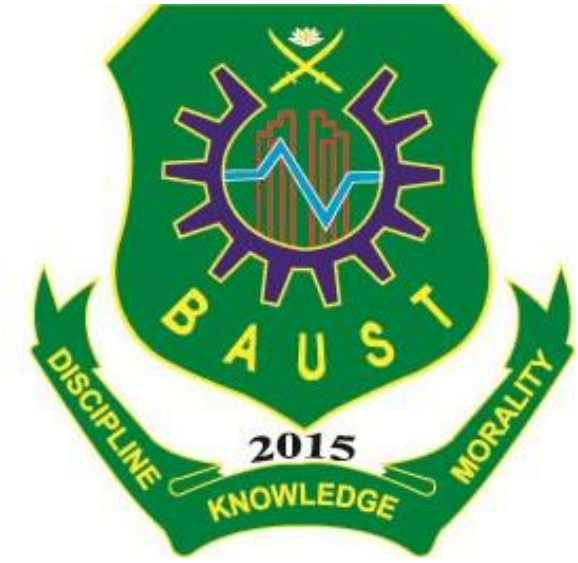
BANGLADESH ARMY UNIVERSITY OF SCIENCE AND TECHNOLOGY (BAUST)



SYLLABUS

Bachelor of Science in
Computer Science and Engineering (CSE)

May 2019

Department of Computer Science and Engineering (CSE)
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Saidpur Cantonment, Saidpur, Bangladesh
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CHAPTER - 1

General Information

1 Introduction

With a view to meeting the increasing demand for the development and dissemination of engineering and technological know-how, Bangladesh Armed Forces established the Bangladesh Army University of Science and Technology (BAUST), Saidpur that promises to provide facilities for higher technical education for the students home and abroad. BAUST starts its journey on 15 February 2015 by offering four-year bachelor's degrees on Computer Science and Engineering (CSE), Electrical and Electronic Engineering (EEE), and Mechanical Engineering (ME).

2 Aim

The aim of BAUST is to conduct undergraduate courses in various disciplines of Engineering according to syllabi leading to Bachelor of Science in Engineering (B. Sc. Engineering) for the students from home and abroad.

3 Objectives

The objectives of BAUST are:

1.3.1 To offer the following courses with a view to meeting the increasing demands in the country:

(i) Four-years bachelor course in Computer Science and Engineering (CSE)
(ii) Four-years bachelor course in Electrical and Electronic Engineering (EEE)
(iii) Four-years bachelor course in Mechanical Engineering (ME)
(iv) Four-years bachelor course in Industrial and Production Engineering (IPE)
(v) Four-years bachelor course in Civil Engineering (CE)
(vi) Four-years bachelor course in Business Administration (BBA) and
(vii) Four-years bachelor course in English.

1.3.2 To produce skilled, well disciplined, self-motivated and dedicated engineers and computer professionals.

1.3.3 To make provisions for research and development and dissemination of knowledge in appropriate fields of science and technology.

4 Location

BAUST is located at Saidpur Cantonment, Saidpur, Nilphamari, a hub of knowledge for Bangladesh Armed Forces. Saidpur Cantonment is a calm and quiet education village, free from all possible pollution of a city life. Whistling birds on the tree branches and overall bounty of nature adds to the existing splendid academic atmosphere.

5 Eligibility of Students for Admission in BAUST

The students must fulfill the following requirements:

a) Applicants must have passed SSC and HSC (or equivalent) examination in Science group with minimum GPA of 3.5 in both but total of minimum 7.5.

b) Candidates who have passed HSC or equivalent exam in the year or one year before the notification for admission can apply. Candidates with more than one year break of study will not be eligible to apply.

c) For O Level/Junior Cambridge and A Level/Senior Cambridge background students, the applicants must have to qualify minimum 5 subjects in O Level/Junior Cambridge and 3 subjects including Mathematics, Physics and Chemistry in A Level/Senior Cambridge with minimum C grade in all subjects.

6 Admission Procedure

1.6.1 Syllabus for Admission Test

Admission test will be conducted on the basis of the syllabus of Mathematics, Physics, Chemistry and English (comprehension and functional) subjects of HSC examinations of all boards of secondary and higher secondary school certificates. Admission test will be conducted out of 100 marks and the distribution of marks is as follows:

Ser.	Subject	Marks
	Mathematics	40%
	Physics	30%
	Chemistry	20%
	English	10%
	Total:	**100%**

1.6.2 Final Selection

Minimum qualifying marks in the written admission test is 40%. Merit list of candidates for final selection and admission to university will be prepared on the basis of the following:

Written Admission Test	60%.
GPA of SSC/ Dakhil / “O”level/ equivalent examination	20%.
Total GPA of HSC/ Alim/ “A” level/ equivalent examination	20%.
Total	**100%**

The Students will be selected as per merit list prepared which will be given in the university website. Individual choice for selection of departments will be given preference as far as possible.

In case of tie, merit position will be determined on the basis of marks obtained in admission test in Mathematics, Physics, Chemistry and English respectively. Further dispute will be solved giving priority of result of HSC over SSC examination.

1.6.3 Medical Checkup

Candidates selected through above procedure will go for medical checkup in BAUST/CMH. If the medical authority considers any candidate unfit for study in university due to critical/contagious/mental diseases as shown in medical policy of university he/she will be declared unsuitable for admission.

CHAPTER - 2

Department of Computer Science and Engineering (CSE)

2.1 Introduction

Computer plays vital and in fact indispensable role in all fields of modern human activities. Consequently Computer Science and Engineering has established itself as one of' the most important branches of engineering. Recent development in computer has a considerable impact on society. It has already expanded to all fields of study starting from genetic engineering to space technology. Recent development in Artificial Intelligence is taking the human civilization to a new dimension. That day is not very far when man can make machines like him. The Department of Computer Science and Engineering is one of the pioneer departments of this university providing top-quality education in Computer Science and Engineering (CSE) at its undergraduate program. ICT is the booming sector in is this era. In Bangladesh, it has already been declared as a thrust sector. Keeping this in mind, the department is offering the perfect environment to produce computer specialist.

2.2 Laboratory Facilities of the Department

The department endeavors to provide its faculty members and students adequate laboratory and other facilities. Departmental undergraduate courses are laboratory intensive and these requirements will be catered by following laboratories:

Software Engineering Lab
Networking Lab
Digital Lab
System Engineering Lab
Programming and Algorithm Lab
Microprocessor and Microcontroller Lab
Robotics and Interfacing Labs
VLSI and Automation Lab
Database and Data Warehouse Lab
Signal and Image Processing Lab
Operating System Lab

Students in Level 1 and Level 2 have to undertake laboratory classes in Physics, Chemistry, English, Electronics and Mechanical Engineering too.

Note: The laboratories of CSE Department are also used by the students of other departments for sessional classes and research work of relevant subject/courses if necessary. Similarly, if necessary undergraduate students of this department can access to the facilities of other departments and centers during project, thesis and research works.

2.3 Co-curricular Activities

Students of this Department regularly participates and achieves success in co-curricular activities such as programming contests, software and hardware project competitions etc.

2.3.1 Programming Contest

The department of CSE regularly arranges programming contest. From its inception, students from BAUST has participated in all the ICPC regionals in Bangladesh.

2.3.2 Software and Hardware Project Competitions

Through software and hardware project competitions, the students get to taste the joy of creation and real-life problem solving. The department of CSE arranges theses competition time to time.

2.3.3 CSE Festival

CSE Fest gives the students an opportunity to explore various types of related activities such as project showcasing, seminars, Quizzes, programming contest, robotics contest, gaming etc. The Fest also brings the industry and the future engineers close together.

2.3.4 Workshop/Training

Workshops, seminars, and training are routine activity in this department. By arranging these events regularly, the department is giving the students an opportunity to satisfy their interest in special areas.

CHAPTER - 3

Rules and Regulations for Undergraduate Programme

3.1 Academic Calendar

3.1.1 From Level 1 to Level 4 there shall be two regular Terms (Term-I and Term-II), each ordinarily having duration of not less than 14 weeks of classes.

3.1.2 In each Term there shall be 4/5/6 theory courses. Besides theory courses there shall be some sessional courses in each term.

3.2 Duration of a Term

The duration of each of term will be as follows:

Ser	Events	Durations
1.	Classes before Mid Term Break	7 weeks
2.	Mid Term Break	1 weeks
3.	Classes after Mid Term Break	7 weeks
4.	Preparatory leave	2 weeks
5.	Term Final Examination	3 weeks
6.	Result	2 weeks
7.	Referred/ Improvement/ Backlog Examination	2 weeks
	Total	**24 weeks**

3.3 Course Pattern and Credit Structure

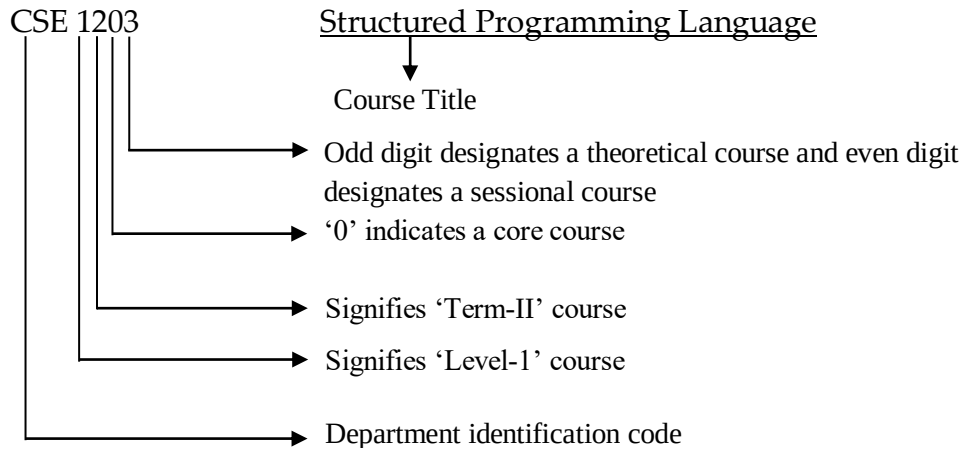
The undergraduate program is covered by a set of theoretical courses along with a set of laboratory courses to support them.

3.3.1 Course Designation System

Each course is designated by a two to four letter code identifying the department offering the course followed by a four-digit number having the following interpretation:

- The first digit corresponds to the level in which the students normally take the course.
- The second digit corresponds to the term in which the students normally take the course.
- The third digit is reserved for departmental use. The fourth digit identifies a specific area/group of study within the department specified by individual departments.
- The last digit is an odd number for theoretical courses and an even number for sessional courses. This is only applicable for engineering programs.

The course designation system is illustrated as follows:



3.3.2 Assignment of Credits.

The assignment of credits to theoretical course is different from that of sessional course, which is stated as follows:

- For theoretical courses one lecture per week per term is equivalent to one credit.
- For laboratory courses two class hours per week per term is equivalent to one credit.
- Credits are also assigned to Project/Thesis work taken by the students. The total credit assigned to project/ thesis work is 6.00 (3.00 for Level-4 Term-I and 3.00 for Level-4 Term-II) for engineering programs.

3.3.3 Types of Courses

The courses included in the undergraduate curricula are divided into the following groups:

3.3.3.1 Core Courses

A number of courses are identified as core courses, which form the nucleus of the bachelor's degree program. A student has to complete the entire designated core courses.

3.3.3.2 Prerequisite Courses

Some of the core courses are identified as prerequisite courses for some other courses. A prerequisite course is one, which is required to be completed before some other course(s) can be taken.

3.3.3.3 Elective Courses

Apart from the core courses, the students can choose from a set of elective courses in level-4 term-I and level-4 term-II..

3.4 The Grading System

3.4.1 The Letter Grade

The total performance of a student in a given course is based on a scheme of continuous assessment. For theory courses this continuous assessment is made through a set of class tests/quizzes, class evaluation, class participation and a term final examination. The assessment in sessional courses is made by evaluating performance of the student at work during the class, set up test, viva-voce, report writing and final quiz. Each course has a certain number of credits, which describes its corresponding weightages. A letter grade with a specified number of grade points is awarded in each course for which a student is registered. A student's performance is measured by the number of credits completed satisfactorily and by the weighted average of the grade points earned. A minimum grade point average (GPA) is essential for satisfactory progress.

Total credits specified in syllabus of each department have to be acquired in order to qualify for the respective degree. Letter grades and corresponding grade points shall be awarded according to the provisions shown below:

Numerical Markings	Grade	Grade Points
80% and above	A+	4.00
75% to below 80%	A	3.75
70% to below 75%	A-	3.50
65% to below 70%	B+	3.25
60% to below 65%	B	3.00
55% to below 60%	B-	2.75
50% to below 55%	C+	2.50
45% to below 50%	C	2.25
40%to below 45%	D	2.00
below 40%	F*	0.00
Incomplete	I	-
Withdrawal	W	-
Project/ Thesis continuation	X	-

* Subject(s) in which the student gets 'F' grades will not be counted towards credit hours requirements and for the calculation of Grade Point Average (GPA)

3.4.2 Incomplete (I) Grade

If a student fails to attend 40% of the classes of any registered course in a Term whatever be the reasons, the registration shall be cancelled for that course and the course will be treated as Incomplete (I) course.

3.4.3 Withdrawal from a Term

If a student is unable to complete the Term Final Examination due to illness, accident or any other valid reason, he/ she may apply in prescribed form to the Registrar through his/ her Head of the Department for total withdrawal from the Term within 7 (seven) working days after the end of the Term final

examination. However, he/ she may choose not to withdraw any laboratory/ sessional/ design course if the grade obtained in such a course is 'D' or better and that he/ she has to indicate clearly in his/ her withdrawal application. In case of illness the withdrawal application must be supported by a medical certificate from CMH/Medical Officer of BAUST. The Academic Council shall take final decision about such an application.

3.5 Distribution of Marks

3.5.1 For Theory Courses

Thirty percent (30%) of marks of a theoretical course shall be allotted for continuous assessment, i.e. class tests/ quizzes/ presentation, class evaluation and class participation. The rest of the marks shall be allotted to the three hour duration term final examination. Distribution of marks for a given course is as follows:

Category	Marks %
Class Participation/ Observation	5%
Class Attendance	5%
Homework assignment and quizzes/class tests	20%
Final Examination (3 hours)	70%
Total	**100%**

The number of class tests/ quizzes/ presentation of a course shall be n+1, where n is the number of credits of the course. Evaluation of performance in class tests/ quizzes/ presentation shall be on the basis of the best n class tests/ quizzes/ presentation. The scheme of continuous assessment that a particular teacher wishes to follow for a course shall be announced on the first day of classes.

3.5.2 For Sessional Courses

Sessional courses are designed and conducted by the concerned departments. Examination on sessional/practical subjects shall be conducted by the respective department before the end of the term. The date of practical examination shall be fixed by the respective department. Students shall be evaluated in the sessional courses on the basis of the followings:

Lab based Sessional

Class Attendance	10%
Class Performance	10%
Report/ Assignment	10%
Quiz	20%
Viva-Voce	20%
Lab Test/ Set up Test/ Final Test	30%
Total	**100%**

Programming/ Project Based Sessional

Class Attendance	10%
Class Performance	10%
Report/ Assignment	10%
Quiz	20%
Viva-Voce/Presentation	20%
Online Test/ Project	30%
Total	**100%**

Basis for awarding marks for Class Attendance shall be as follows:

Attendance	Marks (%)
90% and above	100%
85% to less than 90%	90%
80% to less than 85%	80%
75% to less than 80%	70%
70% to less than 75%	60%
65% to less than 70%	50%
60% to less than 65%	40%
55% to less than 60%	30%
50% to less than 55%	20%
45% to less than 50%	15%
40% to less than 45%	10%

3.6 Attendance

All students are expected to attend classes regularly. The university believes that attendance is necessary for effective learning. The first responsibility of a student is to attend classes regularly. One is required to attend at least 60% of all classes held in any course. Student having attendance from 40% up to 60% shall have to pay a certain fine to attend the final examination. Students having attendance less than 40% shall not be allowed to attend the final examination.

3.7 Calculation of CGPA

Grade Point Average (GPA)

GPA is the weighted average of the grade points obtained of all the courses passed/completed by a student. For example, if a student passes/completes n courses in a term having credits of $C_1, C_2, \dots, C_n$ and his grade points in these courses are $G_1, G_2, \dots, G_n$ respectively then

$$GPA = \frac{\sum_{i=1}^{n} C_i * G_i}{\sum_{i=1}^{n} C_i}$$

Cumulative Grade Point Average (CGPA)

CGPA is the weighted average of the GPA obtained in all the terms passed/completed by a student. For example, if a student passes/ completes n terms having total credits of $TC_1, TC_2, \dots, TC_n$ and his GPA in these terms are $GPA_1, GPA_2, \dots, GPA_n$ respectively then

$$CGPA = \frac{\sum_{i=1}^{n} TC_i * GPA_i}{\sum_{i=1}^{n} TC_i}$$

A Numerical Example:

Suppose a student has completed eight courses in a term and obtained the following grades:

Course	Credits, C_i	Grade	Grade Points, G_i	$C_i \times G_i$
CSE 1101	2.00	A-	3.50	7.00
CSE 1102	0.75	A+	4.00	3.00
EEE 1163	3.00	B-	2.75	8.25
EEE 1164	1.50	C+	2.50	3.75
ME 1181	3.00	D	2.00	6.00
MATH 1141	3.00	A-	3.50	10.50
PHY 1103	3.00	A+	4.00	12.00
PHY 1104	0.75	B	3.00	2.25
HUM 1101	3.00	A	3.75	11.25
Total	**20.00**			**64.00**

GPA = 64.00/20.00 = 3.20

Suppose a student has completed four terms and obtained the following GPA:

Level	Term	Credit Hours Earned, TC_I	GPA Earned, GPA_i	$GPA_i \times TC_i$
1	1	20.00	3.20	64.00
1	2	20.50	3.93	80.565
2	1	19.75	3.96	78.210
2	2	20.25	4.00	81.000
Total		**80.50**		**303.775**

CGPA = 303.775/80.50 = 3.77

3.8 Promotion to the next Term/ Level

3.8.1 In each term there shall be 4/5/6 theory courses. A student has to pass at least 2 out of 4, 3 out of 5 and 4 out of 6 theory courses for promotion to next higher Term/ Level with a maximum of 2 (two) fail theory courses. But only for L-1, T-I a student has to pass at least 1 out of 4, 2 out of 5 and 3 out of 6 courses for promotion to next higher Term with a maximum of 3 (three) fail theory courses because such a student will have no backlog courses. The fail theory courses will be treated as referred course. Students having referred course (maximum three for L-1, T-I and maximum two for all other Levels and Terms) will have to appear in the next consequent referred examination, which will be held combinedly with the Improvement and Backlog examinations at the end of each semester at any convenient time as decided by the authority.

3.8.2 Besides theory courses there shall be some sessional courses in each term for engineering programs and there may be some sessional courses in some terms for other programs. For promotion to next higher Term/ Level a student has to pass in all the sessional courses of the term. A student failed in only one sessional course in the Final Exam shall get a chance to retake the sessional course. But the course has to be cleared within the immediate next Referred Examination.

3.8.3 A student failing in one sessional course, must retake the sessional course in any suitable time as decided by the concerned department before the schedule of the Referred Exam and appear the sessional exam during the Referred Exam schedule. The student has to register the sessional course by depositing a prescribed fee. If any student fails in two sessional courses in the final exam or in the sessional retake course in the Referred Exam in a term, he/she fails in the term and has to repeat the term.

3.9 Referred, Improvement and Backlog Examinations

From Level-1 Term-II and higher, a student may have a maximum of 3 cumulative Backlog courses. Backlog course(s) are those theory course(s) which a student registered in a Term but even after the Final and Referred Examination he/she obtained 'F' grade in that course(s). A student may also appear in the Improvement examination for the passed theory courses with letter grades less than 'B+' in the final examination. The maximum letter grade obtainable in the improvement examination shall be 'B+' and if he/she cannot improve, the former letter grade of the final examination shall prevail. The maximum letter grade obtainable in Referred and Backlog courses shall be 'B'. The Referred, Improvement and Backlog Examinations shall be held once in each term. Referred, Improvement and Backlog courses in each level-term shall be treated as self-study (i.e., retaining the already obtained marks of class tests and class attendance with class performance). The Referred, Improvement and Backlog Examinations will be held combinedly at any convenient time as decided by the authority. A student will be allowed to appear in a maximum of three courses from among his/her referred and Backlog courses. A student will get a maximum of 02 (two) chances to clear the Backlog course(s).

3.10 Special Backlog Examination

A Special Backlog Examination on only Backlog courses may be conducted for the students who have participated in their 4 year degree course (up to level-4 term-II) and have a shortage of maximum 12 (twelve) credits to obtain Bachelor degree. The special backlog examination shall be arranged in a convenient time after 30 (thirty) days of publication of the final results of the level-4 term-II examination. The evaluation system shall be same as backlog with self-study. The students willing to appear at the special backlog examination have to apply to the Head of the Department and with his permission must register within 7 (seven) working days of publication of Level-4 Term-II Final and Backlog examination results. A student who will fail in the special backlog examination shall have to register the fail course(s) in the next regular term.

3.11 Exemption from Taking Courses for Level/Term Repeat Students

If a student fails to get him/herself promoted to the next higher level/term on poor academic performance, he/she has to take readmission in the same level and term in which he/she failed as a repeater student**.** In such case he/she shall be exempted from repeating the passed theory and sessional courses. A Repeater student will have to repeat only those theory and sessional courses in which he/she has failed even after the final and referred examinations.

3.12 Level/Term Repeat for Student under Punishment

No waiver shall be given to a student if a student repeats the Level/Term due to punishment; he/she must have to repeat all the courses of the repeating Level/Term.

3.13 Minimum Earned Credit and CGPA Requirement for obtaining Degree

Minimum credit hour requirements for the award of bachelor's degree in engineering (B.Sc. Engineering) shall be decided as per the existing rules. However, at least 157 credits including the core courses must be earned to be eligible for graduation. The minimum CGPA requirement for obtaining a Bachelor's degree is 2.20. A student is expected to complete the whole course within 4 years (8 terms). For an unavoidable reason if a student fails to complete the course within the stipulated time of 4 years he/she must complete all degree requirements within a maximum period of 6 academic years (12 terms). Failure to complete all degree requirements within the given time frame may disqualify a student from continuation of his/her study at the university.

3.14 Course Registration Procedure

The time and date for course registration shall be announced in advance by the Registrar's office. Students will register his/ her courses in a Term according to following guidelines:

i) A student must pay all Hall dues before the course registration of a Term.
ii) The student must pay the Semester Fee of the semester.
iii) The student will complete the registration and Head of the Department will verify it.

Finally the Office of the Registrar will distribute course-wise list of registered students to the concerned department and Controller of Examinations.

3.15 Industrial/ Professional Training Requirements

Depending on Department's requirement, a student may have to complete a prescribed number of days of industrial/ professional training in addition to minimum credit and other requirements.

3.16 Rounding Off the Decimal Marks

If there is any decimal marks in any of the examinations like class test, tutorial, term paper, viva voce, course final examination then instead of rounding off the decimal figure in the result of every subject/sessional, it is to be rounded off only once during tabulation while converting the total marks to percentage mark after summation of all the subject/sessional marks. To round off, 0.5 and above is to be converted to next higher whole number and less than 0.5 is to be converted to previous whole number (For example 58.5% would be 59% and 58.49% would be 58%).

3.17 Rounding Off the GPA and CGPA

The GPA/CGPA is not to be rounded off like the total marks of each subject/sessional, but it is to be rounded off after two figure of decimal. To round of 3.555 and above after two figure of decimal, it is to be rounded off as 3.56 and 3.554 and below after two figure of decimal, it is to be rounded off as 3.55.

3.18 Honors, Dean's List and University Gold Medal

3.18.1 Honors/ Distinction

A candidates for Bachelor's degree shall be awarded the degree with Honors if their CGPA is 3.75 or better.

3.18.2 Dean's List

In recognition of excellent performance, the name of the students who maintain an average GPA of 3.75 or above in two regular Terms of an academic year may be published in the Dean's List in each Faculty and he/ she will be given a certificate from the respective Dean as recognition. Students who have obtained an 'F' grade in any course during any of the two consecutive regular Terms will not be considered for Dean's List in that year.

3.18.3 University Gold Medal

University Gold Medal for outstanding graduates shall be presented to the students who will secure the 1st position in each Department and whose CGPA is above or equal to 3.75. The student must have completed his/ her undergraduate course work within four consecutive academic years with no 'F' grades and have a satisfactory attendance to his credit.

3.19 Teacher-Student Interaction

The academic system in this university encourages students to come in close contact with the teachers. For promotion of high level of teacher-student interaction, a course coordinator (CC) is assigned to each section of each term. Students are free to discuss with CC about all academic matters. Students are also encouraged to meet other teachers any time for help and guidance for academic matters. Heads of the departments, Proctor, Advisor of Students' Welfare (ASW), and Dean may address the students at some intervals.

3.20 Conduct and Discipline

During their stay in BAUST all students are required to abide by the existing rules, regulations and code of conduct. Students are strictly forbidden to form or be members of student organization or political party, club, society etc., other than those set up by university authority in order to enhance students' physical, intellectual, moral and ethical development. Zero tolerance in regards of sexual abuse, harassment in any forms, drug abuse and addiction are strictly observed in the campus.

CHAPTER – 4

Course Requirements for Undergraduate Students

4.1 Introduction

The list of courses offered to the undergraduate students of Computer Science and Engineering (CSE) are categorized into Core courses and Elective courses. Some of the core courses are offered by the Department of CSE and some by other departments.

4.2 Core Courses

The students have to complete all the core courses listed below:

4.2.1 List of Core Courses – CSE department

Sl No	Course Number	Course Name	Credit Hour
1.	CSE 1100	Introduction to Computer System Sessional	1.5
2.	CSE 1101	Structured Programming Language	3.00
3.	CSE 1102	Structured Programming Language Sessional	1.50
4.	CSE 1201	Discrete Mathematics	3.00
5.	CSE 1203	Object Oriented Programming	3.00
6.	CSE 1204	Object Oriented Programming Sessional I	1.50
7.	CSE 2101	Digital Logic Design	3.00
8.	CSE 2102	Digital Logic Design Sessional	1.50
9.	CSE 2103	Data Structures and Algorithm I	3.00
10.	CSE 2104	Data Structures and Algorithm I Sessional	1.50
11.	CSE 2105	Applied Statistics for Computer Science	3.00
12.	CSE 2106	Object Oriented Programming Language Sessional II	1.50
13.	CSE 2108	Numerical Methods	1.50
14.	CSE 2200	Software Development Project-I	1.00
15.	CSE 2201	Data Structures and Algorithm II	3.00
16.	CSE 2202	Data Structures and Algorithm II Sessional	1.50
17.	CSE 2203	Theory of Computation	3.00
18.	CSE 2205	Database	3.00
19.	CSE 2206	Database Sessional	1.50
20.	CSE 3100	Software Development Project-II	1.00
21.	CSE 3101	Software Engineering	3.00
22.	CSE 3102	Software Engineering Sessional	0.75
23.	CSE 3103	Microprocessors, Microcontroller and Embedded	3.00

		System	
24.	CSE 3104	Microprocessors, Microcontroller and Embedded System Sessional	0.75
25.	CSE 3105	Computer Architecture	3.00
26.	CSE 3107	Data Communication	3.00
27.	CSE 3109	Compiler	3.00
28.	CSE 3110	Compiler Sessional	0.75
29.	CSE 3112	Technical Writing and Presentation	1.00
30.	CSE 3200	Web Engineering Sessional	1.50
31.	CSE 3201	Artificial Intelligence	3.00
32.	CSE 3202	Artificial Intelligence Sessional	0.75
33.	CSE 3203	Operating System	3.00
34.	CSE 3204	Operating System Sessional	1.50
35.	CSE 3205	Computer Networks	3.00
36.	CSE 3206	Computer Networks Sessional	1.50
37.	CSE 3207	Mathematical Analysis for Computer Science	3.00
38.	CSE 3209	Information System Design	3.00
39.	CSE 3210	Information System Design with industrial attachment Sessional	0.75
40.	CSE 4000	Project and Thesis	3.00
41.	CSE 4101	Computer Security	3.00
42.	CSE 4102	Computer Security Sessional	0.75
43.	CSE 4103	Computer Graphics	3.00
44.	CSE 4104	Computer Graphics Sessional	0.75
45.	CSE 41XX	CSE Option 1	3.00
46.	CSE 41XX	CSE Option 1 Sessional	0.75
47.	CSE 41XX	CSE Option 2	3.00
48.	CSE 41XX	CSE Option 2 Sessional	0.75
49.	CSE 4000	Project and Thesis	3.00
50.	CSE 42XX	CSE Option 3	3.00
51.	CSE 42XX	CSE Option 3 Sessional	0.75
52.	CSE 42XX	CSE Option 4	3.00
53.	CSE 42XX	CSE Option 4 Sessional	0.75
54.	CSE 4215	Professional Issues and Ethics in Computer Science	2.00
		Total Credit Hours	**112.25**

4.2.2 List of Core Courses –Arts &Science department

SN.	Course Number	Course Name	Credit Hour
1.	MATH 1141	Differential Calculus, Integral Calculus, and Coordinate Geometry	3.00
2.	PHY 1103	Physics	3.00
3.	PHY 1104	Physics Sessional	0.75
4.	HUM 1201	English	3.00
5.	HUM 1202	Developing English Skill Sessional	0.75
6.	MATH 1203	Ordinary Differential Equations and Partial Differential Equations	3.00
7.	CHEM 2101	Chemistry	3.00
8.	MATH 2103	Vector Calculus, Linear Algebra, and matrices and Complex Variable	3.00
9.	MATH 2203	Laplace Transformation and Fourier Analysis	3.00
10.	HUM 4115	Engineering Economics	3.00
11.	HUM 4273	Financial, Cost and Managerial Accounting	2.00
		Total Credit Hours	**27.50**

4.2.3 List of Core Courses –EEE department

SN.	Course Number	Course Name	Credit Hour
1	EEE 1163	Introduction to Electrical Engineering	3.00
2	EEE 1164	Introduction to Electrical Engineering Sessional	1.50
3	EEE 1269	Electronic Circuits	3.00
4	EEE 1270	Electronic Circuits Sessional	1.50
5	EEE 2269	Electrical Drives and Instrumentation	3.00
6	EEE 2270	Electrical Drives and Instrumentation Sessional	0.75
		Total Credit Hours	**12.75**

4.2.4 List of Core courses –ME department

SN.	Course Number	Course Name	Credit Hour
1	ME 1181	Basic Mechanical Engineering	3.00
2	ME 1250	Engineering Drawing and CAD Sessional	1.50
		Total Credit Hours	**4.50**

4.2.5 Core course –IPE department

SN.	Course Number	Course Name	Credit Hour
1	IPE 4217	Industrial Management	3.00
		Total Credit Hours	**3.00**

Undergraduate students of the Department of Computer Science and Engineering (CSE) have to follow a particular course schedule. The term-wise distributions of the courses are given below:

LEVEL-1, TERM-1

Course No.	Course Title	Hours/Week		Credit	Prerequisite
		Theory	Sessional		
CSE 1100	Introduction to Computer System Sessional		3.00	1.50	
CSE 1101	Structured Programming Language	3.00	-	3.00	
CSE 1102	Structured Programming Language Sessional	-	3.00	1.50	
EEE 1163	Introduction to Electrical Engineering	3.00	-	3.00	
EEE 1164	Introduction to Electrical Engineering Sessional	-	3.00	1.50	
MATH 1141	Differential Calculus, Integral Calculus, and Coordinate Geometry	3.00	-	3.00	
ME 1181	Basic Mechanical Engineering	3.00	-	3.00	
PHY 1103	Physics	3.00	-	3.00	
PHY 1104	Physics Sessional	-	1.50	0.75	
	Total	**15.00**	**10.50**	**20.25**	

LEVEL-1, TERM-2

Course No.	Course Title	Hours/Week		Credit	Prerequisite
		Theory	Sessional		
CSE 1201	Discrete Mathematics	3.00	-	3.00	
CSE 1203	Object Oriented Programming Language	3.00	-	3.00	
CSE 1204	Object Oriented Programming Language Sessional I	-	3.00	1.50	CSE 1101
EEE 1269	Electronic Circuits	3.00	-	3.00	
EEE 1270	Electronic Circuits Sessional	-	3.00	1.50	EEE 1163
HUM 1201	English	3.00	-	3.00	
HUM 1202	Developing English Skill Sessional	-	1.50	0.75	
MATH 1203	Ordinary Differential Equations and Partial Differential Equations	3.00	-	3.00	MATH 1141
ME 1250	Engineering Drawing and CAD Sessional	-	3.00	1.50	
	Total	**15.00**	**10.50**	**20.25**	

LEVEL-2, TERM-1					
Course No.	Course Title	Hours/Week		Credit	Prerequisite
		Theory	Sessional		
CSE 2101	Digital Logic Design	3.00	-	3.00	
CSE 2102	Digital Logic Design Sessional	-	3.00	1.50	
CSE 2103	Data Structures and Algorithm I	3.00	-	3.00	CSE 1203
CSE 2104	Data Structures and Algorithm I Sessional	-	3.00	1.50	
CSE 2105	Applied Statistics for Computer Science	3.00		3.00	
CSE 2106	Object Oriented Programming Language Sessional II	-	3.00	1.50	CSE 1204
CSE 2108	Numerical Methods	-	3.00	1.50	
CHEM 2101	Chemistry	3.00	-	3.00	
MATH 2103	Vector Calculus, Linear Algebra and Complex Variable	3.00	-	3.00	MATH 1203
	Total	**15.00**	**12.00**	**21.00**	

LEVEL-2, TERM-2					
Course No.	Course Title	Hours/Week		Credit	Prerequisite
		Theory	Sessional		
CSE 2200	Software Development Project-I	-	2.00	1.00	
CSE 2201	Data Structures and Algorithm II	3.00	-	3.00	CSE2103
CSE 2202	Data Structures and Algorithm II Sessional	-	3.00	1.50	
CSE 2203	Theory of Computation	3.00	-	3.00	
CSE 2205	Database	3.00	-	3.00	
CSE 2206	Database Sessional	-	3.00	1.50	
EEE 2269	Electrical Drives and Instrumentation	3.00	-	3.00	EEE 1269
EEE 2270	Electrical Drives and Instrumentation Sessional	-	1.50	0.75	EEE 1270
MATH 2203	Laplace Transformation and Fourier Analysis	3.00	-	3.00	
	Total	**15.00**	**9.50**	**19.75**	

LEVEL-3, TERM-1					
Course No.	Course Title	Hours/Week		Credit	Prerequisite
		Theory	Sessional		
CSE 3100	Software Development Project-II	-	2.00	1.00	CSE 2205
CSE 3101	Software Engineering	3.00	-	3.00	
CSE 3102	Software Engineering Sessional	-	1.50	0.75	
CSE 3103	Microprocessors, Microcontroller and Embedded System	3.00	-	3.00	
CSE 3104	Microprocessors, Microcontroller and Embedded System Sessional	-	1.50	0.75	
CSE 3105	Computer Architecture	3.00	-	3.00	
CSE 3107	Data Communication	3.00	-	3.00	
CSE 3109	Compiler	3.00	-	3.00	
CSE 3110	Compiler Sessional	-	1.50	0.75	
CSE 3112	Technical Writing and Presentation	-	2.00	1.00	
	Total	**15.00**	**8.50**	**19.25**	

LEVEL-3, TERM-2					
Course No.	Course Title	Hours/Week		Credit	Prerequisite
		Theory	Sessional		
CSE 3200	Web Engineering Sessional		3.00	1.50	
CSE 3201	Artificial Intelligence	3.00	-	3.00	CSE 2217
CSE 3202	Artificial Intelligence Sessional	-	1.50	0.75	
CSE 3203	Operating System	3.00	-	3.00	
CSE 3204	Operating System Sessional	-	3.00	1.50	
CSE 3205	Computer Networks	3.00	-	3.00	
CSE 3206	Computer Networks Sessional	-	3.00	1.50	
CSE 3207	Mathematical Analysis for Computer Science	3.00	-	3.00	
CSE 3209	Information System Design	3.00	-	3.00	
CSE 3210	Information System Design with industrial attachment Sessional	-	1.50	0.75	
	Total	**15.00**	**12.00**	**21.00**	

LEVEL-4, TERM-1					
Course No.	Course Title	Hours/Week		Credit	Prerequisite
		Theory	Sessional		
CSE 4000	Project and Thesis	-	6.00	3.00	
CSE 4101	Computer Security	3.00	-	3.00	
CSE 4102	Computer Security Sessional	-	1.50	0.75	
CSE 4103	Computer Graphics	3.00	-	3.00	
CSE 4104	Computer Graphics Sessional	-	1.50	0.75	
CSE 41XX	CSE Option I	3.00	-	3.00	
CSE 41XX	CSE Option I Sessional		1.50	0.75	
CSE 41XX	CSE Option II	3.00	-	3.00	
CSE 41XX	CSE Option II Sessional		1.50	0.75	
HUM 4115	Engineering Economics	3.00	-	3.00	
	Total	**15.00**	**12.00**	**21.00**	

LEVEL-4, TERM-2					
Course No.	Course Title	Hours/Week		Credit	Prerequisite
		Theory	Sessional		
CSE 4000	Project and Thesis	-	6.00	3.00	
CSE 42XX	CSE Option III	3.00	-	3.00	
CSE 42XX	CSE Option III Sessional	-	1.50	0.75	
CSE 42XX	CSE Option IV	3.00	-	3.00	
CSE 42XX	CSE Option IV Sessional	-	1.50	0.75	
HUM 4273	Financial, Cost and Managerial Accounting	2.00	-	2.00	
IPE 4217	Industrial Management	3.00	-	3.00	
CSE 4215	Professional Issues and Ethics in Computer Science	2.00	-	2.00	
	Total	**13.00**	**9.00**	**17.50**	

OPTION I and II					
Course No.	Course Title	Hours/Week		Credit	Prerequisite
		Theory	Sessional		
CSE 4105	Introduction to Data Science	3.00	-	3.00	
CSE 4106	Introduction to Data Science Sessional	-	1.50	0.75	
CSE 4107	Digital Signal Processing	3.00	-	3.00	
CSE 4108	Digital Signal Processing Sessional	-	1.50	0.75	
CSE 4119	Advanced Algorithms	3.00	-	3.00	
CSE 4120	Advanced Algorithms Sessional	-	1.50	0.75	
CSE 4121	Basic Graph Theory	3.00	-	3.00	
CSE 4122	Basic Graph Theory Sessional	-	1.50	0.75	
CSE 4123	Fault Tolerant System	3.00	-	3.00	
CSE 4124	Fault Tolerant System Sessional	-	1.50	0.75	

CSE 4125	Basic Multimedia Theory	3.00	-	3.00	
CSE 4126	Basic Multimedia Theory Sessional	-	1.50	0.75	
CSE 4127	Data and Network Security	3.00	-	3.00	
CSE 4128	Data and Network Security Sessional	-	1.50	0.75	
CSE 4129	Object Oriented Software Engineering	3.00	-	3.00	
CSE 4130	Object Oriented Software Engineering Sessional	-	1.50	0.75	
CSE 4131	Artificial Neural Networks and Fuzzy Systems	3.00	-	3.00	
CSE 4132	Artificial Neural Networks and Fuzzy Systems Sessional	-	1.50	0.75	
CSE 4133	Distributed Algorithms	3.00	-	3.00	
CSE 4134	Distributed Algorithms Sessional	-	1.50	0.75	
CSE 4135	Bioinformatics	3.00	-	3.00	
CSE 4136	Bioinformatics Sessional	-	1.50	0.75	
CSE 4137	Robotics	3.00	-	3.00	
CSE 4138	Robotics Sessional	-	1.50	0.75	
CSE 4139	Machine Learning	3.00	-	3.00	
CSE 4140	Machine Learning Sessional	-	1.50	0.75	
CSE 4141	Applied Statistics and Queuing Theory	3.00	-	3.00	
CSE 4142	Applied Statistics and Queuing Theory Sessional	-	1.50	0.75	
CSE 4143	Computational Geometry	3.00		3.00	
CSE 4144	Computational Geometry Sessional	-	1.50	0.75	
CSE 4145	Digital System Design	3.00	-	3.00	
CSE 4146	Digital System Design Sessional	-	1.50	0.75	
CSE 4147	Peripherals, Interfacing and Embedded Systems	3.00	-	3.00	
CSE 4148	Peripherals, Interfacing and Embedded Systems Sessional	-	1.50	0.75	
CSE 4149	Mobile Computing and Applications	3.00	-	3.00	
CSE 4150	Mobile Computing and Applications Sessional	-	1.50	0.75	
CSE 4151	Web Architecture	3.00	-	3.00	
CSE 4152	Web Architecture Sessional	-	1.50	0.75	
CSE 4153	Parallel Processing and Distributed System	3.00	-	3.00	
CSE 4154	Parallel Processing and Distributed System Sessional	-	1.50	0.75	

OPTION III and IV					
Course No.	Course Title	Hours/Week		Credit	Prerequisite
		Theory	Sessional		
CSE 4241	VLSI Design	3.00	-	3.00	
CSE 4242	VLSI Design Sessional	-	1.50	0.75	
CSE 4243	Pattern Recognition	3.00	-	3.00	
CSE 4244	Pattern Recognition Sessional	-	1.50	0.75	
CSE 4245	Digital Image Processing	3.00	-	3.00	
CSE 4246	Digital Image Processing Sessional	-	1.50	0.75	
CSE 4247	Telecommunication Engineering	3.00	-	3.00	
CSE 4248	Telecommunication Engineering Sessional	-	1.50	0.75	
CSE 4249	Simulation and Modeling	3.00	-	3.00	
CSE 4250	Simulation and Modeling Sessional	-	1.50	0.75	
CSE 4251	Data Ware-housing and Data Mining	3.00	-	3.00	
CSE 4252	Data Ware-housing and Data Mining Sessional	-	1.50	0.75	
CSE 4253	Network Programming	3.00	-	3.00	
CSE 4254	Network Programming Sessional	-	1.50	0.75	
CSE 4263	High Performance Computing	3.00	-	3.00	
CSE 4264	High Performance Computing Sessional	-	1.50	0.75	

Summary

Summary of the credit hour requirement to get B.Sc. Engineering degree in Computer Science and Engineering (CSE) are as follows:

Level and Term	Hours/Week		Credits		Total Credits	No. of Theory Courses
	Theory	Sessional	Theory	Sessional		
Level-1, Term-1	15.00	10.50	15.00	5.25	20.25	5
Level-1, Term-2	15.00	10.50	15.00	5.25	20.25	5
Level-2, Term-1	15.00	12.00	15.00	6.00	21.00	5
Level-2, Term-2	15.00	9.50	15.00	4.75	19.75	5
Level-3, Term-1	15.00	8.50	15.00	4.25	19.25	5
Level-3, Term-2	15.00	12.00	15.00	6.00	21.00	5
Level-4, Term-1	15.00	12.00	15.00	6.00	21.00	5
Level-4, Term-2	13.00	9.00	13.00	4.50	17.50	5
Grand Total	**118.00**	**84.00**	**118.00**	**42.00**	**160.00**	**40**

CHAPTER-5

Detailed Outline of Courses

LEVEL-1 TERM-1

CSE 1100 3.00 hours in a week, 1.50 Cr.
Introduction to Computer System Sessional

Introducing major components of a computer; Hardware: processor, memory, I/O devices; Operating system, application softwares: Word processor, Spreadsheet, Slideshow maker.

CSE 1101 3.00 hours in a week, 3.00 Cr.
Structured Programming Language

Programming concepts; Program development stages; Flow charts; Structured programming language: data types, operators, expressions, control structures; Functions and program structure: Function basics, parameter passing conventions, scope rules and storage classes, recursion; Header files; Preprocessor; Pointers and arrays, Strings, Multidimensional array; User defined data types: structures, unions, enumerations; Input and Output: standard input and output, formatted input and output, file access; Variable length argument list; Pointer and it's uses; Command line parameters; Error Handling; Graphics; Linking; Library functions.

CSE 1102 3.00 hours in a week, 1.50 Cr.
Structured Programming Language Sessional

Laboratory works based on CSE 1101

EEE 1163 3.00 hours in a week, 3.00 Cr.
Introduction to Electrical Engineering

Fundamental electrical concepts and measuring units; Direct current (dc): Current, voltage, resistance, power and energy; Series/Parallel Circuits; Methods of network analysis and Network Theorems; Capacitors, Inductors and introduction to magnetic circuits. Alternating current (ac): Instantaneous current, voltage and power for various combinations of R, L and C circuits; Effective current and voltage, average power; Phasor representation of sinusoidal quantities; Sinusoidal Single-Phase Circuit Analysis; Introduction to three phase circuits; Power factor and power equation (Δ and Y circuits).

EEE 1164 3.00 hours in a week, 1.50 Cr.
Introduction to Electrical Engineering Sessional

Laboratory works based on EEE 1163

MATH 1141 3.00 hours in a week, 3.00 Cr.

Differential Calculus, Integral Calculus, and Coordinate Geometry

DIFFERENTIAL CALCULUS

Limit, continuity and differentiability, successive differentiation of various types of functions, Leibnitz's theorem, Rolle's theorem, Mean Value theorem, expansion in finite and infinite forms, Lagrange's form of remainder, Cauchy's form of remainder (expansion of remainder), expansions of functions differentiation and integration, indeterminate form, partial differentiation, Euler's theorem, tangent and normal, sub tangent and subnormal in Cartesian and polar coordinates, maxima and minima of functions of single variables, curvature, asymptotes. (1 Credit)

INTEGRAL CALCULUS

Definition of integrations, integration by the method of substitution, integration by parts, standard integrals, integration by the method of successive reduction, definite integrals, definite integral properties and its use in summing series, Wally's formula, improper integrals, Beta function and Gamma function, multiple integral and its application, area, volume of solid of revolution, area under a plane curve in Cartesian and polar coordinates, area of the region enclosed by two curves in Cartesian and polar coordinate, arc lengths of curves in Cartesian and polar coordinates. (1 Credit)

COORDINATE GEOMETRY

Transformation of coordinates axes and its uses; General equations of second degree and their reduction to standard forms; Pair of straight lines; System of circles; Coaxial circles and limiting points; Equations of parabola, ellipse and hyperbola in Cartesian coordinates; Tangents and normal; Pair of tangents; Chord of contact; Chord in terms of its middle point.; Parametric coordinates; Conjugate diameters; Asymptotes. (1 Credit)

ME 1181 3.00 hours in a week, 3.00 Cr.

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.

PHY 1103 3.00 hours in a week, 3.00 Cr.

Physics

Waves-Oscillations & Wave mechanics

Oscillations: Differential equation of simple harmonic oscillator, total energy and average energy, Combination of simple harmonic oscillations, spring-mass system, damped oscillation, forced oscillation, resonance, stationary wave, phase velocity, group velocity.

Wave mechanics: Fundamental postulates of wave mechanics, Schroding's equation (time dependent and time independent), Operators, Uncertainty principle, energy of a free particle.

Optics and Laser

Theories of light: Interference of light, Young's double slit experiment, Fresnel's bi-prism. Interference in thin films, Newton's rings, Interferometers, Diffraction of light: Fresnel and Fraunhofer diffractions, Diffraction by single slit, diffraction by double slits, diffraction gratings, Resolving power of optical instruments, Polarization of light: production and analysis of polarized light, polarization by double refraction, Brewster's law, Malus law, Nicole prism, , optical activity and polarimeter.

Laser: spontaneous and stimulated emission, Helium-Neon laser, laser applications, Fiber optics.

Structure of Matter and Electricity: Crystalline & non-crystalline solids, single crystal and polycrystalline solids, crystal system, co-ordination number, packing factor, Miller indices, defects in solids, Bragg's law, Bonds in solids, Introduction to energy band, distinction between metal, insulator and semiconductor. **Electricity**: Coulomb's law, electric field, Gauss' law and its application, electric potential, capacitors and capacitance, dielectrics on atomic view, dielectric and Gauss's law, Ohm's law, resistivity -an atomic view, current density and drift velocity, Ampere's law, Faraday's law; Lenz's law, self-inductance and mutual inductance.

PHY 1104 1.5 hours in a week, 0.75 Cr.

Physics Sessional

Laboratory works based on PHY-1103

LEVEL-1 TERM-2

CSE 1201 3.00 hours in a week, 3.00 Cr.

Discrete Mathematics

Mathematical Logic: propositional calculus and predicate calculus; Set theory**:** sets, relations, partial ordered sets, functions; Mathematical reasoning and proof techniques; Counting: permutations, combinations, principles of inclusion and exclusion; Discrete Probability; Recurrence relations and recursive algorithms; Growth of functions; Graph theory: graphs, paths, trees, cycles; Algebraic structures: rings and groups.

CSE 1203 3.00hours in a week, 3.00 Cr.

Object Oriented Programming

Philosophy of Object Oriented Programming (OOP); Advantages of OOP over structured programming; Encapsulation, classes and objects, access specifiers, static and non-static members; Constructors, destructors and copy constructors; Array of objects, object pointers, and object references, In-line functions, friend functions, reference; Inheritance: single and multiple inheritance; Polymorphism: overloading, abstract classes, virtual functions and overriding; Exceptions; Object Oriented I/O, inserter, extractor; Template functions and classes; namespaces, overview of Standard Template Library; Multi-threaded Programming.
Reference languages: C++ and Java

CSE 1204 3.00 hours in a week, 1.50 Cr.

Object Oriented Programming Language Sessional I

Laboratory works based on CSE 1203

EEE 1269 3.00 hours in a week, 3.00 Cr.

Electronic Circuits

Introduction to semiconductors, p-n junction diode, I–V characteristics; Diode applications: half and full wave rectifiers, clipping and clamping circuits, regulated power supply; Bipolar Junction Transistor (BJT): principle of operation, Transistor circuit configurations (CE, CB, CC), BJT biasing, BJT

Transistor modeling, small-signal analysis of single and multi- stage amplifiers, frequency response of BJT amplifier. Field Effect Transistors (FET): Principle of operation of JFET and MOSFET, Depletion and enhancement type MOSFETs, Switching circuits using FETs, CMOS, biasing of FETs, FET small signal analysis, Low and high frequency response of FETs; Operational amplifiers and its applications; Feedback and oscillators circuits; Operation, characteristics and application of SCR, TRIAC, DIAC and UJT; Introduction to IC fabrication processes.

EEE 1270 — 3.00 hours in a week, 1.50 Cr.

Electronic Circuits Sessional

Laboratory works based on EEE 1269

HUM 1201 — 3 hours in a week, 3.00 Cr.

English

English Phonetics, Vocabulary, English Grammar-determiners, modifiers, affixes, root word, head word, types of verbs, different types of Clauses, Sentence construction and different types of sentences, synthesis of sentences, Grammatical Correction; Comprehension, Business Communication, Quotation and Tenders, Job Letters. Paragraph writing, Precise writing, Amplification, Report writing, Situational writing- posters and advertisements, notice and memorandum, message writing, Communication Today; Short stories and Literary articles written by some prominent writers, Research Study, research methodology.

HUM 1202 — 3.00 hours in a week, 1.50 Cr.

Developing English Skill Sessional

Based on HUM 1201

MATH 1203 — 3.00 hours in a week, 3.00 Cr.

Ordinary Differential Equations and Partial Differential Equations

ORDINARY DIFFERENTIAL EQUATIONS:

Degree and order of ordinary differential equation; Formation of differential equations; Solution of first order differential equations by various methods; Solution of first order but higher degree ordinary differential equations; Solution of general linear equations of second and higher orders with constant coefficients; Solution of homogeneous linear equations and its applications; Solution of differential equations of higher order when dependent and independent variables are absent

PARTIAL DIFFERENTIAL EQUATIONS:

Introduction; Solution of linear and non-linear PDE of order one; Second order linear PDE: its nomenclature and classifications to standard forms: Parabolic Elliptic and Hyperbolic; Solution of second order linear PDE by separation of variables; Higher order linear PDE with constant coefficients.

ME 1250 — 3.00 hours in a week, 1.50 Cr.

Engineering Drawing and CAD Sessional

Introduction: Lettering, numbering and heading, instrument and their use, sectional views and isometric views of solid geometrical figures; Plan, elevation and section of multistoried buildings; Building services drawings, detailed drawing of lattice towers; Use of AutoCAD software.

LEVEL-2 TERM-1

CSE 2101 3.00 hours in a week, 3.00 Cr.

Digital Logic Design

Number systems and codes; Digital logic: Boolean algebra, De-Morgan`s theorems, logic gates and their truth tables, canonical forms, combinational logic circuits, minimization techniques; Arithmetic and data handling logic circuits, decoders and encoders, multiplexers and de-mulitplexers; Flip-flops, race around problems; Counters; asynchronous counters, synchronous counters and their applications; Registers and basic memory unit; Synchronous and asynchronous logic design; Design of sequential circuit: State diagram; State minimizations and assignments; Pulse mode logic; Fundamental mode design; PLA design.

CSE 2102 3.00 hours in a week, 1.50 Cr.

Digital Logic Design Sessional

Laboratory works based on CSE 2101

CSE 2103 3.00 hours in a week, 3.00 Cr.

Data Structures and Algorithm I

Internal data representation; Abstract data types; Algorithm performance and elementary asymptotic analysis (Introduction to Big-O notation); Elementary data structures: array, linked list, stack, queue, tree and tree traversal, graphs and graph representation, heap, binary search tree; Sorting algorithms; Searching: linear search and binary search; Advanced data Structures: balanced binary search trees, skip list, advanced heaps; Hashing.

CSE 2104 3.00 hours in a week, 1.50 Cr.

Data Structures and Algorithm I Sessional

Laboratory works based on CSE 2103

CSE 2105 3.00 hours in a week, 3.00 Cr.

Applied Statistics for Computer Science

Summarizing data, basic descriptive statistics, Standard deviation and other measures of dispersion; Moments, Skewness and kurtosis; conditional probability, independence, Bayes theorem, random variables, joint and conditional distributions, Discontinuous probability distribution: Binomial, Poisson and Negative binomial; Continuous probability distribution: Normal and Exponential; expectation, variance and covariance, central limit theorem. Markov inequality, Chebyshev inequality, law of large numbers, Markov chains, simulation, the PageRank algorithm, populations and sampling, sample mean, standard error, maximum likelihood estimation, Bayes estimation, hypothesis testing, categorical data, comparative experiments, multiple linear regression, analysis of variance, statistical inferences and model diagnostics, confidence intervals.

CSE 2106 3.00 hours in a week, 1.50 Cr.

Object Oriented Programming Language Sessional II

Laboratory works based on CSE 1203

CSE 2108 3.00 hours in a week, 1.50 Cr.

Numerical Methods

Laboratory works on the following topic:

Solution of algebraic and transcendental equations: method of iteration, False Position method, Newton-Rhapson method; Solution of simultaneous linear equations: iteration method; Choleski's process; Interpolation: diagonal and horizontal difference, differences of a polynomial, Newton's formula for forward and backward interpolation, Spline interpolation; Integration: Gauss quadrature formula, Trapezoidal rule, Simpson's rule, Weddle's rule; Solution of ordinary differential equations: Euler's method, Picard's method, Milne's method, Taylor's series method, Runge-Kutta method; Least squares approximation of functions: linear and polynomial regression, fitting exponential and trigonometric functions.

CHEM 2101 3.00 hours in a week, 3.00 Cr.

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 mono component system; Properties of dilute solution; Thermo chemistry, chemical kinetics, chemical equilibrium; ionization of water and pi concept; Electrical properties of Solution.

MATH 2103 3.00 hours in a week, 3.00 Cr.

Vector Calculus, Linear Algebra and Complex Variable

VECTOR CALCULUS

Vector Calculus: Multiple products of vectors; Differentiation and integration of vectors together with elementary applications; Gradient, divergence and curl of point functions; Various formulae; Definition of line, surface and volume integrals; Green's theorem; Gauss's theorem; Stoke's theorem. (1 Credit)

LINEAR ALGEBRA

Introduction to systems of linear equations; Gaussian elimination; Inverse of a matrix; Eigen values and Eigen vectors; Cayley-Hamilton theorem; Euclidean n-space; Linear transformations from IRn to IRm; Properties of linear transformations from IRn to IRm; Real vector spaces and subspaces; Basis and Dimension, Change of basis, Rank and Nullity; Inner product spaces; Diagonalization; Linear transformations: Kernel and Range. (1 Credit)

COMPLEX VARIABLE

Functions of a complex variable; Limits and continuity of functions of complex variable; Complex differentiation and Cauchy-Riemann Equations; Mapping by elementary functions; Line integral of a complex function; Cauchy's Integral Theorem; Cauchy's Integral Formula; Liouville's Theorem; Taylor's Theorem and Laurent's theorem; Singular points; Residue; Cauchy's Residue Theorem; Contour integration; Mapping. (1 Credit)

LEVEL-2 TERM-2

CSE 2200 2.00 hours in a week, 1.00 Cr.

Software Development Project-I

Students will work in groups or individually to develop high quality Software Project(s) including new l/O drivers or similar projects involving operating systems modules in different types of Database Systems or object oriented and visual languages, Students will write structured program and use proper documentation.

CSE 2201 3.00 hours in a week, 3.00 Cr.

Data Structures and Algorithm II

Introduction to algorithms; Correctness proof and techniques for analysis of algorithms; Master Theorem; Methods for the design of efficient algorithms: divide and conquer, greedy method, dynamic Programming; Graph algorithms: Basic search and traversal techniques, Topological sorting, Connected components, Spanning trees, Shortest paths, Flow algorithms; Lower bound theory; NP completeness, NP-hard and NP-complete problems; Coping with Hardness: backtracking, branch and bound, approximation algorithms.

CSE 2202 3.00 hours in a week, 1.50 Cr.

Data Structures and Algorithm II Sessional

Laboratory works based on CSE 2201

CSE 2203 3.00 hours in a week, 3.00 Cr.

Theory of Computation

Finite automata: deterministic finite automata, nondeterministic finite automata, equivalence and conversion of deterministic and nondeterministic finite automata, pushdown automata; Context free languages; Context free grammars; Pushdown automata; Regular languages: regular expressions, non-regular languages, the pumping lemma; Turing Machines: basic machines, configuration, computing with Turing machines, combining Turing machines; Un-decidability.

CSE 2205 3.00 hours in a week, 3.00 Cr.

Database

Introduction of database systems; Models: Entity-Relationship model, Relational model; Relational algebra; SQL; Advanced SQL; Some applications using SQL. Integrity constraint; Relational database design; File organization and retrieval, file indexing and hashing; Transaction manager; Concurrency controller; Recovery manager; Security system; Database administration; Introduction to advanced database management systems: distributed database, parallel database, data mining and warehousing, multimedia, object-oriented, object-relational, real-time database.

CSE 2206 3.00 hours in a week, 1.50 Cr.

Database Sessional

Laboratory works based on CSE 2205.

EEE 2269 3.00 hours in a week, 3.00 Cr.

Electrical Drives and Instrumentation

Transformers: Transformation ratio equations, Losses, Ideal Transformer, Voltage regulation, Matching Transformer; Alternators: Faradays Law, Dynamo, Generated voltage equation, Voltage regulation, DC Generator; Synchronous motor and Induction motor; DC motor; Stepper motors; Thyristor and Microprocessor based speed control of motors. Instrumentation amplifiers: Differential, logarithmic and chopper amplifiers; Frequency and voltage measurements using digital techniques; Recorders and display devices; Spectrum analyzers and Logic analyzers; Data acquisition and Interfacing Io microprocessor based systems; Transducers: Types, principles and application of photovoltaic, piezoelectric, thermoelectric, variable reactance and opto-electronic transducers; Noise reduction in instrumentation.

EEE 2270 1.50 hours in a week, 0.75 Cr.

Electrical Drives and Instrumentation Sessional

Laboratory works based on EEE-2269

MATH 2203 3.00 hours in a week, 3.00 Cr.

Laplace Transformation and Fourier Analysis

LAPLACE TRANSFORM

Definition. Laplace transforms of some elementary functions. Sufficient conditions for existence of Laplace transform. Inverse Laplace transforms. Laplace transforms of derivatives. The unit step function. Periodic function, some special theorems on Laplace transform, Partial fraction. Solutions of differential equations by Laplace transform. Evaluation of improper integral.

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.

LEVEL-3 TERM-1

CSE 3100 2.00 hours in a week, 1.00 Cr.

Software Development Project-II

Students will work in groups or individually to develop high quality Software Project(s) including new l/O drivers or similar projects involving operating systems modules in different types of Data Base Systems or object oriented and visual languages, Students will write structured program and use proper documentation.

CSE 3101 3.00 hours in a week, 3.00 Cr.

Software Engineering

Information System Design

Information and System; System Analysis and Systems Analyst; Information gathering techniques; Structured analysis of systems;

Feasibility Study: Concepts (abstraction, refinement, modularity and hierarchy) and classification, Introduction to modeling language (Use case diagram, Sequence diagram and Activity diagram), Cost benefit analysis; Project scheduling; System design techniques; User interface design

Software Engineering

Introduction to system engineering and software engineering; Software requirements analysis, modeling and specification;
Software Designing: principals, models, design patterns and specification
Software Testing: Objectives and principles, testability, testing design and implementation models and documentations, verification, validation and debugging; Quality factors and metrics for different software engineering phases; Software project management issues.

CSE 3102 1.50 hours in a week, 0.75 Cr.
Software Engineering Sessional
Laboratory works based on CSE 3101

CSE 3103 3.00 hours in a week, 3.00 Cr.
Microprocessors, Microcontrollers, and Embedded Systems
Introduction to 8-bit, 16-bit, and 32-bit microprocessors: architecture, addressing modes, instruction set, interrupts, multi-tasking and virtual memory; Memory interface; Bus interface; Arithmetic co-processor; Microcontrollers; Integrating microprocessor with interfacing chips; Programmable peripheral interfacing chip with interface to A/D and D/A converters; Keyboard/display interface; Programmable timer; Programmable interrupt controller, DMA controller; Introduction to embedded systems: overview of the design flow, Embedded systems specifications and modeling; Embedded hardware platforms and peripherals; Interfacing to the external world through sensors and actuators

CSE 3104 1.5 hours in a week, 0.75 Cr.
Microprocessors, Microcontrollers, and Embedded Systems Sessional
Laboratory works based on CSE 3103. Assembly Language will be taught; Contents of Assembly Language are following: Instruction set, 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. Experiments will be performed using Microprocessor and Microcontroller

CSE 3105 3.00 hours in a week, 3.00 Cr.
Computer Architecture
Fundamentals of computer Design; Processor Design; Datapaths Design : single cycle and multi cycle implementations; Control Unit design : hardware and micro programmed; Hazards; Exceptions; Fixed Point Arithmetic; Arithmetic Logic Unit (ALU) Design; System organization; Parallel Processing; Pipeline: pipelined datapath and control, superscalar and dynamic pipelining, Pipeline structure vector supercomputers; RISC Processor; Memory organization.

CSE 3107 3.00 hours in a week, 3.00 Cr.
Data Communication
Fundamentals: Communication Engineering Fundamentals, Waveforms Spectra, Periodic waveforms and its properties, Fourier series, Noise and its different types.

Amplitude Modulation: Amplitude modulation, Amplitude modulation index, Frequency spectrum for sinusoidal AM, AM broadcast Transmitter.

Frequency Modulation: Frequency Modulatio**n,** Sinusoidal FM, Frequency spectrum for Sinusoidal FM, FM transmitter. FM receiver, Phase Modulation.

Pulse Modulation, Pulse Codes Modulation (PCM), Quantization, Compression, PCM Receiver, Differential PCM, Delta Modulation, Sigma-Delta A/D conversion, Pulse Frequency Modulation (PFM), Pulse Time Modulation (PTM), Pulse Position Modulation (PPM).

Digital Communication: Digital Communication, Basic Digital Communication System, Synchronization, Asynchronous Transmission, Probability of Bit Error in Base band Transmission, Matched Filter, Eye Diagrams, Digital Carrier Systems, Amplitude Shift keying, Frequency Shift Keying, Phase Shift Keying, Carrier Recovery Circuits, Differential Phase Shift Keying, Error Control Coding, Block Control, Repetition Encoding, Parity Encoding, Convolution Encoding.

Propagation: Radio Wave Propagation, Mode of Propagation, Microwave Systems, Tropospheric Propagation, VHF/UHF Radio Systems.

Satellite Communication: Satellite Communication, Kepler's First and Second Law, Orbits, Geostationary Orbits, Power System.

Fiber Optic Communication: Fiber Optic Communication, Propagation within a Fiber, Modes of Propagation, Losses in Fibers, Light sources for Fiber optics, Photo detectors.

CSE 3109 3.00 hours in a week, 3.00 Cr.

Compiler

Introduction to compiling; Basic issues; Lexical analysis and Scanning; Syntax analysis; Syntax-directed translation; Attribute Grammars and Semantic Analysis Semantic analysis; type-checking; issues with run-time environments – source language issues; Issues in the design of code generation, Intermediate code generation; Error management; Storage organization-storage allocation strategies, target machine run-time storage management; Code optimization: The principle sources of optimization, Peephole optimization, Optimization of basic blocks-Loops in flow graphs; Introduction to global data-flow analysis-Code improving transformations.

CSE 3110 1.50 hours in a week, 0.75 Cr.

Compiler Sessional

Laboratory works based on CSE 3109.

CSE 3112 2.00 hours in a week, 1.00 Cr.

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, these and books: abstract, preface, contents, bibliography and index; Writing of book reviews and referee reports; Writing tools: Latex; Diagram drawing software; presentation tools.

LEVEL-3 TERM-2

CSE 3200 3.00 hours in a week, 1.50 Cr.

Web Engineering Sessional

At the end of this sessional, students will have knowledge and skills on the following topics: internet, history of the TCT/IP protocol, worldwide web; web servers: case of Apache, other web servers; webpage design: HTML, JavaScript; XML Schemas, their validation and transformation; dynamic WebPages with CGI, PHP or JSP and database access; Web services: SOAP, WSDL (Web Service Description Language), XML-RPC protocol; configuration, maintenance, monitoring and security.

Student will work in groups or individually to develop a web based application with proper documentation that they have to present within this semester.

CSE 3201 3.00 hours in a week, 3.00 Cr.

Artificial Intelligence

Overview of AI, Knowledge representation, LISP and other Al programming languages; Review of Un-Informed Search Strategies and game playing; Informed search Strategies: A*, Heuristic functions, Memory Bounded Search (IDA*, SMA*); Iterative improvement Search (Hill Climbing, Simulated Annealing), constraint satisfaction problems. Review of Propositional logic, first order Logic, Introduction to Planning, Partial Order Planning. Bayesian Rule and its use in probabilistic reasoning; Belief Networks and Decision Networks; Learning Decision Trees; Learning General Logical descriptions-Hypothesis, Examples, Current Best Hypothesis Search, Least Commitment Search; Learning Neural and Belief Networks ANN, Perceptions, MFFN (Back propagation, Applications of Neural Networks, Bayesian Methods for learning Belief Networks, Generic Algorithm, Reinforced learning. Introduction to Natural Language Processing.

CSE 3202 1.50 hours in a week, 0.75 Cr.

Artificial Intelligence Sessional

Laboratory works based on CSE 3201.

CSE 3203 3.00 hours in a week, 3.00 Cr.

Operating System

Introduction of Operating System, types of OS; Process: process managements, process states, job and process scheduling, CPU scheduling algorithms, process coordination, critical section problems, semaphores, Inter-Process Communication (IPC), classical IPC problems, multiprocessing and timesharing, message and mailbox etc.; Memory management: swapping, memory allocation schemes, Paging and segmentation, virtual memory, page replacement strategies, working sets, demand paging; Input/output: hardware/software, disk, disk scheduling algorithms, Secondary storage management, terminals, clocks; Deadlock: resource allocation, detection, prevention, avoidance and recovery; File management; Operating system security; Main Features of Windows, UNIX, LINUX; Introduction to distributed operating systems.

CSE 3204 1.50 hours in a week, 0.75 Cr.

Operating System Sessional

Laboratory works based on CSE 3203

CSE 3205 3.00 hours in a week, 3.00 Cr.

Computer Networks

Introduction: Computer Networks and Applications, OSI reference model, TCP/IP model and terminology, Connectionless and Connection Oriented services, Service primitives, The ARPANET, Hubs, Bridges, and Switches, FDDI, Fast Ethernet; Routing Algorithm.

Physical Layer: Circuit switching and Packet switching, X-25 protocol, Frame relay and Cell relay, ATM reference model.

Medium Access Sub layer: Pure and slotted ALOHA, Persistent and Non persistent CSMA, CSMA with collision detection and collision free protocols, IEEE standard 802.3 and Ethernet.

Data Link Layer: Types of errors, framing, error detection & correction methods; Flow control, Stop & wait ARQ, Go-Back- N ARQ, Selective repeat ARQ, HDLC.

Network Layer: Internet address, classfull address, subnetting, static vs. dynamic routing, shortest path algorithm, flooding, distance vector routing, link state routing, ARP, RARP, IP, ICMP.

Transport Layer: UDP, TCP, Connection management, Addressing, Establishing and Releasing Connection, Congestion control algorithm, Flow control and Buffering, Multiplexing.

Presentation Layer: Data Compression techniques, Frequency Dependent Coding, Context Dependent Encoding.

Application Layer: Internet and intranets, Internet services and goals, DNS, SMTP, FTP, Telnet, HTTP, World Wide Web (WWW), DHCP and BOOTP.

Domain Name System: Name servers; Email and Its privacy; SNMP; HTTP; World Wide Web; Network security: Cryptography, DES, IDEA, public key algorithm; Authentication; Digital signatures, Principles of Reliable Data Transfer FTP.

Networking in Practice: Designing LAN, Cabling, Establishing Client- Server network, Configuring: Directory Server, Proxy server, FTP server, E-mail server, web server, DB server, Firewall, Network troubleshooting, network maintenance, network monitoring, Network programming.

CSE 3206 3.00 hours in a week, 1.50 Cr.

Computer Networks Sessional

Laboratory works based on CSE 3205.

CSE 3207 3.00 hours in a week, 3.00 Cr.

Mathematical Analysis for Computer Science

Recurrent problems; Manipulation of sums; Number theory; Special numbers; generating functions; Probability Distributions and Expectations: total probability and Bayes' rule, discrete probability distributions, continuous probability distributions; Random variables; stochastic process; Markov chains (discrete parameter, continuous parameter, birth-death process); Queuing models (birth-death model, Monrovian model), open and closed queuing network; Application of queuing models.

CSE 3209 **3.00 hours in a week, 3.00 Cr.**

Information System Design

System analysis fundamentals: systems, roles, and development methodologies; Understanding and modeling organizational system; Project management; Information requirements analysis: Interactive methods; Information gathering: Unobtrusive methods; agile modeling and prototyping; The analysis process: Using data flow diagrams; Analyzing systems using data dictionaries; Process specifications and structured decisions; Object oriented systems analysis and design using UML; The essentials of design: Designing effective output, Designing effective input; Designing databases; Human-computer interaction; Quality assurance and implementation: Designing accurate data entry procedures; Quality assurance and implementation.

CSE 3210 **1.50 hours in a week, 0.75 Cr.**

Information System Design with Industrial attachment Sessional

Laboratory works based on CSE 3209.

LEVEL-4 TERM-1

CSE 4000 **6.00 hours in a week, 3.00 Cr.**

Project or Thesis

Each student has to complete one Project or Thesis in the combined duration of two semesters of 4th year. In course CSE 4000, a student has to make a proposal defense at level-4, term-1. The defensed project has to be completed in the continuation in level-4, term-2.

CSE 4101 **3.00 hours in a week, 3.00 Cr.**

Computer Security

Fundamental concepts: confidentiality, integrity and availability, assurance, authenticity and anonymity; threats and attacks, security principles; Cryptographic concepts: encryption, digital signatures, simple attacks on cryptosystems, cryptographic hash functions, digital certificates; Cryptography: symmetric cryptography, public-key cryptography, cryptographic hash functions, digital signatures, details of AES and RSA cryptography; Security: Operating systems concepts, process security, memory and file system security, physical security, application program security, network security concepts, browser security, physical security, applications security, Security Attacks: buffer overflow and other vulnerabilities due to insecure programming, foot printing, social engineering , Trojans and backdoors, sniffing, denial of service, session hijacking, threats on components like webservers, web Applications, mobile platforms, wireless networks, Security Measures: Firewall, Intrusion detection and prevention.

CSE 4102 **1.50 hours in a week, 0.75 Cr.**

Computer Security Sessional

Laboratory works based on CSE-4101

CSE 4103 **3.00 hours in a week, 3.00 Cr.**

Computer Graphics

Standard graphics primitives; Graphics hardware; Graphics pipeline; Coordinate convention; Scan conversion; Clipping; Modeling transformation; Viewing transformation; Projection transformation; Polygons and polygon meshes; Curves and surfaces; Hidden lines and surface removal; Fractals; Ray tracing; Light models; Color models; Graphics programming.

CSE 4104 **1.50 hours in a week, 0.75 Cr.**

Computer Graphics Sessional

Laboratory works based on CSE 4211.

CSE 41XX **3.00 hours in a week, 3.00 Cr.**

Option-I

CSE 41XX **1.50 hours in a week, 0.75 Cr.**

Option-I Sessional

CSE 41XX **3.00 hours in a week, 3.00 Cr.**

Option-II

CSE 41XX **1.50 hours in a week, 0.75 Cr.**

Option-II Sessional

HUM 4115 **3 hours in a week, 3.00 Cr.**

Engineering Economics

Engineering Economics

Economics and engineering; microeconomics and macroeconomics; theory of demand and supply and their elasticities; demand estimation; price determination; indifference curve technique; theory of production; theory of cost and cost estimation; market structure; national income accounting; depreciation; circular flow of income and expenditure; cost-benefit analysis; pay back period, net present value (NPV), internal rate of return (IRR), inflation; economic feasibility of engineering undertakings; Development Economics: Theories of developments; Banking system of Bangladesh, National Budget, Development partners(World Bank, Asian Development Bank, World Trade Organization, International Monetary Fund)

LEVEL-4 TERM-2

CSE 4000 **6.00 hours in a week, 3.00 Cr.**

Project and Thesis

This course is a continuation of the course CSE 4000 from the previous semester. A student has to complete the defense project proposal, submit it by the end of the semester and make an oral defense of the project or thesis.

CSE 42XX **3.00 hours in a week, 3.00 Cr.**

Option III

CSE 42XX **1.50 hours in a week, 0.75 Cr.**

Option III Sessional

CSE 42XX **3.00 hours in a week, 3.00 Cr.**

Option IV

CSE 42XX **1.50 hours in a week, 0.75 Cr.**

Option IV Sessional

HUM 4273 **2.00 hours in a week, 2.00 Cr.**

Financial, Cost and Managerial Accounting

Financial Accounting: Basic Accounting Concepts; Accounting as an Information System; Computerized Accounting System; Conceptual Framework of Accounting; Double Entry Mechanism; Accounting Equation; Introduction to Journal Accounting; Posting to Ledger Accounts; Preparing Trial Balance; Adjusting Entries, Preparing an Adjusted Trial Balance; Preparing Financial Statements; Financial Statements Analysis & Interpretation.

Cost and Management Accounting: Cost Concepts, Cost Classifications & Cost Functions; Job Order Costing & Preparing Job Cost Sheet; Cost Allocation; Cost Volume Pro-t Analysis; Variable Costing Vs. Absorption Costing; Short Term Investment Decision: Relevant & Differential Cost Analysis; Long-term Investment Decision: Capital Budgeting; Working Capital Management; Linear Programming for Management Decision.

IPE 4217 **3.00 hours in a week, 3.00 Cr.**

Industrial Management

Principles of Management; Financial Principles; Management of Innovation; Technology Strategy; Best Management Practices; Sales and Marketing; Ratio Analysis; Prelude Lobster; Designing and Building Yachts; Commoditization vs. Differentiation; Total Quality Management; Entrepreneurship; Strategic Planning and Management of Technology; Teradyne Business Plan; MIS: Introduction, Decision Support Systems, MIS in decision making, Development of communication skills.

CSE 4215 2.00 hours in a week, 2.00 Cr.

Professional Issues and Ethics in Computer Science

An introduction to professionalism: Profession and vocation, Recognition of professionals, their duties and responsibilities, Prestigious position for professionals, Professional bodies trade unions, and other organizations, Professional bodies in CS/IT and related fields, Characteristics and functions of a professional body, Trust, honesty, and integrity, Social responsibilities of computer professionals to: Public at large, Fellow members, Clients

An introduction to ethics: Philosophy, ethics, and applied ethics, Ethics in other professions, Factors affecting in making ethical decisions, Value, value systems, culture, cooperate culture, attitudes, behaviors, beliefs, norms

Theories in ethics: Golden rule, utilitarian principle, Kant's categorical imperative, Descartes' rule of change, Risk aversion principle, avoid hard, no free lunch rule, legalism, evidentiary guidance, client/customer/patient choice, equity, competition, compassion/last chance, impartiality/objectivity, openness, confidentiality

An introduction to computer ethics: Common computer ethics fallacies: Computer game fallacy, law-abiding citizen fallacy, shatterproof fallacy, candy-from-a–baby fallacy, hacker's fallacy, free information fallacy, Code of conducts in IT/CS related professional bodies

An introduction to legal systems: (a) Law, moral, norms, and ethics (b) Judiciary, legislature, executive, and separation of power (c) Common law and civil law (d) Criminal law and civil law (e) Fundamental right and protection (f) Law of contract, law of evidence (g) Property - tangible and intangible

An introduction to legal issues in information systems: (a) Intellectual property: Trademarks, patents, copy rights, Passing off, masquerading (b) Software licensing issues: Creative commons, Open source free software movements, Discussion on recent cases (c) Computer evidence (d) Online transactions: Consent, jurisdictions, Software licensing issues, Creative commons, GPL, Open source (e) Electronic signatures (f) Online communities (g) Computer misuse and frauds

Privacy: Personal information, Data protection principles, Knowledge and consent in the Internet, Big brother concept, Privacy enhancing and invasive tools/methods

Free speech: Internet governance, Anonymity, Public disclosure, Defamation, Un-solicitation,

Dispute resolutions: Contracts- Memorandum of Understanding (MoU), Non-Disclosure Agreement (NDA), User agreements, Liabilities, Vicarious liability, Warranty and maintenance, Offline dispute resolution methods: Mediation, litigation, arbitration, Issues in resolving dispute relating online transactions

Special topics: Feminism, Global warming, Green computing, Rights of employees, Feminism

OPTION I and II

CSE 4105 **3.00 hours in a week, 3.00 Cr.**

Introduction to Data Science

Data Science programming using R/Python, GitHub, Data wrangling: libraries for reading data tables and scrapping web pages; Data visualization; asking relevant questions, exploratory data analysis, inference, estimation, conditional probabilities, regression, modeling, Bayesian statistics; High-dimensional data analysis: support vector machines, k-nearest neighbors, regression trees, random forests, boosting;

CSE 4106 **1.50 hours in a week, 0.75 Cr.**

Introduction to Data Science Sessional

Laboratory works based on CSE 4105.

CSE 4107 **3.00 hours in a week, 3.00 Cr.**

Digital Signal Processing

Introduction to speech, image & data processing; Discrete time signals, sequences; Linear Constant Coefficient difference equation; Sampling continuous time signals; Two dimensional sequences and systems; Z-transform, Inverse Z-transform, H-transform; Frequency domain representation, discrete time systems and signals; Fourier series and Fourier Transform; Parseval's theorem; Equivalent noise definition of bandwidth; Convolution, Correlation and method of numerical integration; Computation of the DFT: Goertzel FFT, Chirp Z-transform algorithms.

CSE 4108 **1.50 hours in a week, 0.75 Cr.**

Digital Signal Processing Sessional

Laboratory works based on CSE 4108.

CSE 4119 **3 hours in a week, 3.00 Cr.**

Advanced Algorithms

Randomized Algorithms: Las Vegas and Monte Carlo Algorithms; Randomized Data Structures: Skip Lists; Amortized Analysis: Different methods, Applications in Fibonacci Heaps; Lower Bounds: Decision Trees, Information Theoretic Lower Bounds, Adversary Arguments; Approximation Algorithms: Approximation Schemes, Hardness of Approximation; Fixed Parameter Tractability: Parameterized Complexity, Techniques of designing Fixed Parameter Algorithms, Examples; Online Algorithms: Competitive Analysis, Online Paging Problem, k-server Problem; External Memory Algorithms; Advanced Data Structures: Linear and Non-linear Methods

CSE 4120 **1.50 hours in a week, 0.75 Cr.**

Advanced Algorithms Sessional

Laboratory works based on CSE 4119.

CSE 4121 **3 hours in a week, 3.00 Cr.**

Basic Graph Theory

Graphs and their applications; Basic graph terminologies; Basic operations on graphs; Graph representations; Degree sequence and graphic sequence; Paths, cycles and connectivity; Euler tours; Hamiltonian cycles; Ear decomposition; Trees and counting of trees; Distance in graphs and trees; Graceful labeling; Matching and covering; Planar graphs; Digraphs; Graph coloring; Special classes of graphs.

CSE 4122 1.50 hours in a week, 0.75 Cr.

Basic Graph Theory Sessional

Laboratory works based on CSE 4121.

CSE 4123 3 hours in a week, 3.00 Cr.

Fault Tolerant System

Introduction of Fault Tolerant Systems and architectures; Goal and Application of Fault Tolerant computing, Fundamental Definitions, Design techniques to achieve fault Tolerance, Fault detection and location in combinational and sequential circuits; Fault test generation for combinational and sequential circuits; Digital simulation as a diagnostic tool; Automatic test pattern generator; Fault modeling; Automatic test equipment, Faults in memory, memory test pattern and reliability; Performance monitoring, self-checking circuits, burst error correction and triple modular redundancy; Maintenance processors.

CSE 4124 1.50 hours in a week, 0.75 Cr.

Fault Tolerant System Sessional

Laboratory works based on CSE 4123.

CSE 4125 3 hours in a week, 3.00 Cr.

Basic Multimedia Theory

Multimedia system-introduction; Coding and compression standards; Architecture issue 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 multimedia document; Networking issues in multimedia - Quality-of service guarantees, resource reservation traffic specification, happing, and monitoring, admission control; Multicasting issues; Session directories; Protocols for controlling sessions; Security issues in multimedia -digital water – making partial encryption schemes for video streams; multimedia applications – audio and video conferencing, video on demand, voice over IP.

CSE 4126 1.50 hours in a week, 0.75 Cr.

Basic Multimedia Theory Sessional

Laboratory works based on CSE 4125.

CSE 4127 3 hours in a week, 3.00 Cr.

Data and Network Security

Overview, Symmetric cipher, Classical encryption technique, Block cipher and the data encryption standard (DES), Triple DES, Introduction to finite fields, Advanced Encryption Standard, Contemporary Symmetric Ciphers, confidentiality using symmetric encryption public, Key encryption and Hash functions, Public-key Cryptography, RSA algorithm, Key management, Diffie-Hellman key exchange, Other Public Key Cryptosystem, Message Authentication and Hash function, Hash Algorithm, Digital

Signatures and Authentication protocols, Network Security practice, Authentication application, Wireless Network Security, Electrical Mail security, IP security, Web security, System security, Intruders, Malicious software and Firewall, Legal and Ethical Aspects.

CSE 4128 1.50 hours in a week, 0.75 Cr.

Data and Network Security Sessional

Laboratory works based on CSE 4127.

CSE 4129 3 hours in a week, 3.00 Cr.

Object Oriented Software Engineering

The object-oriented approach within the context of software engineering, the language, basic (procedural) elements of language: what an Eiffel program is, what the instruction set is, and how to declare and use entities (variables) and routines; The concepts underlying the object-oriented approach: modularity, inheritance, and dynamic binding, case study from the management information-system domain; Environment matters: system configuration, interfacing with external software, and garbage collection. Advanced issues involving exception handling, repeated inheritance, typing problems, and parallelism; object-oriented software engineering process, concentrating on specific guidelines facilitate the translation OOAD to a maintainable Addresses verification and validation (V&V) issues of Eiffel software systems built in a software engineering context; Building reusable libraries; The building of a parallel linear algebra library (Paladin).

CSE 4130 1.50 hours in a week, 0.75 Cr.

Object Oriented Software Engineering Sessional

Laboratory works based on CSE 4130.

CSE 4131 3 hours in a week, 3.00 Cr.

Artificial Neural Networks and Fuzzy Systems

Biological nervous system: the brain and neurons, Introduction to artificial neural network and fuzzy systems, Theory and application of Artificial neural networks and fuzzy logic; Multi-layer perception: Back propagation algorithm, Self-organization map, Radial basis network, Hop field network, Recurrent network, Fuzzy set theory, Failing Adaptive Linear (ADALINE) and Multiple Adaptive Linear (MADALINE) networks, Generating internal representation, Cascade correlation and counter propagation networks, Higher order and bi-directional associated memory, Lyapunov energy function, attraction basin, Probabilistic updates: simulated annealing, Boltzmann machine, Adaptive Resonance Theory (ART) network. ARTI. ART2. Fuzzy ART mapping (ARTMAF) networks. K.ohonen'8 feature .l\ Learning Vector Quantization (LVQ) networks, Logic control: Adaptive fuzzy neural network; Genetic algorithm and evolution compacting, Applications to control; Pattern recognition; Nonlinear system modeling, Speech and image processing.

CSE 4132 1.50 hours in a week, 0.75 Cr.

Artificial Neural Networks and Fuzzy Systems Sessional

Laboratory works based on CSE 4131.

CSE 4133 3 hours in a week, 3.00 Cr.

Distributed Algorithm

Models of distributed computing, Synchrony, communication and failure concerns, Synchronous message-passing distributed systems, Algorithms in systems with no failures - Leader Election and Breadth-First Search algorithms, The atomic commit problem, Consensus problems - the Byzantine Generals Problem, Asynchronous message-passing distributed systems, Failure detectors, Logical time and vector clocks, Routing algorithms.

CSE 4134 1.50 hours in a week, 0.75 Cr.

Distributed Algorithm Sessional

Laboratory works based on CSE 4133.

CSE 4135 3 hours in a week, 3.00 Cr.

Bioinformatics

Sequence similarity, homology, and alignment. Pairwise alignment: scoring model, dynamic programming algorithms, heuristic alignment, and pairwise alignment using Hidden Markov Models. Multiple alignment: scoring model, local alignment gapped and ungapped global alignment. Motif finding: motif models, finding occurrence of known sites, discovering new sites. Gene Finding: predicting reading frames, maximal dependence decomposition. Analysis of DNA microarray data using hierarchical clustering, model-based clustering, expectation-maximization clustering, Bayesian model selection.

CSE 4136 1.50 hours in a week, 0.75 Cr.

Bioinformatics Sessional

Laboratory works based on CSE 4135.

CSE 4137 3 hours in a week, 3.00 Cr.

Robotics

Introduction to robotics, overview of robot mechanisms, dynamics, and intelligent controls, planar and spatial kinematics, and motion planning; mechanism design for manipulators and mobile robots, multi-rigid-body dynamics, 3D graphic simulation; control design, actuators, and sensors; wireless networking, task modeling, human-machine interface, and embedded software mechanical design, rigid body velocity, Jacobean, inverse kinematics, redundant and parallel robots, trajectory control, face control and hap tics, Micro and Nan-robotics, mobile robots.

CSE 4138 1.50 hours in a week, 0.75 Cr.

Robotics Sessional

Laboratory works based on CSE 4137.

CSE 4139 3 hours in a week, 3.00 Cr.

Machine Learning

Introduction to machine learning, Supervised, unsupervised and reinforcement learning, Unsupervised learning algorithms, Concept Learning, Decision Tree Learning, Attribute based and relational supervised learning algorithms, Artificial Neural network based learning algorithms, Bayesian Learning, Evaluating Hypothesis, Genetic algorithm and genetic programming, Reinforcement learning algorithms, Computational learning theory.

CSE 4140 1.50 hours in a week, 0.75 Cr.

Machine Learning Sessional

Laboratory works based on CSE 4139.

CSE 4141 3 hours in a week, 3.00 Cr.

Applied Statistics and Queuing Theory

Applied Statistics:

Introduction; Frequency distribution, Mean, median, Mode and other measure of central tendency standard deviation and other measure of dispersion, Moments, Skewness and kurtosis, Elementary probability theory, Characteristics of distributions, elementary sampling theory, Estimation, Hypothesis testing and regression analysis. Probability distribution and expectations, discontinuous probability distribution, e.g. binomial, position and negative binomial. Continuous probability distributions, e.g. normal and exponential.

Queuing Theory:

Stochastic processes, Discrete time Markov chain and continuous time Markov Chain. Birth-death process in queuing. Queuing models: M/M/1,M/M/C,M/G/1,M/D/1,G/M/1 solution of network of queue-closed queuing models and approximate models. Application of queuing models in Computer Science.

CSE 4142 1.50 hours in a week, 0.75 Cr.

Applied Statistics and Queuing Theory Sessional

Laboratory works based on CSE 4141.

CSE 4143 3 hours in a week, 3.00 Cr.

Computational Geometry

Drawing fundamental geometric objects: Basic concepts, algorithms and their complexity; Point inclusion problems, convexity testing; Polygon triangulations and polygon partitioning; Convex hulls in two-dimensional and three-dimensional spaces; Proximity analysis: Voronoi diagrams and Delaunay triangulations. Drawing Graphs: Styles and applications of graph drawing; Drawing of rooted trees and planar graphs.

CSE 4144 1.50 hours in a week, 0.75 Cr.

Computational Geometry Sessional

Laboratory works based on CSE 4143.

CSE 4145 3 hours in a week, 3.00 Cr.

Digital System Design

Digital system design Hierarchy; ASM charts; Hardware description language; Design using MSI and LSI components; Combinational and sequential circuit design with PLD's, Introduction to CPLD's & FPGA's; Design of memory subsystem using SRAM and DRAM; Design of various components of a computer: ALU, memory and control unit - hardwired and micro-programmed, Microprocessor based designs; Computer bus standards; Design using special purpose controllers. Introduction to Embedded Systems; Product design; Product development process; Modularity in Design Research Directions: Architecture innovations; Application domains; User interfaces Case
Studies;

CSE 4146 1.50 hours in a week, 0.75 Cr.

Digital System Design Sessional

Laboratory works based on CSE 4145.

CSE 4147 3 hours in a week, 3.00 Cr.

Peripherals, Interfacing and Embedded Systems

Interrupts, address space partitioning, A-to-D and D-to-A converters and some related chips. Interfacing ICs of I/O devices – I/O ports, Programmable peripheral interface, DMA controller, interrupt controller, communication interface, interval time, etc. IEEE 488 and other buses, interfacing with microcomputer. Interfacing I/O devices – floppy disk, hard disk, tape, CD-ROM & other optical memory, keyboard, mouse, monitor, plotter, scanner, etc. Microprocessor in Scientific Instruments and other applications – Display, Protective Relays, Measurements of Electrical quantities, Temperature monitoring system, water level indicator, motor speed controller, Traffic light controller, etc. Microprocessor based interface design

Introduction to Embedded system, The Embedded Design Life Cycle, Models of Computation, State Charts, General language Characteristics (SDL, Petri nets, Message Sequence Charts, UML, JAVA, HDL), Embedded System Hardware,(Input, Communication, Processing Unit, Memories, output) Embedded operating systems, middleware & Scheduling, Implementing, ASIC, Embedded Systems Hardware/Software design.

CSE 4148 1.50 hours in a week, 0.75 Cr.

Peripherals, Interfacing and Embedded Systems Sessional

Laboratory works based on CSE 4147.

CSE 4149 3 hours in a week, 3.00 Cr.

Mobile Computing and Applications

Basic concepts: Mobile computing; Mobile computing architecture, Mobile technologies, Anatomy of a mobile device, Applications of mobile computing, Technical issues for mobility, Mobile agents and process migration.

Introduction to Mobile Development Frameworks and Tools: Fully Centralized Frameworks and Tools, N-Tier Client–Server Frameworks and Tools, J2ME, WAP, Symbian EPOC, iPhone, Android, Windows CE.

Android application development: Getting started with android programming, Android architecture, Application framework and libraries, Android runtime, Linux kernel, Android user interface, Data persistence, Messaging and networking, Location Based Services, Developing android services, Android application publishing

The User Experience: The Small Screen Problem, The Unified Look and Feel Paradigm, The iPhone Human Interface Guidelines, The Blackberry User Interface Guidelines, Common User Interface Guidelines,

Security Issues in mobile computing: Security threats, Ensuring consistency and reliability.

The Future of Mobile Computing: Upcoming Technologies, Convergence of Media and Communication Devices.

CSE 4150 1.50 hours in a week, 0.75 Cr.

Mobile Computing and Applications Sessional

Laboratory works based on CSE 4149.

CSE 4151 3 hours in a week, 3.00 Cr.

Web Architecture

The objective of this course is to introduce and explain the basic concepts of web architecture. Students of this course assume to have prior knowledge of computer network and programming languages as the prerequisite. A reasonable familiarity of java programming will be the added advantage. Throughout the course, the introductory concepts of web architectures for developing web applications will be studied. Students will learn how to write Java applications that share data across the Internet for games, collaboration, software updates, file transfer and more. A behind-the-scenes look at HTTP, CGI, Servlets, Enterprise Java Beans, ORM, which supports the Internet and the Web will be provided. This course explores the knowledge and the tools to create the next generation software that takes full advantage of the Internet.

CSE 4152 1.50 hours in a week, 0.75 Cr.

Web Architecture Sessional

Laboratory works based on CSE 4151.

CSE 4153 3 hours in a week, 3.00 Cr.

Parallel Processing and Distributed System

Introduction: Trends towards parallel processing, Parallel processing mechanism, Multiprogramming and Time sharing, Parallel Computer Structures, Parallelism and Pipelining, Parallel processing applications, Speedup Performance Laws, Parallel Random Access Machines (PRAM) and VLSI model.
Hardware Technology: Advanced processor Technology, Superscalar and Vector processor, Shared memory organization, Design of Linear and Non linear Pipeline processor, Multiprocessor System Interconnects.

Pipelining and Vector Processing: Principles of Pipelining, Classification of pipelined processors, Instruction and Arithmetic pipeline design, Vector Processing principles, Vector processing requirements, Designing Pipelined processors, Compound Vector processing, Recent Vector processors, Vectorization and Optimization methods.

Parallel Programming: Parallel Programming models, Parallel Languages and Compilers, Code Optimization and Scheduling, Loop Parallelization and Pipelining, Parallel Programming Environments, Shared-variable program structures, mapping programs onto Multicomputers.

Distributed System: Introduction, Distributed System Architectures, Communication in Distributed Systems, Distributed Middleware, Client/Server Design Issues, Inter-process communication, RPC , Distributed Objects and Remote Invocation , Virtualization & Code Migration, Naming, Distributed Synchronization & Coordination, Consistency & Replication in Distributed Systems, Fault Tolerance, Distributed Transactions , Security, P2P Systems, Cloud Computing, Grid Computing.

Distributed System Programming: Java RMI, CORBA, P2P, COM, DCOM, Multi Agent System, SOAP, Web Service.

CSE 4154 1.50 hours in a week, 0.75 Cr.

Parallel Processing and Distributed System Sessional

Laboratory works based on CSE 4153.

OPTION III and IV

CSE 4241 3 hours in a week, 3.00 Cr.

VLSI Design

VLSI Design Methodology: Top-down Design Approach, Technology Trends and Design Automation Algorithms; Introduction to CMOS Inverters and Basic Gates; CMOS Fabrication Process and Layout; CMOS Circuit Characteristics and Performance Estimation; Buffer Circuit Design; Introduction Bi-CMOS Circuits; Complex CMOS Gates; CMOS Building Blocks - Adder, Comparator, Multiplier, Counter, and Shifter; Data Path and Memory structures.

Design Methodology and Tools; Hardware modeling - Hardware Modeling Languages, Logic Networks, State Diagrams, Data-flow and Sequencing Graphs, Behavioral Optimization; Floor Planning and Architecture Design; ASIC design using FPGA and PLDs.

CSE 4242 1.50 hours in a week, 0.75 Cr.

VLSI Design Sessional

Laboratory works based on CSE 4241

CSE 4243 3 hours in a week, 3.00 Cr.

Pattern Recognition

Pattern Recognition: introduction, importance, Statistical and Neural Pattern Recognition: Bayesian classifier, Bayes decision theory, discriminate functions and decision surfaces, Bayesian classifier for normal distribution, Linear classifiers: discriminate functions and decision hyper planes, perception algorithm, least squares methods; Kessler's construction, Nonlinear classifiers: two and three layer perceptions, back propagation algorithm; Template matching: optimal path searching techniques. Dynamic programming methods, Correlation methods; Context dependent classification: observable and hidden Markov models and Viterbi algorithm. Three problems of HMM and their application in Speech Recognition, Syntactic Pattern Recognition, Clustering algorithms.

CSE 4244 1.50 hours in a week, 0.75 Cr.

Pattern Recognition Sessional

Laboratory works based on CSE 4243.

CSE 4145 3 hours in a week, 3.00 Cr.

Digital Image Processing

Digital image fundamentals: visual perception, Light and Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Some basic relationships between pixels, Linear and Nonlinear operations; image transforms: First Fourier Transform (FFT),Discrete Cosine Transform (DCT), Karhunen and Loeve Transform (KLT), Wavelet transform and sub-band decomposition; image enhancement in the frequency domain and image restoration techniques, image compression techniques, image compression standards: JPEG,MPEG, H.261, and H.263, Image Segmentation.

CSE 4146 1.50 hours in a week, 0.75 Cr.

Digital Image Processing Sessional

Laboratory works based on CSE 4245

CSE 4247 3 hours in a week, 3.00 Cr.

Telecommunication Engineering

Overview of telecommunication: history, evolution, convergence of telecommunication and data networks; Transmission media: Characteristics and applications of twisted pairs, coaxial cables and optical fibers, Terrestrial and satellite microwave, radio waves, VSAT; Telephone operating principles: telephone equipment, description of the modern phone; Telephone switching systems: PSTN, PBX, Centrex, standards; Basics of communication systems: modulation, multiplexing; Switching system: circuit switching, packet switching; Voice over Internet Protocol (VoIP), Fax over IP network, voice over frame relay, and ATM, ACDs, call centers, computer integration; Data communication equipment: introduction to terminals, modems, RS-232 and other interfaces, modem types; Tele-Traffic analysis; Cellular telephony: Frequency reuse, frequency management, channel alignment, handoff strategies, FDMA, TDMA, CDMA and GSM, Introduction to satellite communication, Optical fiber communication, Submarine cables, Digital Radio Microwave, etc.

CSE 4248 1.50 hours in a week, 0.75 Cr.

Telecommunication Engineering Sessional

Laboratory works based on CSE 4247.

CSE 4249 3 hours in a week, 3.00 Cr.

Simulation and Modeling

Simulation modeling basics: systems, models and simulation; Classification of simulation model; Steps in a simulation study; Concepts in discreet-event simulation: event scheduling vs. process interaction approaches, Time-advance mechanism, organization of a discreet-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 (or comparing real-world observations and simulation outputs, input modeling; Generating random numbers and random variants; Output analysis. Simulation languages; Analysis and modeling of some practical systems, Random Number Generator, Random Variables, Probability Distribution.

CSE 4250 1.50 hours in a week, 0.75 Cr.

Simulation and Modeling Sessional

Laboratory works based on CSE 4249.

CSE 4251 3 hours in a week, 3.00 Cr.

Data ware-housing and Data Mining

Introduction; Data warehousing and OLAP technology for data mining; Data preprocessing; Data mining primitives, languages and systems; Descriptive data mining: characterization and comparison; Association analysis; Classification and prediction; Cluster analysis; Mining complex types of data; Applications and trends in data mining.

CSE 4252 1.50 hours in a week, 0.75 Cr.

Data ware-housing and Data Mining Sessional

Laboratory works based on CSE 451.

CSE 4253 3 hours in a week, 3.00 Cr.

Network Programming

Basic Networking Software (Protocol stacks, TCP/IP, HTTP, etc) Internet architecture and history, Elementary socket programming in C, Low level networking, Ethernet, ARP, The network layer, IP, DHCP, NAT, The network layer, routing, IPv6, Transport layer protocols, TCP, UDP, The socket interface (writing clients and servers) Advanced socket programming, non-blocking sockets, Server design (forking, threads, preforking), daemons, Network Programming in Java, DNS, email, HTTP, cgi, cookies, P2P Web services (XML, JSP, SOAP, etc) XML, DTDs, Schemas, XML Parsing, XSLT, Client side scripting, Javascript, AJAX, Web server technologies, Tomcat, servlets, Web server technologies, JSP, Web server, technologies, RPCs, Java RMI, XML-RPC, CORBA, Server scripting languages, PHP, Ruby Web services, SOAP, WSDL, UDDI, The Semantic Web, RDF, OWL. Network security Cryptography, authentication, digital signatures, Network security, Kerberos, IPSec, SSL, Implementation of security, Anonymity on the Web, tor, Multimedia and VoIP, RTP

CSE 4254 1.50 hours in alternate week, 0.75 Cr.

Network Programming Sessional

Laboratory works based on CSE 4253.

CSE 4263 3 hours in a week, 3.00 Cr.

High Performance Computing

Parallel Processing Concepts (Quick Overview)

Levels of parallelism (instruction, transaction, task, thread, memory, function), Models (SIMD, MIMD, SIMT, SPMD, Dataflow Models, Demand-driven Computation etc), Architectures: N-wide superscalar architectures, multi-core, multi-threaded

Parallel Programming with CUDA

Processor Architecture, Interconnect, Communication, Memory Organization, and Programming Models in high performance computing architectures: (Examples: IBM CELL BE, Nvidia Tesla GPU, Intel Larrabee Microarchitecture and Intel Nehalem microarchitecture), Memory hierarchy and transaction specific memory design, Thread Organization

Fundamental Design Issues in Parallel Computing

Synchronization, Scheduling, Job Allocation, Job Partitioning, Dependency Analysis, Mapping Parallel, Algorithms onto Parallel Architectures, Performance Analysis of Parallel Algorithms

Fundamental Limitations Facing Parallel Computing

Bandwidth Limitations, Latency Limitations, Latency Hiding/Tolerating Techniques and their limitations

Power-Aware Computing and Communication

Power-aware Processing Techniques, Power-aware Memory Design, Power-aware Interconnect Design, Software Power Management

Advanced Topics

Petascale Computing, Optics in Parallel Computing, Quantum Computers, Recent developments in Nanotechnology and its impact on HPC

CSE 4264 1.50 hours in alternate week, 0.75 Cr.

High Performance Computing Sessional

Laboratory works based on CSE 4263.