistor DC Amplifiers; CE, CB and CC Amplifiers , their Equivalent Circuits and Computation of Current, Voltage and Power Gains; Class A, Class B and Class C Amplifiers, class AB pushpull Amplifier.
Feedback Circuits: Feedback Principles and Characteristics; Current and Voltage Feedback Amplifiers; Positive and negative feedback.
Oscillators: Oscillators and Conditions for Sustained Oscillations; RC Phase Shift, Collpit and Crystal Oscillators.
MOS devices: Introduction to JFET, MOSFET, PMOS, NMOS & CMOS: biasing & application in switching circuits.
Optoelectronic devices: PN & PIN photodiode, phototransistor; solar cell, photocell, LED, LCD & alphanumeric display.

Books Recommended:

1.	V.K.Mehta	**:**	Principles of Electronics.
2.	Theraja, B L	**:**	Basic Electronics
3.	Robert Boylsted & Louis Noshelsky	**:**	Electronics Device and Circuits Theory
4.	S. L. Gupta & V. Kumar	**:**	Handbook of Electronics
5.	J. J. Brophy	**:**	Basic Electronics for Scientists
6.	J. J. Millman & C. C Halkias	**:**	Electronics Devices and Circuits

EEE 2102: Electronic Devices and Circuits Lab

Laboratory works based on EEE 2101.

EEE 2103: Basic Mechanical Engineering

Sources of energy: conventional and renewable; Introduction to IC engines, Refrigeration and Air conditioning systems. Statics of particles and rigid bodies; Forces in trusses and frames; Relative motion; Kinematics of particles: Newton's Second Law of Motion; Kinematics of rigid bodies.
Introduction to Robotics; Plane, rotational and spatial motion with applications to manipulators; Geometric configurations: structural elements, linkage, arms and grippers; Motion characteristics.

MATH 2101: Complex Variable and Matrices

Complex Variable: Complex number system; General functions of a complex variable; Limits and continuity of a function of complex variable and related theorems; Complex differentiation and the Cauchy Riemann Equations; Mapping by elementary functions; Line integral of a complex function; Cauchy Integral Theorem; Cauchy Integral Formula; Liouville Theorem; Taylor Theorem and Laurent Theorem. Singular points; Residue; Cauchy Residue Theorem. Evaluation of residues; Contour integration; Conformal mapping.
Matrices: Definition and Algebra of matrices; Special types of matrices. Determinant of a square matrix: Properties; Crammer's rule; Rank of a matrix; elementary transformation and normal form. The adjoint and inverse of a square matrix. Matrix inversion by partitioning; Solution of system of linear equations: Gauss-Jordan method.

CSE 2105: Object Oriented Programming using Java

Programming with JAVA: Data Types; Variables, and Arrays; Operators; Control Statements; Classes and Methods; Inheritance; Packages and Interfaces; Exception handling; Multithreaded programming. Input/Output; Abstract Window Toolkit (AWT) and Swing; Java Applet.
Network Programming in Java: Socket overview, Reserved Socket, Internet Addressing, Java and the Net, InetAddress, TCP/IP Client Sockets, TCP/IP Server Sockets, Datagrams; Datagram Server and Client.

Books Recommended

1.	Deitel and Deitel	**:**	JAVA- How to program
2.	Balagurusamy, E	**:**	JAVA
3.	Herbert Schildt and Patrick Naughton	**:**	JAVA- The Complete Reference
4.	Eliot Rusty Harold	**:**	JAVA Network Programming

CSE 2106: Object Oriented Programming using Java Lab

Laboratory work based on **CSE 2105**.

Second Year Second Semester

CSE 2201: Algorithms

Algorithm Analysis: Techniques for analysis of algorithms, Methods for the design of efficient algorithm: divide and conquer, greedy method, dynamic programming, back tracking, branch and bound, Basic search and traversal techniques, graph algorithms, Algebraic simplification and transformation, lower bound theory, NP-hard and NP-complete problems.

Books Recommended

1. Horowitz and Shahny : Analysis of Algorithms

CSE 2202: Algorithms Lab

Laboratory work based on CSE 2201.

CSE 2203: Database Management System

Introduction to Database System: Purpose of database systems, View of Data, Data Models & Languages, Database Administrator & Users, System Structure
Entity-Relationship Model: Basic Concepts, Design issues, mapping constraints, keys, weak entity sets, E-R diagram and its extended features, design of an E-R database schema, reduction to table
Relational Model: Structure of Relational Database, Relational Algebra, Extended Relational-Algebra Operations, Modification of the database, Views.
Structure Query Language: Background, Basic Structure: Set, Aggregate Functions, Null Values, Nested Subqueries, Derived Relation, Views, Modification, joined relations, DDL.
Integrity Constraints: Domain Constraints, Referential Integrity, Assertions, and Triggers.
Data Storage structure: Overview of physical storage, RAID, File organization and record organization in a File, Data Dictionary storage.
Indexing and Hashing: Basic concepts, Ordered Indices, B+ tree, B tree, Hashing, Index definition in SQL.
Transaction: Transaction concept, Transaction State, Implementation of Atomicity & Durability, Concurrent execution, Serializability, Recoverability, Transaction in SQL.
Database System Structure: Networks types: Centralized, Client-Server, Parallel, Distributed System.

Books recommended

1. Korth and Silverchatz : Database System Concepts
2. O. William : Principle of Database Systems
3. Jeffrey Ullman : Relational Database Management System

CSE 2204: Database Management System Lab

Laboratory works based on CSE 2203

CSE 2205: Computer Architecture

Fundamentals of Computer Design: Introduction, definition of performance, job of computer designer, historical perspectives.
Processor design: Introduction, Processor Organization, information representation, number formats; Instruction types, assembly Language programming; Fixed point Arithmetic: Addition, subtraction, multiplication, division; ALU design, Basic ALU Organization, floating point arithmetic, arithmetic processors; Stack processor.
Control design: Introduction, Instruction Sequence, instruction interpretation; Hardwired control: Design methods, multiplier control unit, CPU control unit; Micro-programmed control: Basic concepts, control memory optimization, multiplier control unit, Micro-programmed Computers: Conventional and nanno-programmed computers;
Memory Organization: Review of primary and secondary memories; memory hierarchies; High-speed memories, Interleaved memories, Caches, associative memories.
System Organization: Communications: Introduction, bus control; I/O systems: Programmed I/O, DMA and interrupts, I/O processors, Basic concepts of parallel processing.
RISC and CISC processors: Introduction, data dependency, addressing modes, condition code, register sets, brief study of standard RISC and CISC processors.

Books Recommended

1. Hayes, J P : Computer Architecture and Organization
2. Mano, M : Computer System Architecture
3. Stone : Introduction to computer Architecture
4. Sloan, M E : Computer Hardware and Organization

CSE 2206: Data Communication

Principles of communication system: Basic constituents, classification of RF spectrum, noise
Transmission Lines and media: Introduction, primary line constant, characteristics impedence, propagation coefficient, phase and group velocity, loseless lines at radio frequency. Transmission lines at circuit elements, Smith chart, wire and wireless media.
Data Encoding Techniques: AM, FM and PM, SSB, DSB, and SSB generation, SSB circuits, Mixers & Converters.AM and FM transmitters, SSB transmitter, receiver. ASK, FSK, PSK, QPSK, PCM, DM, NRZ, NRZL, NRZI, Bipolar AMI, Pseudotemetry, Manchester and differential Manchester encoding.
Optical fiber: Introduction, Principle of light transmission, losses, dispersion, light sources, photodetector, connectors and splices. modulation techniques.
Radio wave communication: Introduction, propagation in free space, tropospheric and ionospheric propagation, surface wave. Chapman theory of layer formation, Ionospheric storm.
Satellite communication: Introduction, Types of satellite, construction, Orbit, Attitude control, Station Keeping, altitude, transmission path, VSAT

Books recommended

1. *Stallings W* : *Data Communications and Computer Networks*
2. Roddy and Coolen : Electronic Communications
3. M. S. Roden : Analog and Digital communication Systems
4. Kennedy & Davis : Electronic Communication Systems
5. William A Shay : Understanding Data Communication & Networks
6. S. E. Matter & A. G Chynoweth : Optical fibre telecommunication

STAT 2201: Statistics and Probability

Introduction: Definition and characteristic features of the science of statistics, Main divisions of statistical theory.
Frequency Distribution and Measures of Location, Measures of Dispersions, Skewness & Kurtosis, Moment of Frequency distribution: Frequency distributions, Graphical Representation of Frequency distributions, Forms of Frequency Curves, Caparison of frequency distribution, Measures of Location or Measures of central tendency, Requisites for an ideal measure of central tendency. Measures of dispersion, characteristics of an ideal measure of dispersion, moments, Sheppard's corrections to moments of grouped frequency distributions, symmetrical and skewness, kurtosis, Pearson's β-and γ -coefficients, Factorial and absolute moments
Theory of Probability: Random experiments, Sample Space, Events, Algebra of events, Types of events, Mathematical and statistical definition of probability, Theorem of total probability, its generalization and geometrical interpretation, Boole's inequality; Theorem of compound probability; Conditional Probability, Independence of events, Bayes theorem.
Discrete Probability Distributions: Binomial distributions, First four moments of the binomial distribution, Moment generating and cumulative functions of the binomial distribution, Poisson distribution, Derivation of Poisson distribution from Binomial distribution, Moment generating and cumulative functions of the Poisson distribution Mean and variance of the Poisson distribution, Mode of the Poisson distribution, Negative Binomial distribution.
Continuous Probability Distributions: Univariate distribution, Definition of moments, etc for univariate continuous probability distributions, Normal distribution, Chief features of the normal curve, Some properties of the Normal distribution, Normal approximation to the Binomial distribution, Moment generating function.

MATH 2201: Vectors, Fourier Analysis, and Laplace Transforms

Vector Spaces: Definition and properties, subspaces, basis and dimension, change of basis; Linear Transformation (LT): definition and properties, linear operator matrix, geometry of LT, standard plane LT.
Vector Algebra: Scalars and vectors, equality of vectors; Addition and subtraction of vectors; Multiplication of vectors by scalars; Scalar and vector product of two vectors and their geometrical interpretation; Triple products and multiple products; Linear dependence and independence of vectors.
Vector Calculus: Differentiation and integration of vectors together with elementary applications; Definition of line, surface and volume integrals; Gradient, divergence and curl of point functions, various formulae, Gauss theorem, Stoke theorem, Green theorem.
Fourier Analysis: Real and complex form of Fourier series; Finite transform; Fourier Integral; Fourier transforms and their uses in solving boundary value problems of wave equations.
Laplace Transforms: Definition; Laplace transforms of some elementary functions; Sufficient conditions for existence of Laplace transforms; Inverse Laplace transforms; Laplace transforms of derivatives. The unit step function; Periodic function; Some special theorems on Laplace transforms; Partial fraction; Solutions of differential equations by Laplace transforms; Evaluation of improper integrals.

Third Year First Semester

CSE 3101: Peripherals and Interfacing

Input/Output Devices: Digitizer, Scanners, OCR, bar codes, Magnetic card readers, touch screens, Printers, Monitors etc.
Disks and Drives: Floppy Disk and Drives, Hard Disk and Drives, Compact Disk and Drives etc.

Interface between Computer and the outside world: Sensors, transducers and signal conditioning, Interfacing Memory and I/O Devices such as monitors, printers, keyboard, disk drives, Data acquisition and some other smart interface cards; IEEE488 and other buses and interfacing scientific instruments. Study of Microcomputer's chips.
Microprocessors Supporting Chips: 8155, 8255, DMA controller etc.
Interfacing real worlds: Display of decimal & alphanumeric character, Measurement of electrical quantities - frequency, voltage, current etc. Temperature, water level & motor speed measurement. Traffic control.

Books Recommended

1. Rafiquzzaman : Microprocessor and Microcomputer based system design
2. Artwick : Microcomputer Interfacing
3. Ramesh Goanker : Microcomputer Interfacing

CSE 3102: Peripherals and Interfacing Lab
Lab works based on CSE 3101.

CSE 3103: Software Engineering and Information System Design

Introductory concepts: Classification of software products; Software products attributes; The need of software engineering; Software engineers' professional responsibility.
Software Process: Software engineering process, methods, and tools; Generic view of software engineering; Software process models; Fourth generation techniques; Process technology.
Project Management: Overview and importance of project management; Project management activities; Project planning; Activity organization; Project scheduling.
Software metrics: Measuring software; Lines of Code and Function Points; Metrics and software quality.
Risk Analysis and Management: Reactive versus proactive risk strategies; Software risks; Risk identification; Risk projection; Risk refinement; Risk mitigation, monitoring, and management.
Requirements and Specification: Requirements Engineering; Requirements analysis; System models; Requirements definition and specification; Software prototyping; Formal specification; Algebraic Specification; Model-based specification.
Software Design: Software design fundamentals; Architectural design; Object-oriented design; Function-oriented design; Real-time system design; User interface design.
Dependable Systems: Concepts of software reliability, reliability specification and measurement; Fault avoidance; Fault tolerance; Exception handling; Defensive programming.
Verification and Validation: Software testing fundamentals; Testing methods and strategies.
Evolution: Software maintenance; Configuration management; Software Re-engineering.

Books recommended

1. Sommerville, Ian : Software Engineering
2. Pressman, Roger S. : Software Engineering: A Practitioner's Approach
3. Mathew, Sajan : Software Engineering

CSE 3104: Software Engineering and Information System Design Lab
Lab works based on CSE 3103 and a term project.

CSE 3105: Operating System

Introduction: Evolution, Goals and Components of OS, Types of OS. Operating System Services

Process management: Process states and state transition, Process Control Blocks, Job and Process scheduling, Process Communication, Threads
CPU Scheduling: Scheduling levels, Objectives and criteria, CPU scheduling algorithms, Algorithm Evaluation
Process Synchronization: Process co-ordination, Critical section problems, Semaphores, Monitors, Classical problems of process synchronization.
Deadlock: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock prevention, avoidance, and detection, Recovery form deadlock, Deadlock handling.
Memory management: Logical and Physical Address Space, Swapping, Memory allocation schemes, Paging and Segmentation, Segmentation with Paging
Virtual memory: Demand paging, Performance of Demand Paging, Page replacement algorithms, Allocation of frames, Demand Segmentation
Secondary storage management: Disk structure; Disk scheduling, Disk management, Swap-space management, Disk reliability, Stable storage implementation
File-System: File and Directory concept, File system structure, Allocation method, Free space Management, Directory Implementation.
Protection and Security: Goals of protection, principle of protection, Access matrix, Access Control, Security problems and Threats, Computer Security, Implements Security Defenses,
Unix O/S: Overview, system structure, user perspective, O/S services, Introduction to the kernel and buffer cache, internal representation of files, Compiler, Loader, Linker, System call, Remote procedure call, Unix socket, Multithreading.

Books Recommended

1.	Silberschatz and Galvin	**:**	Operating System Concepts
2.	Stalling, William	**:**	Introduction to Operating System
3.	Milenkoviæ, Milan	**:**	Operating Systems: Concepts and Design
4.	Tanenbaum, Andrew S.	**:**	Modern Operating Systems

CSE 3106: Numerical Methods

Numerical Methods: Solutions of Polynomials and Transcendental Equations. Interpolation. Least Squares Approximation of Functions. Solution of systems of Linear equations by Gauss-Seidel iterative method. Numerical Differentiation and Integration. Numerical Solutions of Ordinary Differential Equations.
Polynomial Interpolation: Errors in interpolation, The Lagrange polynomials; Lagrange's interpolation formula for unequally spaced data.
Numerical Integration: Trapezoidal rules; Simpson's rule; Romberg's formula; Legendre polynomials.
Solution of Partial Differential Equations: Introduction, Examples of Partial differential equation, the approximation of derivatives of finite differences, Parabolic Differential, equation, Derivation of the Elliptic Differences, Laplace equation, Iterative Method, Successive Over-relaxation and Alternating and Direction methods.
Computer program for solution of numerical methods: Programs for Trapezoidal rules, Simpson's rule, Romberg's formula, Solution of equation by Gauss- Jordan elimination method, Matrix inversion method.

Books Recommended

1.	E Balagurusamy	**:**	Numerical Methods
2.	Rajaraman, V.	**:**	Computer Oriented Numerical Methods
3.	Kuo	**:**	Computer Application of Numerical Methods.
4.	I.S. Sokolnikoff & R.M. Redheffer	**:**	Mathematics for Physics and Modern Engineering

CSE 3107: Technical Writing and Presentation
Issues of technical writing and effective oral presentation in Computer Science and Engineering; Writing styles of definitions, propositions, theorems and proofs; Preparation of reports, research papers, theses and books: abstract, preface, contents, bibliography and index; Writing of book reviews and referee reports; Writing tools: LATEX; Diagram drawing software; presentation tools.

GED 04: History of Emergence of Independent Bangladesh

Pre-Pakistan Political History (up to 1947): Geographical features of Bangladesh-Ethnic composition-Language- Cultural syncretism and religion- Battle of Polashi- Movement against British Rule- Sipoy Mutiny- Division of Bengal and Annulment- Formation of Muslim League- Emergence of Pakistan-Declaration of Independence of India- Bi-nation theory- Lahore Proposal, 1940- Crips Proposal- Cabinet Mission- Independent Bengal Movement- 3rd June Plan- Division of Bengal, 1947

Politics During Pakistan Period (1947- Election of 1970): Birth of State of Pakistan- Geographical Impact on Politics- History of Governance (military rule of Ayub Khan and Yahiya Khan)- Language Movement-Election of 1954- Promulgation of Constitution in 1956 and 1962- Regional Discrimination and Provincial Autonomy Movement- Resistance against cultural aggression and resurgence of Bengali culture- Six Point Movement of Sheikh Mujibur Rahman- Agartola Conspiracy Case, 1968- Mass Upsurge of 1969- Eleven Point Movement-Election of 1970.

Background History of Liberation War (After Election - starting of Liberation War): Attitude of Pakistani Rulers and Political Instability after the Election of 1970- Yahiya- Mujib and Mujib – Bhutto Meeting-Adjournment of the Session of National Assembly by Yahiya Khan-Non-cooperation Movement under the leadership of Awami League- Hoisting of National Flag- Historical Speech of Bangobhondhu Sheikh Mujibur Rahman on 7th March – Subsequent initiatives of Political Compromise- (Sheikh Mujib-Yahiya and Sheikh Mujib-Yahiya-Bhutto Meeting)- Armed preparation to attack Bengal-25th March Black Night-Operation Searchlight and Genocide, repression, refugees- Armed Blocked.

The War of Liberation: Declaration of Independence- Revolutionist Government- Spontaneous early resistance and subsequent organized resistance (Mukti Fouz, guerrillas and the frontal warfare)- Struggle preparation from Air, Water and Land- Formation of various forces (Mujib Bahini, Kaderia Bahini etc.) - Territorial blocked- Anti-liberation activities of the occupation army with the help of local Collaborators-Publicity campaign (role of Shadheen Bangla Bater Kendro, campaigns abroad and raising public opinion in favour of liberation war- Role of students, women and mass people-Role of other Foreign Countries-Contribution of India and formation of joined command-Surrender of Pakistani Forces and Acquiring Independence of Bangladesh- Contribution of Bangabondhu and his leadership in the independence struggle.

Constitutional History: Proclamation of Independence, 10 April 1971- Provisional Constitution of Bangladesh Order, 11 January 1972-Constitutent Assembly Order of Bangladesh, 22 March 1972- First Session of Constituent Assembly and Formation of Draft Constitution Framing Committee- Second Session of Constituent Assembly and adaptation of draft Constitution- Final Session of Constituent Assembly and enforcement of Constitution of Bangladesh-Salient Feature of the Constitution of 1972.

List of Historical Cases:
State vs. Dosso (1958)
Asma Jilani vs. Government of Pakistan (1972)
Tamizuddin Khan vs. East Pakistan (1964)

Books Recommended

১. সিরাজ উদ্‌দীন আহমেদ : স্বাধীন বাংলাদেশের অভ্যুদয়ের ইতিহাস
২. মুনতাসির মামুন ও অন্যান্য : স্বাধীন বাংলাদেশের অভ্যুদয়ের ইতিহাস

BUS 3101: Financial and Managerial Accounting

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.
Financial statement analysis and interpretation: ratio analysis.
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 technique; Cost-Volume-Profit analysis: meaning, breakeven analysis, contribution margin approach, sensitivity analysis.
Short-term investment decisions: relevant and differential cost analysis.
Long-term investment decisions: capital budgeting, various techniques of evaluation of capital investments.

Third Year Second Semester

CSE 3201: Mathematical Analysis for Computer Science
Recurrent problems; Manipulation of sums; Number theory; Special numbers; Generating functions. Random variables; 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.

CSE 3202: Theory of Computation

The Central Concepts: Introduction to Finite State Machines and Finite State Automata; Alphabets, Strings and Languages.
Finite Automata: Deterministic Finite Automata, Non-deterministic Finite Automata, and their applications; Finite Automata with Epsilon-Transitions.
Regular Expressions and Languages: Regular Expressions, Finite Automata and Regular Expressions, Applications of Regular Expressions, and Algebraic Laws for Regular Expressions.
Properties of Regular Languages: The Pumping Lemma for Regular Languages and its applications; Closure Properties and Decision Properties of Regular Languages; Equivalence and Minimization of Automata.
Context-Free Grammars and Languages: Context-Free Grammars; Parse Trees; Applications of Context-Free Grammars; Ambiguity in Grammars and Languages.
Pushdown Automata: Definition and the languages of a PDA; Equivalence of PDA's and CFG's; Deterministic Pushdown Automata.

Properties of Context-Free Languages: Chomsky and Greibach Normal forms for CFG's; The Pumping Lemma for CFL's; Closure and Decision properties of CFL's.
Introduction to Turing Machines: The Turing Machine, Programming Techniques for Turing Machines, Extensions to the Basic Turing Machine, Restricted Turing Machines, Turing Machines and Computers.

Books Recommended

1. Hopcropt, J.E. & Ullman , J.D.	**:**	Introduction to Automata Theory, Languages & Computation
2. Lewis Papadimitriou	**:**	Elements of the Theory of Computation
3. John C Martin	**:**	Introduction to Languages and Theory of Computation

CSE 3203: Computer Networks

Introduction: Data and signal, Basic data communication system, Transmission impairments, Data rate, Bandwidth and channel capacity. Network types, Network architecture protocols, Outline of OSI and TCP/IP reference model.
Data transmission techniques and multiplexing: Asynchronous and synchronous transmission. Simplex, Duplex, Full duplex transmission. Frequency division and time division multiplexing. Carrier system.
Error detection techniques: Parity check, Longitudinal Redundancy check and CRC. Data link and error control protocol: Basic characteristics, Flow and error control techniques, Framing. Stop and wait ARQ, HDLC protocol.
LAN and WAN: LAN Architecture, LAN Topologies, LAN standards, Wireless LANs, Medium access control protocols, Bridged Ethernet, Circuit Switching, Packet Switching, Routing Algorithms: Bellman-Ford algorithm, Dijkstra's algorithm, Congestion Control, Frame Relay, ATM overview and ISDN.
Internet Principle: Principles, Bridge and Gateway, Internet protocol, IP datagram format, IP addressing, subnetting, Routing Protocols, Internet Control Message Protocol (ICMP), DHCP, ARP, Autonomous systems, AS routing, RIP, OSPF, BGP.
Network management: Network management with SNMP, FTP, email, SMTP and MIME, URL, HTTP, DNS.
Case studies: **Design and development of computer network under Windows and Linux and share various resources.**

Books Recommended

1. Stallings W	**:**	Data Communications and Computer Networks
2. Tanenbaum	**:**	Computer Networks
3. William A Shay	**:**	Understanding Data Communication & Networks

CSE 3204: Computer Networks Lab
Laboratory works based on CSE 3203

CSE 3205: Microprocessors and Microcontrollers

Introduction: Microprocessors and microcomputers; Evolution of microprocessors; microprocessor applications; Programming Languages; General architecture of microprocessor; The Memory; Input/Output; Co-processors.
Microprocessor Software Concepts: Instruction formats; Addressing Modes; Instruction Types; Introduction to Assembly Language Programming.
Intel 8085 microprocessor: Internal architecture; Register structure; Programming model; Addressing modes, Instruction set; Programming; Memory subsystem; Bus timing and standards.

Input/Output interfacing: Polling and Interrupts; Microprocessor organizations; Architecture options for microprocessor; I/O control signals; I/O port organization and accessing; Programmable and non-programmable I/O ports; Programmable I/O ports: 8255A; Programming the 8255; Applications. Programmed I/O; Standard I/O; Memory mapped I/O; Programmable communication interface: 8251A; DMA.
Intel 8086/8088 microprocessors: Internal architecture; Register structure; Programming model; Addressing modes; Instruction set.
Overview of Other Processors: Intel 80186, 80286, 80386, 80486 & Pentium microprocessors and other advance processors; Motorola 68000.
Assembly Language Programming: Machine & Assembly instruction types & their formats; Character representation instructions; Instruction execution; Control structures, Subroutines, Interrupt, Macros & files; I/O programming; Assembler, Cross-Assemblers.

Books recommended

1.	M. Rafiquzzaman	**:**	Microprocessor and Microprocessor based system
2.	D. V. Hall	**:**	Microprocessors and Interfacing
3.	Malvino, A P	**:**	Digital Computer Electronics
4.	Liu and Gibson	**:**	Microprocessor Systems: The 8086/8088 Family

CSE 3206: Assembly Language, Microprocessors and Microcontrollers Lab
Assembly Language : Hardware architecture and software architecture; Instruction types and their formats; Assembly program format; Assembly process; Interrupts and system services; Addressing methods; High level control structure formation; Use of subroutines and macros; Numeric processing and string processing; Concurrent processes and high level linking; Disk geometry, file system and file I/O handling.
And laboratory works based on CSE 3205

CSE 3207: Web Engineering

World Wide Web: Concepts, Web page: static, Dynamic, Active. Scripting languages: Server side, Client Side. Web site development Phases, Web: Designing, Development and Publishing, HTTP, URL registration, browsers, search engines, Web server, Proxy servers.
HTML: Introduction To HTML, Common HTML, Some basic tags, Text formatting tags, Ordered & Unordered Lists , Inserting image, Links: text, image links, image mapping, Tables , Frames, HTML Form.
Javascript: Intro to script, types, intro of JavaScript, JavaScript identifiers, operators, control & Looping structure, Intro of Array, Array with methods, Math, String, Event handling, Validations On Forms
PHP: PHP-Introduction to PHP, Syntax, Operators, Variables, Constants, Control, Date and Time functions. Web Features- Sessions, Forms, GET and POST data, Cookies, HTTP Headers, Database Programming, Streams and Network Programming, Streams File Uploading and File Downloading.
ASP: Introduction of ASP, Working with ASP page, Request & Response object, Application & Session, Error Handling in ASP Database Handling: Connection, Recordset, Command Object
Ms .Net Programming With C#: Introduction to C# .Net language, Creating Your First C# Program, C# Environment, Literals, Variables and Data Types, Operators and Expressions, Classes and Objects, Inheritance, Interfaces, Delegates, Events, Exception Handling
Database Application with ADO.NET: Introduction to ADO .NET ADO .NET Architecture: Understanding the ConnectionObject, Building the ConnectionString, Understanding DataReaders, Understanding DataSets and DataAdapters, DataTable, DataColumn, DataRow, Understanding the DataViewObject, Working with System.Data.OleDb, Using DataReader, Using DataSet

Reference Books:
1. Complete reference HTML.
2. JavaScript Bible
3. Programming ASP Ivan Bayross
4. PHP and MySQL for Dynamic Web Sites: Visual Quickpro Guide, Second Edition by Larry Ullman

CSE 3208: Web Engineering Lab
The laboratory works based on CSE 3207

GED 3208: Socio-economic and Political Studies in Bangladesh

Land and People of Bangladesh: Ethnic origin, culture, language, religion and occupation; a brief history of the region.
Emergence of Bangladesh: Socio-political and economic factors and events leading to independence of Bangladesh.
Geography of Bangladesh: Soil type, agro-ecological zones of Bangladesh; floods – nature and causes.
Conservation of Natural Resources: Forest and fisheries; population movement and urbanization, environmental management.
Economy of Bangladesh: Major sectors of production-agriculture, industry, services; agricultural development – land reform measures in Bangladesh, modernization of agriculture – H Y V technology; industry and trade.
Political Developments in Bangladesh: Forms of government in Bangladesh since independence; salient features of Bangladesh constitution – ordinances and amendments; democracy and political parties; administrative system in Bangladesh.

Books Recommended
1. Talukker Moniruzzaman, The Bangladesh Revolution and its Aftermath
2. Raunak Jahan, Bangladesh Politics: Problem, Promise and Performance, UPL, Dhaka
৩. মো. সিরাজুল ইসলাম (সম্পাদিত), বাংলাদেশের ইতিহাস (৩য় খণ্ড)
৪. এম আর আখতার মুকুল, বাহান্নর ভাষা আন্দোলন

BUS 3201: Professional Ethics and Industrial Management

Professional Ethics: Human Values; Engineering Ethics and Theories; Social Ethics and Engineering as Social Experimentation; Safety, Responsibilities and Rights of Engineers; Global Issues and Engineers as Managers, Consultants and Leaders.
Industrial 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.

Fourth Year First Semester

CSE 4101: Artificial Intelligence

Introduction: Introduction to AI and intelligent agents, General Concept of Knowledge.
Symbolic Knowledge and Reasoning: Building a Knowledge Base Agent, Propositional logic, First order logic, Inference in First order Logic,
Uncertain Knowledge and Reasoning: Inconsistencies and uncertainties, probabilistic reasoning, Structured knowledge, Fuzzy Logic.
Knowledge Organization and manipulation: Search strategies, Game planning, Knowledge Organization and management.
Knowledge acquisition: Introduction, Types of learning, general model, Learning automata, Genetic algorithm, Learning by Induction,
Introduction to Natural Language Processing: Overview of Linguistics, Grammars and Languages, Basic Parsing Techniques, Semantic Analysis & Structures, Natural Language generation and Systems.
Expert System: Expert consultation, Development of Expert Systems, Computer vision, Robotics.
Logic programming: Background, Representation and reasoning, Logic programs and programming styles, Programming in PROLOG. List processing, arithmetic, I/O and memory operations and databases in PROLOG. User interface and interface engine of AI.

Books recommended

Dan w. Patterson	:	Introduction to Artificial Intelligence and Expert System
Stuart Russell and Peter Norving	:	Artificial Intelligence: A Modern Approach
E. Rich and K. Knight	:	Artificial Intelligence

CSE 4102: Artificial Intelligence Lab
Laboratory works based on CSE 4101.

CSE 4103: Compiler Design and Construction

Introduction: Phases of a compiler (lexical analyzer, syntax analyzer, semantic analyzer, intermediate code generator, code optimizer, code generator, symbol-table manager & error handler).
Lexical analysis: role, finite automata, from regular expression to NFA, from NFA to DFA, design of a lexical anlyzer generator using LEX.
Syntax analysis: role, CFG, writing a grammar, top-down parsing, bottom-up parsing, operator precedence parsing, LR parser, using ambiguous grammar, parser generators (YACC).
Symbol table, structure and management.
Intermediate code generation: intermediate languages, declarations, assignment statement, Boolean expression, case statements, backpatching, procedure calls.
Code optimization: principle of source optimization, optimization of basic blocks, loop in flow graphs, global data flow analysis, iterative solution of data flow equations.
Code generation: Issues in the design of a code generator, target machine, runtime storage management, basic blocks and flow graphs, register allocation and assignment, dag representation of basic blocks, peephole optimazations, generating code from dags.

Books recommended

1. Hopcroft and Ullman	:	Introduction to Automata Theory, Languages and Computation
2. Adamek	:	Automata and Algebra
3. Aho and Ullman	:	Principles of Compiler Design
4. Lewis and Stern	:	Compiler Design Theory

CSE 4104: Compiler Design and Construction Lab

Laboratory works based on CSE 4103 and project works using some lexical analyzer and parser designing tools.

CSE 4105: Cryptography and Network Security

Introduction: OSI Security Architecture, Classical Encryption techniques – Cipher Principles, Data Encryption Standard, Block Cipher Design Principles and Modes of Operation, Evaluation of DES, AES, Triple DES, Placement of Encryption Function, Traffic Confidentiality

Public Key Cryptography: Introduction to Number Theory, Public Key Cryptography and RSA, Elliptic Curve Architecture and Cryptography, Diffie-Hellman key Exchange, PKI.

Authentication and Hash Function: Authentication requirements, Message Authentication Codes, Hash Functions – MD5, SHA, HMAC, Digital Signatures, Protocols and Standards for Digital Signature, Digital Certificates, Biometrics.

Network Security: Authentication Applications: Kerberos, X.509, Authentication Service, Electronic Mail Security, PGP, S/MIME, IP Security, Web Security. SSL and SET technologies

System Level Security: Intrusion detection, password management, Viruses and related Threats, Virus Counter measures, Firewall Design Principles, Trusted Systems.

Legal, Privacy, and Ethical Issues in Computer Security: Protecting programs and data, Information and law, Rights of employees and employers, Software failures, Computer crime, Privacy, Ethical issues in computer society.

Books recommended:

1. W. Stallings, "Cryptography and Network Security: Principles and practice"
2. Bruce Schneier, "Applied Cryptography", John Wiley & Sons Inc, 2001.
3. Charles B. Pfleeger, Shari L. Pfleeger, "Security in Computing", 3rd Edition, Pearson Education, 2003.

CSE 4106: Cryptography and Network Security Lab

Laboratory works based on CSE 4105.

CSE 4107: Simulation and Modeling

Simulation modeling basics: systems, models and simulation; Classification of simulation models; Steps in a simulation study; Concepts in discrete-event simulation: event-scheduling vs. process-interaction approaches, time-advance mechanism, organization of a discrete-event simulation model; Continuous simulation models; Combined discreet-continuous models; Monte Carlo simulation; Simulation of queuing systems.

Building valid and credible simulation models: validation principles and techniques, statistical procedures for comparing real-world observations and simulated outputs, input modeling; Generating random numbers and random variates; Output analysis. Simulation languages; Analysis and modeling of some practical systems.

CSE 4108: Computer Graphics

Introduction to Computer Graphics: Introduction, Presentation graphics, Application Areas, GUI; Graphics Hardware: Display devices Architecture and Input Devices;
Graphic Primitives: Drawing Points, Lines, Circles, Ellipse, Rectangles, Arcs; Polygons: Inside-outside tests, polygon fill algorithms, Character generation;
Two-dimensional Viewing and Clipping: Viewing pipeline, Window to view port transformation, Point, Line, Polygon, Curve and Text clipping;
Transformations of Objects: Basic transformations, Affine Transformations, Translations, Rotations, Scaling, reflection and Shearing, Composite transformations matrices, Transformation of 3D objects (4×4 matrices).
Curve and Surface design: Interpolation and approximation techniques, B-spline, Bezier curves and Surfaces, Fractal Geometry
3D Object Representation: 3D Graphics Pipeline, Projection: Different types of Parallel and Perspective Matrices; B-Rep, Constructive Solid Geometry, BSP tree, Octree, Hidden lines and Surface detection: Back face Detection, Painters algorithm, Z-buffering; light models,
Rendering: Constant, Goraud and Phong shading; Ray-tracing; Different Types of Color Model
Some Topics of Graphics: Introduction to OPEN GL

Books recommended

1. Donald Hearn and Paullin Baker : Computer Graphics
2. Foley, Vandam, Feiner, Hughes : Computer Graphics, Principle and Practice
3. Vera B Anand : Computer Graphics & Geometric Modeling for Engineers

CSE 4109: Computer Graphics Lab
Laboratory works based on CSE 4108.

Fourth Year Second Semester

CSE 4201: Digital Signal and Image Processing

Introduction to Signals: Concepts of signals, systems and signal processing; classification of signals; Digital signals and systems; Classification of discrete time signals; Sampling theorem; Fourier series and Fourier transform; Autocorrelation.
The Z-Transform: The Z-Transform and its properties; the inverse Z-Transform.
The Discrete Fourier Transform (DFT): The Discrete Fourier Transform (DFT), redundancy in the DFT; The Fast Fourier Transform (FFT); the FFT decimation in time & decimation in frequency; Interrelationship between the DFT & Z-transform; Convolution of sequences & sectioning.
Digital Filter: Digital Filter characterization; Digital filter structures; Design of Digital Filters; Recursive Filter design; Effects of finite word length; Simple models for quantization noise in recursive systems; Non-recursive filter design via the DFT computational techniques; Other radix formulations; Other radix formulations; Spectral analysis using the FFT; Speech processing algorithms;
Image processing: Image perception, sampling & quantization, transforms, representation, enhancement, filtering and restoration, edge detection and histogram, image analysis and computer vision, image reconstruction.

Books Recommended

1. Proakis & Manolakis : Digital Signal Processing
2. R Gonzalez, E Woods : Digital Image Processing
3. Oppenheim & Schafer : Discrete Time Signal Processing
4. Anil : Elements of Image Processing

CSE 4202: Project and Thesis

Study of problems in the field of Computer Science and Engineering.

Optional Courses:

CSE 4203: Distributed Systems

Introduction to Parallel and Distributed Systems: Architecture, Challenges, principle and paradigm, Middleware: Introduction to Erlang, Communication: synchronous and asynchronous communication abstraction and model, message passing and shared memory. Replication & Consistency: Control replication, data replication, consistency model and protocols. Distributed Shared Memory: Design issue, Implementation issue, consistency issue, Shared Memory model, MPI, LINDA, ORCA, case study: TradMark, JACKAL. Distributed Objects: introduction, remote objects, CORBA, Distributed Shared object, Globe. Synchronization & Coordination: Distributed algorithms, time and clocks, Local state, Global State, consistency protocols, coordination elections, distributed transactions management. Fault Tolerance: Failure model, Faults, Process Resilience, reliable communication, Recovery, checkpoints and checkpoint algorithms, Rollback recovery algorithms, Security: Threats and attacks, policy and mechanism, Design issue, design of cryptographic algorithms, cryptographic protocols, key distribution, authentication, secure communication, auditing. Naming: Basic concept, Naming Services, DNS, Attribute based naming, X.500 and LDAP, Distributed File Systems: Client perspective, Server perspective, NFS, Coda, Google File System(GFS). Parallel Programming: parallel computing, parallel programming structure, PlanetLab, Grid: Grid model, Grid Middleware, Globus toolkit, PlanetLab Overview.

CSE 4204: Distributed Systems Lab

Laboratory works based on CSE 4203.

CSE 4205: System Programming

Systems programming concepts, general machine structures, machine and assembly language, concepts of translation oriented system programs; **Kernel:** General kernel responsibilities, kernel organization, kernel compiling and installing, kernel's role at system startup, process creation and termination, Process execution, ELF format, inter process communication, signal handling, Memory management: page frame management, memory area management, kernel memory management, VFS: VFS data structures, File system handling, Generic characteristics of Ext3 file system, **Interrupt:** Interrupt handlers, registering an interrupt handler, writing an interrupt handler. **System Calls:** system call handler, system call implementation, entering and exiting a system call. **Linux Module Programming**: linux device driver, Building, installing and loading modules, I/O architecture, the device driver model, device files, character device driver, block device driver, working with USB device driver. **Assembler, Linker & Loaders:** Basic Assembler Functions, Machine Dependent Assembler features, Machine Independent Assembler Features, Assembler Design Options - One pass assembler and multipass assembler, Basic Loader Functions, Machine

Dependent Loader Features, Machine Independent Loader Features, Linkage Editors, Dynamic Linking, Bootstrap Loader, Basic Macro Processor Functions.

CSE 4206: System programming Lab

Laboratory works based on CSE 4205.
Student will be asked to develop some system tools based on various system call. Linux module programming will be an important part of this lab. They will be asked to develop device driver for Linux as a Linux module.

CSE 4207: Basic Multimedia Theory

Multimedia systems - introduction; Coding and compression standards; Architecture issues in multimedia; Operating systems issues in multimedia - real-time OS issues, synchronization, interrupt handling; Database issues in multimedia - indexing and storing multimedia data, disk placement, disk scheduling, searching for a multimedia document; Networking issues in multimedia - Quality-of-service guarantees, resource reservation, traffic specification, shaping, and monitoring, admission control; Multicasting issues; Session directories; Protocols for controlling sessions; Security issues in multimedia digital water-marking, partial encryption schemes for video streams; Multimedia applications - audio and video conferencing, video on demand, voice over IP.

CSE 4208: Multimedia Lab

Laboratory works based on CSE 4207.

CSE 4209: Algorithm Engineering

Computational complexity, Parameterized complexity, Algorithms for combinatorial optimization, practical computing and heuristics, Approximation algorithms, LP based approximation algorithms, randomized algorithms, Experimental algorithmic, Algorithms in state-of-the-art fields like Bioinformatics, Grid Computing, VLSI design etc.

CSE 4210: Algorithm Engineering Lab

Laboratory works based on CSE 4209.

CSE 4211: Computational Geometry

Introduction: Definition of Computational Geometry, Limitations of Computational Geometry, Affine Geometry, Affine Space, Geometric primitives, Degeneracies and Robustness, Application Domains.
Geometric Data Structures: Vectors, Points, Polygons, Edges, Geometric Objects in Space.
Incremental Insertion: Insertion sort, Star-shaped polygons, Convex Hulls, Insertion Hull, Point enclosure, Ray-Shooting method, Line clipping, Polygon clipping, The Sutherland-Hodgman Algorithm.
Incremental Selection: Selection sort, Gift-Wrapping, Grahams scan method, Removing of hidden surfaces, Delaunay Triangulation, Mate of an Edge, Voronoi regions,Voronoi Diagrams, Duality of Voronoi Diagrams and Deluanay Triangulations.

Plane Sweep Algorithms: Line segments intersections, Event Points, The Sweep line structure, Monotone Polygon, Monotone Polygon Theorem, Decomposition of Polygons.
Divide and Conquer Algorithms: Merge sort, Intersection of half planes, Kernel of a polygon, Merge Hull, Closest Points, Polygon Triangulation, Polygon Triangulation theorem.
Visibility Graphs: Algorithms for weak and strong visibility, Planar Graphs, Art Gallery Problems, Shortest Paths for a point Robot, Shortest paths for a translating Polygonal Robot.
Combinational Geometry: Hamm-Sndwich cuts, Helly's theorem, K-sets,
Rectilinear Geometry: Intersection and union of Rectangles, Rectangle searching.

Books recommended:

1. M. de Berg, M. van Kreveld, Mark Overmars & Otfried Schwarzkopf — Computational Geometry: Algorithms and Applications.
2. Shanon — Computational Geometry
3. Michael J. Laszlo — Computational Geometry and Computer Graphics in C

CSE 4212: Computational Geometry Lab
Laboratory works based on CSE 4211.

CSE 4213: Machine Learning

Introduction to machine learning; Learning algorithms: supervised, unsupervised, reinforcement, attribute based, neural network based, relational supervised and negative correlation; Genetic algorithm, genetic programming and evolutionary programming; Practical application of machine learning.

CSE-4214: Machine Learning Lab

Laboratory works based on CSE 4213.

CSE 4215: Pattern Recognition

Introduction to Pattern Recognition: Human perceptions, Definition and approaches, Terminology, Learning methods, Decision space and decision boundary, Pattern recognition system design, Applications.
Syntactic Pattern Recognition: Quantifying structure in pattern description and recognition, Grammar based approach and applications, Elements of formal grammar, Recognition of syntactic description, parsing, The CYK parsing algorithm, Augmented transition networks.
Statistical Pattern Recognition: Probability of events, Conditional probability, Statistical decision making, Baye's theorem, Nonparametric decision making, Clustering: Definition and classification, Hierarchical clustering algorithms, Partitional clustering algorithms.
Artificial Neural Networks: The Basic Neuron, Artificial model of a neuron, Classification of ANN, Learning in ANN, The delta rule, Hebbian learning, McCulloch-Pitts Model, The perceptron, ADALINE, MADALINE, Kohonen Self-Organizing Networks, Hopfield model, Associative memory, Back propagation learning algorithms. Applications of Neural Network.

Books Recommended

1. Beale R and Jackson : Neural Computing: An Introduction
2. Igor Aleksander and Helen Morton : An Introduction to Neural Computing

CSE 4216 Pattern Recognition Lab

Introduction to MATLAB; Laboratory works based on CSE-4215and using MATLAB: Bayesian classifier, linear classifier, nonlinear classifier, image matching, speech recognition, context dependent classification.

CSE 4217: VLSI Design

VLSI design methodology: top-down design approach, technology trends and design automation algorithms; Introduction to CMOS inverters and basic gates; Brief overview of CMOS fabrication process: layout and design rules; Basic CMOS circuit characteristics and performance estimation; Buffer circuit design; Complex CMOS gates, CMOS building blocks: adder, multiplier; data path and memory structures.
Hardware modeling: hardware modeling languages, logic networks, state diagrams, data-flow and sequencing graphs, behavioral optimization.
Architectural Synthesis: circuit specification, strategies for architectural optimization, data-path synthesis, control unit synthesis and synthesis of pipelined circuits.
ASIC design using FPGA and PLDs.

CSE 4218: VLSI Design Lab

Laboratory works based on CSE 4217.

CSE 4219: Wireless Networks

Introduction to Wireless Communication: Evolution of mobile communications, mobile radio systems around the world, trends in cellular radio and personal communications.
Modern Wireless Communication Systems: Second generation (2G) Cellular networks, third generation (3D) wireless networks, wireless local loop (WLL) and LMDS, wireless local area networks (WLANs), Bluetooth Personal area networks (PANs).
The cellular Concept – System Design Fundamentals: Introduction, frequency reuse, channel assignment strategies, type of handoffs, handoff strategies, interference and system capacity, trunking and grade of service, improvement of coverage and capacity in cellular systems.
Mobile Radio Propagation: Introduction to radio wave propagation, free space propagation model, relating power to electric field, basic propagation mechanisms, reflection, ground reflection, diffraction, scattering, outdoor and indoor propagation models.
Small scale Fading and Multi-path: Small scale multi-path propagation, Impulse response model of a multi-path channel, small-scale multi-path measurements, parameters of mobile multi-path channels, types of small scale fading, Rayleigh and Ricean distributions, statistical models for multi-path fading channels, theory of multi-path shape factors for small scale fading wireless channels.
Modulation techniques for mobile radio: Frequency modulation, amplitude modulation, angle modulation, digital modulation, line coding, pulse shaping techniques, geometric representation of modulated signals, linear modulation techniques.
Equalization, Diversity and Channel Coding: Introduction, fundamentals of equalization, linear inequalities, nonlinear equalization, algorithms for adaptive equalization, diversity techniques, interleaving, fundamentals of channel coding.
Speech Coding: Introduction, characteristics of speech signals, quantization techniques, ADPCM, frequency domain coding of speech, vocoders, linear predictive coders.
Multiple Access Techniques for Wireless Communications: Introduction, FDMA, TDMA, spread spectrum multiple access, SDMA, packet radio, reservation protocols, capacity of cellular systems.
Y-Max: Introduction to Y-max technology.

Recommended Books:

1. Wireless Communications — Theodore S. Rappaport
2. Wireless and Mobile Network Architectures — Yi-Bing Lin, Imrich Chlamtac
3. Mobile Wireless Communications — Mischa Schwartz

CSE 4220: Wireless Networks Lab

Laboratory works based on CSE 4219.

CSE 4221: Optical Fiber Communication

History of optical communication, advantages and limitations of fiber communication. Theory of light: reflection, refraction, critical incident angle, total internal reflection. Electromagnetic waves, Maxwell's equation, damping waves, wavefront, propagation constant, phase velocity, group velocity. Basics of optical fiber: acceptance angle, numerical aperture, fiber structure, comparison with copper, meridional rays, skew rays, v number of a fiber, modes in a planar guide, Evanescent field, single mode fiber, multimode fibers. Fabrication of optical fibers: Vapor phase deposition techniques: OVD, MCVD, PCVD, VAD, coating. Optical sources: requirements , energy band diagram, LED: (principle of action, internal quantum efficiency, homostructure and heterostructure of LEDs), Laser: (principle of action, properties of stimulated radiation, positive feedback, population inversion, lasing effect, properties of laser beam, types of lasers: QW, Fabry-Perot, DFB, VCSEL), Superluminescent diodes (SLD), blocks of optical transmitter. Photo detectors: principle of action, responsivity, quantum efficiency, modes of operation, advantages of reverse biasing, sensitivity, efficiency of light-current conversion, p-i-n photodiodes: (features, types, advantages), avalanche photodiode: working principle, noise sources in photodiode, blocks of receiver. Losses in fiber: Material absorption loss, Linear scattering loss, Nonlinear scattering loss, Fiber bend loss, Coupling loss, Dispersion, Polarization loss. Fiber optic cables, optical connectors: (basic structure, preparation, types, characteristics), fiber splices: (splicing procedure, mechanical splice, fusion splice, PAS, PAT). Optical network: OTDM, WDM and DWDM: (lasers, transmitter requirements, receiver requirements, add/drop problem, repeaters), Tunable lasers: (characteristics, external cavity, DBR, integrated cavity lasers). Optical amplifiers: advantages, types, SOA: (types: FPA and TWA, principle of operation, advantages, and disadvantages). EDFA: (principle of operation, characteristics, structure, advantages, noise, DBFA, EBFA). Optical switches, Wavelength converters, Couplers / splitters, WDM mux and demux, filters, Isolators, Circulators, Attenuators. Optical layer: sections, sublayers, services. Protection and restoration techniques.

CSE 4222: Optical Fiber Communication Lab

Laboratory works based on CSE 4221.

CSE 4223: Human Computer Interaction

Foundations of Human Computer Interaction: Humans and Machines, Interaction, Collaboration. Models in HCI: Cognitive Models, Socio-organizational Issues and Stakeholder Requirements. Importance of cognitive abilities. Design Process: Interaction Design Basics, HCI in Software Process, Design Rules, Universal Design, User Center Design. Design. Prototyping, Task Analysis, GOMS and other key HCI methods. Lifecycle Models. User Interfaces: Interfaces Basics, Interaction Techniques, System Control of Interfaces, Human Factors and Strategies in Designing Interfaces. Evaluation and User Support: Evaluation, Evaluation of Interfaces, User Support. Tasks Models and Dialogs: Analysing the Task, Dialog Notations and Design. Groupware, Ubiquitous Computing, Virtual and Augmented Reality. Social-Cultural Contexts of HCI.

CSE 4224: Human Computer Interaction Lab

Laboratory works based on CSE 4223.

CSE 4225: Mobile Computing

Overview: Mobile Technologies, Anatomy of a Mobile Device, Survey of Mobile Devices, Applications of Mobile Computing; Application Design: Context, Information Architecture, Design Elements, Mobile Web vs Native Applications; Development Environments: Introduction to Objective-C, The Model-View-Controller Model, The Delegate Pattern, The iPhone, Android, & Blackberry SDKs; The Application Environment: Limited Resource Computing, Memory Management, Low Power Computing, Fault Tolerance and Persistence, Security Issues; Wireless Communication Technologies: Celluar networks, Wireless (802.11), TCP/IP in the mobile setting, Geolocation and Global Positioning System (GPS); The User Experience: The Small Screen Problem, The Uni_ed Look and Feel Paradigm, The iPhone Human Interface Guidelines, The Blackberry User Interface Guidelines, Common User Interface Guidelines; Distributed Computing: Consistency and Reliability, Security Issues, Ad hoc Networks, Sensor Networks; The Future of Mobile Computing: Upcoming Technologies, Convergence of Media and Communication Devices.

CSE 4226: Mobile Computing Lab

Laboratory works based on CSE 4225.